

**Dr. Timi Ećimović, Prof. Emeritus Dr. Matjaž Mulej, Dr. Rashmi Mayur**

# **SYSTEM THINKING AND CLIMATE CHANGE SYSTEM**

**(AGAINST A BIG “TRAGEDY OF THE COMMONS”  
OF ALL OF US)**



Korte, Slovenia, 2002

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**Editor:**

Boris Maraž

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**CIP – Kataložni zapis o publikaciji – A CIP Catalogue record for this book,  
Narodna in univerzitetna knjižnica, Ljubljana, Slovenija,  
National and University Library, Ljubljana, Slovenia,**

**Ećimović, Mulej, Mayur**

System Thinking and Climate Change System

**ISBN 961 – 236 – 380 – 3**

**SYSTEMS THINKING AND CLIMATE CHANGE  
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By

Dr. Timi Ećimović, Prof. Emeritus Dr. Matjaž Mulej, Dr. Rashmi Mayur

***Acknowledgment:***

***To our beloved ones: thanks for understanding.***  
***To friends and coauthors: thank you for your selfless friendship and support.***  
***To readers: thank you for your concern and interest.***  
***To all humans: don't give up!***

Korte, Slovenija, 2002

## FOREWORD – EXECUTIVE SUMMARY

In this book we are trying to assist our readers to more easily and better understand the following *findings*:

- Life, even survival of us, the modern civilization, depends a lot on conditions provided by the *nature* in which we all live, and by the climate change system as an essential part of it.
- Nature, climate and climate change system are *no simple systems* (features, entities, and processes), but complex and complicated (see chapters with “TR” in titles).
- So far humans have not been sufficiently successful in their influencing the climate and climate change system: the dangerous consequences result from ***too much one-sidedness*** of humans, and suggest humans to use more systems/holistic thinking. (See chapters with no TR in titles)
- Most people do not know enough about how usable and useful is *system thinking* when one deals with many, rather complex, life issues, including climate and climate change system.
- This book, we hope, will help us all to live better, even prevent a big “tragedy of the commons” – the end of all of us, which is caused by partial measures causing broader, even global effects!

We humans live on Earth, which is a *small, but integral part of the Universe*. We are able to live here due to suitable climate and other living conditions. All over the billions of years of the existence of our planet Earth, the climate has kept changing. The impacts causing this changing, in general, result from natural processes and/or human interventions. Both kinds of impacts can cause consequences, which are both good and bad by human criteria. E.g. from a rather one-sided/narrow/shallow/oversimplifying viewpoint the changes in the human life over the last 2 – 3 centuries are bringing the so called *progress*: more comfort, a higher standard of living on the basis of the many technological and non-technological innovations. But from a more holistic/broader/systemic/complexity-facing viewpoint we see that the same changes tend to cause our own *extinction*. Which is the ***correct viewpoint?*** The usual answer would read: the common sense. But the modern experience demonstrates very many destructive consequences of the “common” sense, i.e. the *one-sided viewpoint* as a usual basis of thinking, decisions making and acting, which is normal with all of us individuals as specialists knowing a small fragment of reality. So, at least since the UN (humankind’s highest political body) has planned for “***sustainable*** (i.e. no short-term and nature-destroying) ***development***”, the humankind of today knows: we should better apply the “uncommon” sense, i.e. the holistic/systemic thinking. Each and every individual human idea, decision, and action may seem to make a small, even negligible impact, but the consequences of all of them together may be tremendous.

In the case of our climate, our human actions tend to cause our own ***self-destruction***, because we tend to ***lack holism***, both in our knowledge, values, emotions, and resulting actions.

It is hard to believe what we, as humankind, know about the world and the universe. Many well-known issues and insights, however, are fragments of the whole, and we have to understand the whole on the basis of fragments without knowing the whole. And what is the whole, where are limits of fragments, and what are issues of a whole? We, the authors of this book, think *the whole is everything*, and all other features are issues within/without inferior and superior systems/wholes/entities making partial or (fictitiously) absolute whole/s.

We think the *absolute/only/total whole* is what we humans call the ***Universe***.

Now, how to understand our own role as humans within the Universe, when our understanding of the nature, space, environment is evolving/innovated from fragments, which have never been put together to allow for a holistic insight?

The present human civilization is following a path to destruction, because it is built on the ***unrealistic premise of unlimited resources*** – profit at any cost – without accountability and responsibility to humankind of the current and the next generations. Many hard issues of today could have been less hard, if the thinking process had not taken the paradigm of the narrow-

minded profit motivation alone, as the single priority in the active and demanding role of the “developed world”, followed by the “developing world”.

The natural evolvement, which has only one direction – the dynamic multidimensional evolvement ahead, does not include its own payment system, profit, financial institutions, and all other innovation of great importance for our civilization of today. The nature has its own absolute knowledge, energy, matter, ability and possibility to construct systems/entities according to the existing information, matter, and energy of its own. The question is “Why is there a planetary system like the Solar System?” and the answer is “We do not know, but we think that it is a result of the available natural information, energy and matter”.

Does this mean, that we have to abandon the existing economic system aimed at profit? It may be impossible to do in the short run. At present we need economy as a social sub-system, and with development of the inter-human relations into a globalize unit, we may find ourselves within a social order with an equitable and just economic system. The point is not in profit as a quantity, but in *human attitudes* behind the style of economy it represents, especially the one-sidedness of thinking, decisions making and acting. Why?

What happens is that **profit kills profit**: the *external economics theory* teaches us to consider the cost that we cause e.g. by pouring toxins in a swamp – an *avoided cost*. But it is actually a *shared cost* that we all cover by taxes, health problems and resulting medical costs, etc. This is a case of “*the tragedy of the commons*”. The side-consequences, in the case of human impacts ruining the climate conditions as preconditions of our survival, tend to become the central consequences. But they are still considered uncertain, as long as the common sense is the narrow rather than requisitely holistic thinking, decision-making, and acting.

What is certain, hence, is that the time has come for our civilization to make a decision about our future, including our own very near future. That decision, we believe, will take us forward to a sustainable future, if a requisitely holistic thinking comes to *complement* the usual narrow specialists’ thinking. It should help us see that we are not independent, but *interdependent*, i.e. needing each other and needed by each other, because we all are specialists. And we all live on the same planet Earth, which we cannot produce. But we can kill/ruin it.

Black/white, shallow/deep, good/bad, positive/negative, primitive/civilized, and many more coupled terms could be put together and enable us humans to see the origin of interdependences, interactions and co-operation of the natural systems. What was first “hen or egg”, “innovation or routine”? The answer is obvious, but rarely taken into account: they are interdependent, as soon as we consider the natural dynamics, not only a moment (which does not exist on its own anyway). So are specialized professionals, needing *creative interdisciplinary co-operation* as their/our shared way out of the blind alley of a too narrow thinking and action.

People, values and knowledge have been making an epic song of our civilization, which has been going on since humans have existed. And so has other nature, including climate and climate change. We people are a part of nature, although this has been admitted less over the last three centuries than ever before. The *climate and climate change reflect this interdependence*, which we may never forget about in order not to suffer another “tragedy of the commons”.

“Tragedy of the commons” is, hence, an expression in the economic literature describing the consequences of decisions favoring one-sided, narrow interest to more holistic, broader ones. While T. Ecimovic and M. Mulej were spending a week in Washington, D.C., in October 2002, a discussion revealed a close link between cases of the “tragedy of the commons”: in China, the government stopped limiting the number of cattle, sheep and goats per square mileage. Entrepreneurial, but one-sided (i.e. normal) individuals made these numbers outgrow the natural capacities. Their land is converting to desert. Similar decisions and resulting processes have been taking place all over the Earth throughout history. But the industrialization and globalization periods brought an essential difference: “*the tragedy of the commons*” is *becoming global*. We still can stop this dangerous process. – This is what this book is all about.

### *About the authors*

**Dr. Timi Ecimovic (1941)**, an eminent international scientist, independent researcher, lecturer, and head of SEM Institute for Climate Change is working on nature, space and environment protection, the climate change system, sustainability, and sustainable future. He was among the first researchers to apply nature, space, and environment protection in a local community by activities we call today Local Agenda 21 Processes – a holistic program for survival of our civilization under new challenges of the third millennium – **from local community to global civilization**. With his research/work within the climate change system activities/problems recording/understanding/researching he has been among the leading independent researchers with many international publications and talks. Together with many researchers in co-operation worldwide within case studies and complex problem solving research and learning he is assisting a better understanding of the present. His latest research directed towards the system theory/thinking may provide a possible answer enabling us to better understand our world.

Dr. Timi Ecimovic is an active member of the European Academy of Sciences and Arts, the European Academy for Environmental Affairs, Doctor of Environmental Sciences (H.C.), the Chairman of World Thinker's Forum, and many other institutions.

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**Motto:** THE CLIMATE CHANGE SYSTEM IS AN ENVIRONMENTAL / MENTAL ISSUE, REQUIRING SYSTEMS THINKING FOR HUMANKIND TO SURVIVE<sup>1</sup>

## **0. THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THIS BOOK<sup>2,3</sup>**

Climate is one of the many *crucial preconditions of survival of our civilization* living here for many millennia, now and – hopefully – in the near and long-term future. Like many other natural, technical, and social components of life, climate is no isolated feature, but a feature with essential *interdependencies* with many other features with which climate, therefore, exists in mutual interaction / interplay. These interdependencies are natural facts, which many humans tend to make an oversight of and/or forget about. Many other essential features of the planet Earth including the humankind's life and activities share the same destiny. The *oversight of interdependencies* has shown up as a very crucial mistake many times, extremely visibly in the first half of the 20<sup>th</sup> century in the form of the two World Wars and the World-wide Economic Crisis between them (1914-1945). Very soon after that period, the humankind of today was offered a new *worldview* under the name of the *General Systems Teaching*.<sup>4</sup> Its author was Ludwig von Bertalanffy (LvB), a world-top scientist in many fields. Among them, we will address the *systems thinking and systems theory* that resulted from work by him and other authors, including ourselves<sup>5</sup>, later on, and we will try to find out its capability to help humankind of today solve their own problems as demonstrated in the data about climate change. The problem, which we address *through* the problem of climate change, is the *very dangerous lack of holistic thinking about issues that have more than a very small, localized, short-term and narrow – unimportant impact over the survival of humankind*.

## **1. SOME COMPLEMENTS AND CRICISMS CONCERNING LUDWIG VON BERTALANFFY 'S (LvB) GENERAL SYSTEMS THEORY<sup>6</sup>**

### **1.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 1**

The beginning of systems theory is credited to Ludwig von Bertalanffy. His important texts span over good four decades since 1928. The world wars, economic, ecological etc. crises of his lifetime proved that he was right when he required humans to be *holistic* in their thinking, decision-making and acting. Still, this/his worldview has not become a general habit, and this fact endangers humankind, including its impacts over the climate change.

<sup>1</sup> Chapters denoted with TR will present data on nature's actual situation, the other chapters our suggested solutions.

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<sup>3</sup> This contribution is based a lot on the Basic Research Program »Innovative Enterprise in Transition«, sponsored by Ministry of Education, Science and Sports, Republic of Slovenia, in 1999-2003.

<sup>4</sup> This is a literal translation of the German wording by LvB. (See: Elohim, 2001)

<sup>5</sup> Especially Matjaz Mulej, the author of the Dialectical Systems Theory (DST), and Stefan Kajzer, his close coauthor for several decades, including some parts of the DST, such as the Law of Requisite Holism. See Ch. 1.4.

<sup>6</sup> Vojko Potocan and Matjaz Mulej

## 1.1 ACHIEVEMENTS OF LvB IN GENERAL

LvB is well known as the original author of the concept »General Systems Theory«<sup>7</sup>. His idea did not remain only an idea, but it became a concept, which means a *relevant idea*, which should be dealt with in philosophy as the science of thinking about thinking<sup>8</sup>. A concept (1) relates to other concepts, (2) renders components of the entity dealt with inseparable from each other<sup>9</sup>, (3) condenses components, and (4) is in a state of symbol in relation to other concepts (Pelko, 2000). This is well visible from the fact that LvB's concept is still alive after that many decades. Even more we can see: it is still **relevant, objected and neglected**: it is taught, but in a rather small selection of universities, because the narrow specialization (which LvB attacked) keeps being more frequent than holism<sup>10</sup>.

## 1.2 THE BASIC CONTRIBUTIONS OF LvB IN THE AREA OF THE THEORY AND PRACTICE OF SYSTEMS THINKING

From a rather careful re-reading of LvB's classic book (1968, revised edition 1979) and Davidson (1983) we can briefly extract **three basic essential contributions** he made to the world-wide science and practice:

- The *holistic worldview* attacking the over-specialization of the industrial era and its positivistic science, which reduced creativity to finding out given data.
- Some *basic notions / concepts* supportive of his holistic worldview.
- *Isomorphisms (i.e. similarities)*, which refer to common attributes (among many, on which different sciences tend to concentrate and work upon), making thus a bridge toward a rather general or generalized view of nature and humankind.
- GST is using the language of mathematics as its research language, but it still remains, first of all, a *mental tool of problem solving*.<sup>11</sup>

<sup>7</sup> This is the topic we are going to concentrate upon. But LvB was very important in several other fields as well, such as biology (comparative physiology of metabolism and growth, growth equation, method for early detection of cancer), linking natural sciences and humanities (modern theories of development including the necessity of regarding the living organism as an organised system, directing of biology toward discovering the laws of biological systems, thesis on usability of the general biological laws outside biology, living organism as an open system interacting with its environment, including the behavioural and social sciences), etc. (See: Bertalanffy, 1928; Bertalanffy, 1952; Bertalanffy, 1967; Bertalanffy, 1968; Bertalanffy, 1981; Bertalanffy and Rappoport, 1956-72). In 1937 he developed his hypothesis that the natural laws are valid on all levels of existence and started an interdisciplinary investigation of such laws. That's where from he came to his General Teaching on Systems, called in translation by others the General Systems Theory (GST). - Every entity can be called a system, and this fact makes many forget about holism.

<sup>8</sup> GST is considered a scientific discipline, which aims at unity of science based on discovery and use of generally valid unified principles covering different systems. It deals with knowledge about systems in general. Thus, GST allows for a wide-ranging general systems approach. This means a combination of the roles of GST as a worldview and as a general methodology.

<sup>9</sup> We tend to call this relation – interdependence or, using the ancient Greek word, dialectics. (Mulej, 1974 and later)

<sup>10</sup> Specialists even tend to use LvB's language to be precise and to stay inside their own framework, rather than be as holistic as he required. LvB made it actually possible for them by his definition that the *system is a whole, which maintains itself by mutual interaction of its parts*. It may be made of smaller systems and be a part of a larger system. An entity can therefore be defined as a system or as a subsystem, which depends on the *observer's focus*. A system is also *greater/different than the sum of its parts, because a system consists of the parts plus the way the parts relate to each other and the qualities that emerge from those relationships*. The principle of emergence also renders systems *more complex* than they seem to be. *Relations*, not the substance of parts of an entity, are the *fundamental reality* tackled by systems thinking. *Components* of a system display their *full range of traits* only by *interaction* (among themselves and with their environment). – Although LvB speaks of *focus*, he does not seem to care for the fact that focus depends on a specialty and takes the role of the *selected viewpoint*, inside which one can meet a partial holism, which is not in line with the LvB's requirement for the worldview as citizens of the entire world and caring for the entire biosphere. (See: Elohim, 1999) We will come back to this issue later on. See Ch. 3.

<sup>11</sup> This may be considered a new renaissance, of which now the complexity theory tends to speak (see: Wood, 2000; Dent, 1999). A kind of systemic thinking existed in antique times in the ancient Greek idea of a unified view of

- GST also represents, along with a point of new effects, a new *responsibility* – the one for the *definition of boundaries* of the entity under consideration under the label of a system. The boundary definition must be broad enough to include all impacting factors, which are important in the case under consideration. Optimization of parts is sub-optimization and not good enough, too partial and one-sided.

In a discussion by e-mail about these topics, Mark Davidson, possibly the best expert on LvB, sent Mulej the following statement (on 31 Dec., 2001), which nicely adds to the above ones:

“A Bertalanffy disciple in psychiatry, author-educator-psychoanalyst Silvano Arieti (1914-1981), suggested that Bertalanffy should be known as the founder of the “science of similarities”. That phrase was well chosen, inasmuch as the credibility of GST as a potential science depends on its success in dealing with similarities. Bertalanffy called these similarities isomorphisms, by which he meant structural likenesses that reflect a commonality in the way the parts of a system relate to each other... Bertalanffy... was an implacable opponent of reckless analogising, most notably an opponent of what he called the “nothing-but” fallacy that portrays organisms as nothing but machines. He continually warned of mistaking models for what they represent. Just as blueprints for a building do not equal the building, models of human behavior and human society are not the equivalent of humanity. He noted that theoretical models necessarily reduce reality to conceptual skeletons – too much detail makes a model unwieldy – so model-designers must always be aware of the risk of failing to include parts that are vital to a particular study. “Wherever entities are studied and compared,” he wrote, “there are diversities as well as uniformities. Both must be given equal weight.” He also cautioned against model building as a scientific fad: “Enthusiasm for the new mathematical and logical tools has led to feverish model-building as a purpose in itself – an indoor sport – often without regard to empirical fact.”

“Second, having adopted that cautionary position, he saw no need to apologize for using models. For all their shortcomings, he regarded models as extremely valuable tools of scientific thought... But for GST to become an exact science, Bertalanffy realized, it would need to focus on similarities that could be translated in laws expressed in mathematics... By using differential calculus, he was able to provide mathematical precision to such GST concepts as dynamic equilibrium (the steady state), the import of energy from the environment (negentropy), and self-restoration in response to external disturbances (equifinality).

“Bertalanffy predicted that open system would be his most fruitful model, and he urged that researchers in all fields assess its value in the interpretation of phenomena in their respective areas.

“Another basic GST model, hierarchical order, suggested to Bertalanffy that many if not all disciplines could benefit from considering the possibility that, in any organizational hierarchy, there is tendency toward increasing complexity (anamorphosis) and a correlation between increasing complexity and progressive differentiation, mechanization, and centralization...”

Let us **summarize!**

- The General Theory of Systems, as LvB preferred to call his concept, means that his preference was for *generality*, not so much for the concept of a system.

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*cosmos*, universe, including the Aristotelian holism and teleology. But after the renaissance, the scientific revolution found it necessary to be analytical, which means to concentrate on parts rather than the whole. This new approach was unavoidable and fruitful, but it went too far. A new renaissance came to be needed to renew holism.

- In GST, the system was defined on the mathematical basis as *any* whole consisting of a set of components and a set of their mutual relations.
- It was supposed to be open, which means having relations with its *environment* as well.
- In other words, LvB wanted to find and produce a *bridge* between all the many different sciences in order to enable a more holistic approach to dealing with the (*entire!*) *biosphere*.
- A system is *describing* something, which exists in reality.
- LvB uses the notion system *interchangeably* with the object under consideration and represented by a system (but he warns against doing so!).
- General attributes of systems as found by different disciplines and applicable to other disciplines of both (natural) sciences and social sciences are supposed to be *isomorphisms* and *sufficient* for this bridge to be built and applied in order for the nature of the entire life in the nature to be understood more easily and generally.<sup>12</sup>
- This capacity was (and is) supposed to enable humankind of today to survive, because the *one-sidedness* of the overspecialized disciplines and practices *ruins as much as it produces*, because it is able to be deep inside a single discipline / view at reality, rather than to network the mutually partly related and partly different and hence interdependent disciplines.

It all makes sense, doesn't it?

Still, after good seven decades (since LvB's first renown articles in 1928), after good five decades (since his article mentioning general systems in 1945), good three decades (since his seminal book in 1968), *not enough* has happened, which would reach beyond a desire and fight for LvB's concept to survive and to win the battle against the narrow specialization/s (in which a few handfuls of systems theorists and cyberneticians take part rather than practically everybody)<sup>13</sup>. The *narrow specialization* is still prevailing and flourishing, in many respects for very good reasons and with good results. Holistic thinking and acting tends hence to be limited into the areas of single specialized disciplines rather than interdisciplinary and/or transdisciplinary<sup>14</sup>. The wonderful concept of holism has been kept to – very poorly, and now new sciences such as *chaos theory* and *complexity theory* are absorbing the concept of the GST (and possibly developing it further). This is actually fine, but the weak side of the story is that they tend to feel and behave as if there has never been anything before their own history (although they tend to use the word system very frequently – mostly without a clear definition<sup>15</sup> of what they mean by the word in the given case – and to quote authors listed in the systems science community; see: /Dent, 1999; Wood 2000; etc./).

There is obviously a *difficulty* about making LvB's concept a reality in the contemporary circumstances.

<sup>12</sup> In an e-mail discussion, In October, 2002, with M. Mulej, M. Davidson expressed his decision to stress interdependence as a crucial idea of LvB in his next edition of his book on LvB (forthcoming in German), not only isomorphisms.

<sup>13</sup> The informal systems thinking is not mentioned here, although it might be a very important fact. It would be very unusual to find only the formalised systems thinking using all the language of systems theory. Systems theory is much younger than humankind. And many persons as individuals and groups of different sizes must have been quite holistic in the thousands of years before the systems theory was formulated and applied. They could hardly be successful without being requisitely holistic. (See: Mulej et al., 1998, and 1999 and other contributions to IDIMT '98 and IDIMT '99; Mulej et al., 2002; Petzinger, 2000; etc.) We will come back to this issue later on. See Ch. 3.2.

<sup>14</sup> Both the narrow specialization and holistic thinking are needed. The latter uncovers complexity which results from relations, the specialization uncovers complicatedness. (Schiemenz, in Mulej et al., 2000, and earlier) We will come back to this issue later on. See Ch. 3.4.2.

<sup>15</sup> LvB detected a lack of a clear definition of both science and GST with both practitioners and researchers in his time, too.

### 1.3 DIFFICULTIES WITH IMPLEMENTATION OF LvB'S IMPORTANT CONCEPTS

We could summarize our own local and international experience concerning backgrounds of making the LvB's concepts a practice as follows:

- LvB explicitly speaks about holism as a *worldview*, which is important, but not enough. In this way, he may be read as limiting his approach to an impact over *values*<sup>16</sup>, and leaving *knowledge* of its advocates and users to themselves, as individuals and groups who are unavoidably specialized in a discipline of their own choice. He also leaves the possibilities aside, which might have to be created for his concept to have more influence.<sup>17</sup>
- *Notions*, which come along with LvB's GST as a worldview, are rather few and not elaborated enough in details to become a prescribing operational vocabulary and method/ology. The worldview of holism has hence a too poor cognitive support to easily become widely accepted and work along with narrow specialization/s.
- *Specialization* is not a matter of bad will or bad behavior of contemporary individuals, be they scientists or practitioners, but an unavoidable consequence of the immense and growing stock of knowledge of humankind. Inside their own horizons those scientists and practitioners tend to comprise all they find important – to them and to their topic under consideration, and nothing else .
- *Holistic thinking* is a vague concept rather than a precisely defined one. Does it cover wholes without holes, or holes without wholes? In other words, a person is supposed to behave as a citizen of the world, not of a single country only, and to consider the entire biosphere (like LvB requires<sup>18</sup>). It is easy to say that LvB is right, in the time after two World Wars and the time of a permanent danger of a nuclear war, etc. But (the total, real) holism is still beyond the human capacity to practice in the daily life and work of every human being alone.<sup>19</sup>

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<sup>16</sup> We will be back to values later on. See Ch. 4.3, 6.4. They subjectively reflect the objective needs perceived by the given person and combine the cognitive and emotional aspects of her personality traits in a synergetic way.

<sup>17</sup> We will come back to the notions of values, knowledge and possibilities later on. (See: Mulej et al., 2000 and earlier, since 1974, and Mulej, 2000) See Ch. 4 and Ch. 6.5.

<sup>18</sup> Let us quote from LvB (1979, pp. 187-188): “Considered in the light of history, our technology and even our society are based on the physicalistic world picture which found an early synthesis in Kant’s work. Physics is still the paragon of science, the basis of our idea of society and our image of man.

“In the meanwhile, however, new sciences have arisen – the life, behavioural, and social sciences. They demand their place in a modern world view, and should be able to contribute to a basic reorientation. Less advertised than the contemporary revolutions in technology but equally pregnant of future possibilities is a revolution based on modern developments in biological and behavioral science. For short, it may be called the *Organismic Revolution*. Its core is the notion of *system* – apparently a pale, abstract and empty concept which nevertheless is full of hidden meaning, ferment and explosive potentialities.

“The beginning of this new conception can be epitomized in a short statement. The 19<sup>th</sup> and first half of the 20<sup>th</sup> century conceived of the world as *chaos*. Chaos was the oft-quoted blind play of atoms which, in mechanistic and positivistic philosophy, appeared to represent ultimate reality, with life as an accidental product of physical processes, and mind as an epiphenomenon. It was chaos when, in the current theory of evolution, the living world appeared as a product of chance, the outcome of random mutations and survival in the mill of natural selection. In the same sense, human personality, in the theories of behaviorism as well as of psychoanalysis, was considered a chance product of nature and nurture, of a mixture of genes and an accidental sequence of events from early childhood to maturity.

“Now we are looking for another basic outlook on the world – *the world as organization*. Such a conception – if it can be substantiated – would indeed change the basic categories upon which scientific thoughts rest, and profoundly influence practical attitudes.

“This trend is marked by the emergence of a bundle of new disciplines such as cybernetics, information theory, general systems theory, theory of games, of decisions, of queuing and others; in practical application, systems analysis, systems engineering, operation research, etc. They are different in basic assumptions, mathematical techniques and aims, and they are often unsatisfactory and sometimes contradictory. They agree, however, in being concerned, in one way or another, with “systems”, “wholes” or “organization”; and in their totality, they herald a new approach.” – Hence, it is not only generality which matters to LvB, but a very broad holism, too.

- *Generality on the basis of isomorphisms* (= similarities), actually, leaves the specialization alive and unquestioned, although LvB quotes the danger of over-specialization at the very beginning of his seminal book. Isomorphisms namely limit themselves to carrying some concepts from one science to the area of another science, but LvB does not seem to ask the question of *interdependence of sciences or practices*<sup>20</sup>.
- *Viewpoints* from which the same biosphere, incl. humankind, is looked at, select the attributes to be found crucial among many. They do not erase other attributes, but forget about them, find them (fictitiously and wrongly) unimportant or even non-existent, at least »belonging to another discipline« rather than to the same nature, biosphere, organization (in LvB's terms). Holism comes to be rather fictitious, if a single viewpoint is selected, in terms of the requirement that the entire biosphere should be considered.
- *Interdependence of viewpoints* is in this way forgotten about, so are *synergies* that result / emerge from the overseen mutual impacts resulting from interactions based on interdependencies of the fictitiously separated attributes of reality.
- *Complexity* of the real life tends to be forgotten about, too. Generality is emphasized, which seems to be how several later authors understand the so-called *transdisciplinarity*. But generality, especially the one linked with isomorphisms of several disciplines / viewpoints concerned with parts of attributes of nature, is unavoidably limited to the general part / subsystem of the entire system of attributes, thus leaving aside the group-specific and individual subsystems of attributes. This is a serious simplification, based on admitting (realistically!) the definition that science simplifies and is based on reductionism. Besides, on another occasion (LvB, 1979, p. 259) LvB defines GST as a new field in science as a logical mathematical field; this is not very much in line with the definition that GST is supposed to be a worldview (as quoted here earlier in footnote).

His concept of *organization* involves interdependence and interaction of mutually different components of the same entity<sup>21</sup>. It should imply the same interdependence concerning the viewpoints (which have evolved, among other effects, to several ten thousand specialized scientific disciplines and professions). It maybe does so implicitly rather than explicitly. If GST should help solving real problems, which it was created for, it should not go for simplification by *isomorphisms* only, but add consideration of the real complexity, too. This can hardly be done without a lot of (the requisite) *interdisciplinarity*, which enables specialists to be what they are *and* to attain the *requisite level of holism*. Which level is the requisite one, depends on the decisive persons.

LvB speaks of *goal-directedness* (LvB, 1979, 258) with the usual weak point of many: there is no discussion about what is the *basis for goals* to be defined, not only attained. The Mulej's (DST) (Mulej, 2000; Mulej et al, 2000; and earlier, since 1974; Ch. 4 here, in brief) showed that lots of attention must be paid to the definition of starting points, on which the definition of the selection of the (dialectical system of the requisite) viewpoint/s depends, and so in turn does the definition of goals. Many misunderstandings arise also from the LvB's putting equal the object under consideration and the system as its mental representation<sup>22</sup>, although he warns

<sup>19</sup> Teamwork may do a better job concerning holism, but LvB does not elaborate on it. We will come back to this issue later on. See Ch. 4.

<sup>20</sup> LvB does not seem to think a lot about interdisciplinarity as a way toward holism, although he speaks of interdependence and organization. We will come back to this issue later on. See Ch. 3.4, 4, 5.

<sup>21</sup> The perhaps best case of a real-life application of LvB's concept is the worldwide control over the nuclear weapons since the end of the 2<sup>nd</sup> World War. Global superpowers possess many of them, but keep them out of use. The United Nations declaration on *sustainable development* has received much more pressure of narrow interests. Including the climate change. We will come back to this issue later on.

<sup>22</sup> LvB, and many other authors, implicitly or explicitly put the system equal to object under consideration by saying no word about the viewpoint from which they watch the object when they call it a system.

about it (as quoted above); in DST this is corrected by the explicit care for the selection of viewpoints and author's responsibility for it and the consequences of it.

Etc. Being a wonderful concept, **GST has not come to be elaborated enough** for many later authors and users to really understand LvB. What results is far from LvB's basic intentions:

- *Oversights are replacing insights, the broader ones, at least.*
- A seminal idea of the holistic thinking does *not* become a really influential concept, even less so a reality in which the exaggerated specialization would receive a way out of its (and humankind's) *blind alley*.

Something needs to be added. We have done so by developing Mulej's (DST) and related findings of other members of our group. We will come to DST in Chapter 4.

Let us now try to understand why in practice one lacks to implement the LvB's concepts, from the viewpoint of economic reasons against them.

#### 1.4 ECONOMIC<sup>23</sup> REASONS OPPOSING BERTALANFFIAN THINKING IN PRACTICE: THE LAW OF REQUISITE HOLISM<sup>24</sup> IN DECISION MAKING

LvB spoke for a very broad and deep kind of systemic thinking, maybe even for a *total system*. He mentions planet, humanity, biosphere as a whole, global system of mutually symbiotic societies, global community, inspiring large scale action at this level of reality, our collective and hence individual survival, etc. (Davidson, 1983) Davidson rightly speaks of the LvB's »uncommon sense« in the title of his book about him. *The common sense is the opposite, the one-sided, narrow one*. Which one is right? It depends on the viewpoints.

The available room allows only for a summary of economic reasons as backgrounds of rationality, efficiency and effectiveness of decisions and action humans of today take as businesspersons. *Long-term views* are rarely preferred to *short-term* ones, *broad views* are rarely preferred to *local ones*, in the mainstream criteria of what is the basis of rationality, efficiency and effectiveness. In theoretical terms, this orientation is ascribed to Adam Smith and his book about the Wealth of Nations. In it, many find a statement, that

*everybody may be allowed to think of his or her benefit only,  
because the invisible hand of market and profit  
takes care of the common good.*

Such readers of Adam Smith make a *critical oversight*: the invisible hand praises only suppliers who please their customers well enough (See: Mulej et al, 1992; Petzinger, 2000). And this means that

**suppliers must seriously consider their *interdependence***

<sup>23</sup> Economic reasons are meant to be bases and tools of judgement, what effort matches the foreseen and/or attained outcomes best. It makes sense, if the outcomes/outputs outweigh the efforts/inputs, in terms of criteria chosen by the decision-makers. They may be entrepreneurs, inventors, ecologists, quality consultants, researchers, developers, family decision-makers etc, by their concrete roles in the concrete cases and conditions. – Climate may be included into criteria or left aside, as »the less important« attributes of inputs, processes, structures, and outputs, etc. are.

<sup>24</sup> We will come back to it later on. See Ch. 3.4, 4.2. It basically warns that everybody selects his/her/their viewpoints and therefore introduces in his/her/their basis of thinking, decision making, and acting what is found crucial. The other real/existing attributes are found rather unimportant and left aside. Therefore, he/she/they are also responsible for the resulting insights and oversights, if too little or too much was introduced and used rather than the requisite (= both necessary and sufficient at the same time) portion of attributes. This law is the youngest part of the DST.

**with their customers and other co-opetitors  
in order to attain their own benefit.  
They do not watch their own benefit only, literally.**

Consideration of *interdependence and ethics of interdependence*<sup>25</sup> when others were reading Adam Smith etc., has not prevailed over a more *biased* one for several reasons. These reasons include the following experiences:

- It is *decision making* which leads life. And it is based on *interests* and other values and emotions, and on talents, knowledge to answer the questions “what?” and “how?” that all together make an interdependent / ordered set, i.e. system (called »subjective starting points« in DST – see Ch. 4). With them one perceives the outer circumstances, conditions and preconditions. This is the basis of *selection of viewpoints* to be considered, and of the resulting decision making, acting, and benefiting. From economic viewpoints, which prevail in the humankind’s reality of today, *the marginal benefit and marginal cost* have a high priority (Rebernik, Repovz, 2000). “In the long term, we will all be dead”, humankind’s economists have been taught by the most influential economist of the 20th century, lord J. M. Keynes. Thus: **what is “sustainable development” compared to the current benefit?** – If such a question is replied on business terms of the free-market economy, the LvB's concept of the GST as a / the worldview can *hardly enter the scene*.
- Life is supported by *technology* of any work process in production and all other activities. Technology is no longer based on the real-life experience (of trial and error) only, but more and more on *science*, for humankind to avoid disasters. Scientists have the obvious tendency to attain *objective* scientific insights, fortunately. But they tend to be naturally *limited* to a selected viewpoint for the amount of problems to be manageable, unfortunately. Interdependencies under consideration are limited to the *selected object* under consideration and the *selected viewpoint* or set of viewpoints or, in a best-case scenario, to a dialectical system of viewpoints. (See: Mulej, 2000 and earlier, since 1974) – The selections are quite **far from the worldwide scope and scale, which LvB has required, normally, because LvB requires a (nearly?) total system** (as we conclude from the above quotations).
- One reason for the above selection is the (unavoidable!) *specialization* of science, knowledge, and skills to single disciplines and professions, for the amount of data, messages, and information of today to be *manageable*. It is well known that in the last few decades more scientific and other findings have been published, more books and articles, than in all thousands of years before 1950s. About 200.000 articles are published a year, some of them are classified as the ones in best scientific journals, many further journals and languages are neglected in this process, so are books. – It has become **impossible for individual specialists, both scientists (in labs) and practitioners (in the real world) to match the Bertalanffian scope and scale**. Flood (1999) puts it nicely: humans are somewhere between mystery and mastery of life, knowing of the unknowable, managing with the unmanageable.
- The unavoidable specialization has been the reason for one more fact: reduction of the GST ideas to an understanding of its notion of transdisciplinarity, which tends to support *formal isomorphisms* (see: Jackson, 1991; etc.). They are rather *transferable* from one single science to another single science than making them *co-operate*. Thus, the concepts claimed by GST come to be limited to application *inside single* viewpoints and objects selected for consideration as *small fractions* of the entire biosphere. – The so-called generality of such isomorphisms mostly becomes a formality, in terms of the above understanding / quotation of LvB. Specialists are unavoidable, but they should better add

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<sup>25</sup> See Ch. 3.4.5.

to their role the one of **interdependent *mono-disciplinary specializations needing and practicing inter-disciplinary creative co-operation as a basic way toward a trans-disciplinarity, which would not be too reductionistic / generalistic.*** Thus, the notion of GST would be better applied.

- But, over the last three centuries, since the times when enlightenment and rationalism had replaced the medieval concluding with no proving, *reductionism* has been a very helpful style of both the scientific thinking and the practical work. Appreciation of the many good experiences of the reductionistic thinking resulted, because it certainly did provide and still does provide many important insights and capacities to control the selected parts of reality. (See: de Zeeuw, 1999) But they though tend to be only *partially realistic* and hence only *partially scientific and usable and useful* due to their reductionistic (i.e. narrow, limited) basis of analysis and hence of outcomes. – But the Bertalanffian concept causes **another danger: *no focus, which most people might be able to cope with.***
- Though, there seems to hardly be *another way out*. Specialization has caused specialists to educate specialists. The dilemma has been clear: you are either a rather narrow specialist, who knows a lot / enough / something about a small fraction of reality, or you know nothing deeply enough. The problem could be overcome by *teamwork*. But, only individuals who are able and willing to **work with mutually different specialists** know that they are interdependent with the ones different from them. The others live with negligence of dialectics<sup>26</sup>, as a practice and a philosophical science of interdependence, which does not suit the closed-in / “tunnel-vision” thinking of specialists in their own ivory towers.<sup>27</sup> Besides, dialectics would best be applicable in the formulation offered by Fridrich Engels (Engels, 1956), which has been even more frequently misread and misused than the ancient Greek and Hegelian formulations. The ancient Chinese “yin and yang” is a version of the same concept, which is also very much forgotten about or misunderstood by the West. (Delgado, Banathy, 1993) **The West prefers systematic work style to the systemic one** (Mueller-Merbach, 1992), i.e. thinking in parts with no interdependencies between them rather than in wholes. – That’s why Davidson (1983) rightly comments that Bertalanffian thinking is found uncommon sense.
- LvB might not have used *dialectics*, formally and directly. Anyway, in order to introduce the notion of interdependence, LvB introduced his own understanding of the notion “organization”. He stresses **interdependence, not the subordination** or the legal aspect of an organization. Over millennia, there has been a lot of reduction of the notion of organization to the issues of power and bosses’ control over subordinates’ motivation and work processes. (Schmidt, 1993) It had the form of organizational schemes stressing hierarchy of the commanding (“higher”) position rather than hierarchy of processes (sequences, following order of process steps, succession) and interdependence inside them and between them. Subordinates were visibly dependent on their bosses, who could hire and fire them. But bosses hired them, when they needed their help, work. In order to give them good orders, bosses also needed data, messages and information from their subordinates. *Interdependence has been around*, but they preferred to see it as a one-way dependence, which has been only the legal viewpoint, actually. – Necessary, but not enough, to match the Bertalanffian concept of organization – and be holistic.
- Another subordination has also been practiced for millennia since the humankind’s transition from the nomadic economy to the *settled agricultural* one. This innovation enabled many more humans to survive, but it also made humans (wrongly) feel as *bosses*

<sup>26</sup> Dialectics is the ancient Greek word for interdependence, which is the ancient Latin word for mutual need for each other, which is due to mutual difference due to which A is complementary to B and B is so to A. (see: Vodnik, 1960; Delgado and Banathy, eds., 1993; Bai and Lindberg, 1997; Mulej, 1974 and later; etc.) We will come back to it later on. See Ch. 3 and 4.

<sup>27</sup> See: Creech (1994) etc. for – dangerous – practical consequences of one-sided thinking.

over the nature rather than as an equal and interdependent part of nature. **Negligence** of and also a lack of data about **interdependencies in nature, including the humans**, have been practiced for millennia. This may have been less of a problem as long as humans were much less numerous, production and waste was much smaller, nature was still able to digest it all. The *industrial period* on the basis of free entrepreneurship made people in the West much richer by innovation (Rosenberg, Birdzell, 1986), and the nature much more unable to digest all the waste. *One-sided innovation* caused soil to become less fruitful, air and water etc. to become sources of illnesses such as pest, cancer, etc., although the aim has been the opposite outcome.<sup>28</sup> But relations between causes and consequences, inputs and outputs, have been hard to see, especially all the so-called side-effects. Only later on, recently, such data were offered by Gaia etc., even much after the main bulk of the work had been done by LvB; Gaia has been reaching some understanding and broader publication only recently (Myers, 1991). The United Nations conference in Rio de Janeiro, 1992, claimed the concept of “sustainable development” and thus required interdependence of humans and other parts of nature to be considered better. All later conferences, though, gave poor outcomes, so far. – **The concept of humans and “natural environment” prevails over the concept of “co-world”**<sup>29</sup>.

- Similar is the prevailing of the contemporary *disregard for interdependencies* in relations of *humans to humans*. What happens is a **reduction of e.g. the notion of democracy from an organizational form enabling (interdisciplinary) co-operation, creativity, and coming closer to holism, to a tool of control over the governmental relations** on the level of political entities, only / mostly. Why should democracy as a concept of equal rights and duties be reduced to the general part of concerns of a society and forget about relations in all other organizational entities? Democracy provides for a possibility for all members of an organization to make an impact, indirectly and in synergy, at least. From the Bertalanffian viewpoint, this would mean an important chance for everybody to be a *responsible citizen* rather than a passive member of the unit under consideration. Networks made of friends function much better than hierarchical subordinations, experience has demonstrated. Hierarchical subordination surfaced millennia ago, when they were building pyramids as graves of the pharaohs in Egypt. (Schmidt, 1993) It was an innovation, then, giving the broader professionals the upper hand over the narrower ones. It also provided for a type of motivation. Both reasons have survived until the very contemporary times. Scientific management (Taylor, 1967) etc. resulted, but in times when there were many less highly educated and trained persons around than today, in the advanced part of the world, at least. In the market, businesses, other organizations, families, schools, local communities, *democracy makes much more sense than hierarchy* as somebody’s right to order others to work for his or her own benefit<sup>30</sup>. But it goes *against the grain* of those persons who forget about their own specialization and resulting interdependencies. - They cannot be expected to care for a Bertalanffian role as citizens of the entire world.
- Our recent analysis of *what is offered under the concept of “system”* in the “systems thinking / science / theory and cybernetics community” lets us see quite clearly (again) that *very few authors* tend

<sup>28</sup> That's why »the tragedy of commons« results that we have mentioned in the book title and Foreword.

<sup>29</sup> Pless (1998) speaks of “Mitwelt” rather than “Umwelt”. She is much closer to LvB than other authors are

<sup>30</sup> Private ownership is found the most efficient, today. Rightly, in economic data. But which private ownership? There are at least two concepts. The ancient Roman definition says that ownership is the owners' right to use and abuse. There is no responsibility, which has surfaced later on in one part of the world (See: Ursic, 1996).

- to define explicitly what they mean by a “system”<sup>31</sup>, in spite / because of its long list of meanings;
- to work in interdisciplinary teams rather than individually and inside their own specialization. (See: Trappl, ed., 2002; etc.)

What results, is the ***oversight of the crucial role of the selected (system/s or even dialectical system/s of) viewpoint/s in one’s definition,***

- what parts of reality are considered, and what about their interdependencies with other parts of reality;
- what parts of the really given systems of attributes of the feature / object / thing / event / process under consideration are found worth consideration, and which ones are less / not so.

This oversight is actually the basis of *reductionism*. This would be less of a problem, if it did not happen *under the name of systemic thinking*, frequently even explicitly under the name of the GST (see: ISSS45, 2001). – It happens for practical reasons, summarized as the prevailing of the real complexity and complicatedness over the natural human capacities to see and think holistically, especially in terms of LvB.

The consequences are oversights, disappointing surprises, several kinds of blindness (Oshry, 1996).<sup>32</sup>

- What might be worth consideration here, last but not least, might be the issue “What comes *first, analysis or synthesis?*” We have put this question very many times over e.g. Mulej’s good thirty years of dealing with systems theory and applying it to innovation management, including consulting. The usual response is: “Analysis comes first, synthesis follows it to summarize its findings.” This is not hard to prove. But there is another question: “Why do different individuals / groups reach different conclusions when analyzing the same situation / event / process / thing / individual / group / object / feature, ...?” There is the crucial role of the fact that every **analysis does not only lead to a synthesis (of conclusions, results), but also depends on a synthesis (of the starting points of the analysis)**, which causes the *orientation of analysis* to be either more holistic or more reductionistic or less so. Thus, there are two types of synthesis, in a schematic approach. The one before analysis is, of course, impacted by the synthesis of results from a foregoing analysis, which has also been based on *synthesis of the starting points* for the analysis under consideration. - This means, that LvB was very right, when he wanted GST to be a new worldview and a new methodology, both at the same time<sup>33</sup>.
- Etc.

We better stop here and make a conclusion from the collected insights. It reads:

**the LvB's concept is very necessary to humankind,  
but both the understanding and implementation of it**

<sup>31</sup> One can easily be confused by the very different meanings of the word *system*. It may mean an existing object, a mental and/or emotional representation of such an object from a selected viewpoint, a method, a usual way of working, a defined order, a mathematical ordered set, a complex feature, an emerging feature, a synergetic feature, a round-off entity of any contents, a tool or aide, etc. Therefore, a clear, exact and explicit definition of the selected content is necessary.

<sup>32</sup> We will come back to it later on. See Ch. 3.4.2.

<sup>33</sup> See: Mulej, on subjective and objective starting points, 1974 and later, only a few years after Bertalanffy’s book, which was not known or used in Yugoslavia then. LvB’s revised edition of 1979 was published at the same time as Mulej’s book of DST (Mulej, 1979) which sold in 3,000 copies in a nation of two million. It was a bestseller among professional books of the time.

**depend on humans, especially on their / our capacity  
to think, decide, and act requisitely holistically.**

## **1.5 THE LAW OF REQUISITE HOLISM VERSUS REDUCTIONISM AND IR/RESPONSIBILITY – A POSSIBLE WAY CLOSER TO LvB'S CONCEPTS**

Mulej and Kajzer (1998) introduced the *law of requisite holism*<sup>34</sup> and tried it in a number of international conferences successfully. On these terms, all the above and other cases say: all the authors / decision makers / actors tend to define *their limits and frameworks* of research and/or practical activities inside their *own level of holism / as comprehensively as they have found appropriate*. It has not always been good enough, which is visible in the *outcomes*. If they are satisfactory, the *level of their holism* is OK<sup>35</sup>. In many cases it is not so, an exaggerated reductionism prevails too much<sup>36</sup>. **Closer to the LvB's concept of holism authors / decision makers / actors are, more of a chance for success they have**, if they deal with complex features.

On the said terms,

- *Democracy* is better than autocracy (in politics, organizations, schools, families, local and other communities, everywhere).
- (Co-operating) *leadership* is better than (commanding) managership (See: Creech, 1994).
- *Recognizing the given complexity* is better than a bluffing oversimplification, etc.

A *methodology* is needed to make this all happen. Among the systems theories, the following ones seem to come closest to it: Soft Systems Methodology, Viable Systems Model, Critical Systems Thinking, Dialectical Systems Theory, Cybernetics. They try to make an impact over the humans, implement the LvB's idea of a holistic worldview.<sup>37</sup>

But they are all used, abused, misused, or refused by *decisions*. Let us take the case of business decision making, because these decisions have had a major impact over the climate and other environment problems of today (See e.g.: Hawken, 1994; Ecimovic et al., 2000).

## **1.6 THE ROLE OF BUSINESS DECISION MAKING IN IMPLEMENTATION OF THE LvB'S CONCEPTS**

LvB, actually, *speaks for sustainable development*, by suggesting his very holistic worldview. But his suggestion cannot become reality on its own, but by human decision-making, especially the business decision-making (BDM).

The possibility of application of the Bertalanffian concept of sustainable development (BSD) (Bertalanffy, 1968/1979) in BDM is determined by a number / system / dialectical system of factors. Considering the experience from the business systems (BS) and different investigations, the following can be found about covering BSD in BDM.

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<sup>34</sup> We will come back to it later on. See Ch. 3.4, 4.2.

<sup>35</sup> What is OK and what is not OK, depends on criteria, which are chosen, again with a more or less requisite holism of thinking, decision making, and action. It may also differ quite a lot from person to person, depending on differences in starting points and resulting (dialectical systems of) viewpoints, of course. See Ch. 3 and 4 and 5 for theory, Ch. 6 for practical consequences.

<sup>36</sup> E.g., only one percent of inventions patented in USA, really become innovations, i.e. successes. (www)

<sup>37</sup> We will come back to them later on. See Ch. 4 and 5. The others, which we know of, tend to offer tools for humans to better deal with some other topics and problems, and do not care much what kind of people and for what kind of purpose will use these tools.

The great importance of decision-making (DM) in business operation is based on its impact on the definition / determination of objectives / goals, processes, and the structure of BS as well as on the BS's way of employment of its monetary, material and human resources. The development of DM is, therefore, determined by *management*, which has thus a *direct influence* on the determination of goals, on the direction of the operation, and on the achievement of business results (Potocan, Kajzer, Mulej, 1997). They may include BSD or leave it out.

Whether or not BDM meets the law of requisite holism and matches enough the LvB's criteria, depends to a great extent on the decision-makers' *selected subjective starting points* for its design, formation and operation including the knowledge (thesaurus) of decision-makers. Modern concepts of DM are based on the *interdisciplinary approach, holistic consideration, and methodological standardization* (Potocan, 1997), as a dialectical system, of course. The application of all three of them in the decision-makers' thinking, decision-making, and action enables a rather comprehensive view of business operation but, nevertheless, it neither provides the BSD completely nor for sure. Reality is too complex.

*Transdisciplinarity* is a basic theoretical concept in GST and is valid also for the treatment of the BS, incl. BSD, by BDM. It faces an open definition of the area of its possible solution. It cannot be totally assured in a real DM situation, as the decision-makers consider only science/s that they find important, on the basis of their subjective assessment. For this reason, the BDM can only receive a finite and partial level of transdisciplinarity, attained by the **interdisciplinary cooperation of monodisciplinary sciences** (Mulej, Kajzer, 1998).

DM can also be made more holistic by the consideration of knowledge of the majority of sciences necessary for the conception, operation, and organization of DM (Potocan, 1998). The **possible holism of BD** can be defined as an interval that is, on one extreme point, restricted with a *complete/total holism* and, on the other extreme point, with a *complete/total one-sidedness* of consideration. According to the definition, a *total holism* of DM includes *all* knowledge of any DM (total knowledge). It cannot be assured in business operation since it requires *unrealistic* abilities (perfect knowledge, rationality, knowledge of the entire world) of its participants. On the other hand, the application of the *total one-sidedness* can make BDM cover all the insight, of course only inside the framework of the *selected* starting-points or within the consideration of a selected set of attributes, i.e. as a *fictitious holism*. The issues of BDM are business problems (i.e. social phenomena) on which natural and social laws make a synergetic impact, are simultaneous and hardly separable. Business problems can be quite comprehensibly studied from the quantity aspect (inside natural sciences), and less comprehensibly from the quality aspect (inside social sciences).

The third basic concept concerning B/DM is the **methodological standardization** of B/DM. By its application we can form *general* starting points for BDM to allow for a *uniform* treatment of different DMs and for the DM in different BSs. By standardization we, therefore, assure a uniform approach to, understanding, and implementation of BDM. A *less total, rougher standardization* makes possible a higher uniformity of different DMs and the DM in various fields. Nevertheless, their results depend on the subjective characteristics of decision-maker/s (knowledge on contents and on methods, values, talents, emotions). They have a lot of choice left. Within the application of a rougher standardization, we can, therefore, learn to know the *majority* of *general* features of DM and can, in this way, create resulting *general* solutions, but no detailed ones. Through a *more precise standardization* we can limit the area of DM uniformity and within its framework assure a rather big methodological holism of DM.

The solution for the *selected area* thus considers a majority of important factors, processes and DM situations. The methodological standardization, therefore, enables a wide-reaching and profound DM and, in this way, contributes to increasing of holism of BDM and supports the concept of BSD.

Further on, a direct implementation of the DM process involves numerous **factors that restrict** the attainment of BSD in BSs. BDM can be defined as the entity of issues of preparation and of a direct implementation of DM. Within the preparation of DM, we determine the *goal area* dealt with, the *aspects* of treatment, and the *factors* of treatment. By the research of the existing and envisioned situation/s we attempt to find out the (potential) deviations of outcomes from the desired / foreseen state, and define them as problems. In our further work, we select the actual *business problems* (out of a number of problems), which we try to thoroughly investigate on the basis of the cognition of (a dialectical system of) the major aspects of their operation. Within BDM, we study the *economics* (economic adequacy of DM), *ethics* (moral adequacy of DM in relation to the social and natural environment), *image* (adequacy of DM behavior), and *innovation*, attained by the BS under consideration, and synergies of these basic aspects. We continue with the selection of the factors (subjects and objects), which significantly influence DM. The concept, formation and the working out of the preparation of DM are necessarily *subjective* (from the decision-maker/s' aspect) and also incomplete / poorly holistic (from the business operation and the environment / sustainability aspect). This is so for natural reasons discussed above<sup>38</sup>.

This selection is anyway followed by a direct **application of DM** that includes the definition of a DM situation, the formation of a model (or a /dialectical/ system of models) of possible solutions, the evaluation of possible solutions, the selection of the best solution / decision, and the implementation of the chosen solution. The (requisite) *level of holism* of a given DM is determined by a number of subjective and objective factors, as a (dialectical) system. DM covers cognition of *purpose* (objective, subjective) of the *BS* and its *environment*, the *situation* in BS and in BS environment, the provision of the *additional knowledge* (on methods and on content), needed for its implementation, the system of *evaluation*, the system of *selection*, *operation* system, and the adequate *controlling* system. The (requisite) level of holism of each and every among the above stated elements depends on holism of knowledge about DM methods and content and on the adequacy of the set goals.<sup>39</sup>

However, a complete system of elements of DM, thus created, still does not assure a requisite holism of DM. The impact of any individual element on the holism of DM depends upon the *subjective adequacy* of DM implementation. In this way, the mode / process of application of DM impacts the holism of *implementation* and of possible *results* of DM.

We are, therefore, facing two kinds of **problems**:

- By the selection of the area, aspects and goals of DM, we *limit* the research area and sub/consciously *refuse* the possibility of (a total) *holism*. The main reasons for this are the *economics* of labor and the (unavoidably) *biased knowledge and values* of decision-maker/s. The defined area is thoroughly investigated, and the *economics of DM* remains the main factor for the judgment on its adequacy. Of course, the economics of DM is influenced both by subjective and objective factors. For this reason, each DM solution is a self-sufficient entity in accordance with the recognized characteristics of the real situation, of the available sources for DM, and of the DM conditions taken in account.

<sup>38</sup> Hence they hardly can attain the requisite holism, which would allow for fully reliable decisions.

<sup>39</sup> If an expert system is supposed to support DM, then additional issues show up, such as syntax, semantics, and pragmatics of DM, etc. (Potocan, 1999)

- This DM process may lead to the highest possible / requisite level of integrity within DM in modern circumstances of business operation. However, it significantly deviates from the hypothetically possible optimal DM aimed at the BSD.

In short, the case of DM shows that the LvB's approach would be very *desirable*, but could be *hard to implement* in practice. The human activity remains between mastery and mystery, knowing of the unknowable, and managing with the unmanageable (Flood, 1999).

## 1.7 CONCLUSIONS ABOUT LvB'S CONCEPTS CONCERNING THE CLIMATE CHANGE

The Bertalanffian total level of holism seems impossible to attain. An action such as UNO's requirement (in Rio, 1992 and later, including 2002 in Johannesburg, SA) for "sustainable development" to become the basic general concept of economic life, is a badly needed one. But it hardly has a chance to succeed, if the *objective and subjective starting points of all, or of the decisively many*, at least, individuals and organizations, do not make them **feel** enough of **interdependence** with many others to accept *broader criteria* of their own marginal benefit and marginal cost. This is the part of the subjective starting points, which is expressed as *values*.

The *knowledge on contents* answers the question »what and why«. It includes the *many facts from many disciplines of science*, both on nature and on humankind as the especially influential part of nature. These facts exist and need to be both **known and synergetically linked into new wholes of knowledge**. This would reduce the holes in knowledge.

The *knowledge on methods* answers the question »how and why«. No goal can be attained, if the question *How* receives no requisitely holistic answer. In the case of the search for holism, the point is the transition from giving orders with disregard for interdependence, and group work (limited to multidisciplinary with no mutual links between the disciplines), to **team-work realizing creative co-operation of mutually different specialists as interdependent, mutually complementary ones**.

Humans of today will never attain the total holism: this is beyond the *human scope*. But we certainly can, both as individuals and as humankind of the current period, do much more than so far. *Broader criteria of the marginal benefit and marginal cost* might be a good first step.

There is a *common denominator* of all the possible cases and examples as well as of all different contents of systems, which all in one way or another meet criteria of the law of **requisite holism**. These are the *information needs*, that are addressed by the content of the system(s) in question from the (dialectical systems of) viewpoint/s, selected by those who introduce systems to re/present the selected attributes of the selected parts of reality.

In other words, it is *always up to the influential ones* to decide, *which level* of holism is the appropriate one. This is a serious responsibility. It is naturally impossible to take this responsibility and meet it with a poor or no **transdisciplinarity, interdisciplinarity, democracy, creative co-operation of as many specialists as may be essential / requisite in the given case**. How far toward all these attributes of human behavior we go, depends essentially on the individual / **prevailing subjective starting points**, i.e. the system made of values, knowledge and skills, emotions and talents. They, of course, reflect the external needs

and possibilities<sup>40</sup>, too. If the subjective starting points become more **systemically**, not only systematically, conceived and implemented than so far, humankind has more chance to be able to consider the concept of sustainable development – and thus to survive.

Therefore, it is not enough to produce a science as an objective insight to be used as a tool by humans of any kind.<sup>41</sup> It all depends on humans and other parts of nature, and their interactions, which reflect their interdependencies. We will later on concentrate on humans, again (but add some ideas about the other parts of nature first in Ch. 1 TR, to see objective reasons to do so).

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<sup>40</sup> The external needs and possibilities, as a dialectical system, make the so-called objective starting points, i.e. the external circumstances / conditions and preconditions of a human action. The objective starting points are interdependent with the subjective ones, of course. See Ch. 4.

<sup>41</sup> It is not the gun that kills. Etc.

## ***1.TR THE CLIMATE AND THE CLIMATE CHANGE AS A NATURAL SYSTEM<sup>42</sup>***

### **1.TR.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 1.TR**

From the natural viewpoint the climate change system alias the climate, the climate change – is a set / system / complex entity of conditions within the living space of the biosphere. Actually the living space is the biosphere itself, which is a tiny part of the Earth Planetary System. Watching the climate, and taking it into consideration when humans have been making their decisions – these have been two very separated issues, especially in the recent centuries in which the industrial life has been taking the lead and has caused a narrow professional specialization to reign and prevail.

There are two main sources of the climate change: the natural ones, and the ones caused by humans. We humans should understand both of them in order to accept the natural ones and to possibly prevent their tough impact over ourselves, such as floods, droughts, atmosphere and water pollution etc. But we should better understand and cope with our own tough impacts and prevent them, too.

### **1.TR.1 THE NATURAL AND ARTIFICIAL SYSTEMS ON EARTH AND AROUND IT**

The systems (as complex entities rather than mental pictures of them) could be formally set according to their size as follows:

- MACRO / MEGA / SUPERIOR / SENIOR / VERY BIG etc., systems such as the Universe, the biggest system known to humans, the Milky Way, the Solar System, the Planet Earth System etc., and
- MICRO / INFERIOR / JUNIOR / SUB etc. systems that are smaller and are either natural such as Homo Sapiens / plant / animal / living creature/s, and or artificial / human-made systems such as a township / car / aircraft / rocket, etc.

Of course, the above artificial and natural systems cause a need for differentiation of sciences to natural and social sciences, of which none includes all human activities as an integral part of the nature. We think there are no artificial and natural systems, but all of them are natural as long as they are results of living creatures' activity. But we know it may take a long time for many to understand such a philosophy. For the time being let us use the terms artificial and natural systems.

The system theory, thinking, analysis, and synthesis are the best assistants available today for humans to understand complex problems, which both the macro and micro systems are. There is no simple system, and there is no system we may say that humans know everything about. This could be stated more rightfully when one uses system thinking, which could make the difference between the scientific thinking of today and of tomorrow.

The challenges to us humans of today are much more complex than ever before, because we have reached a sort of a critical peak of our ability to understand the present time. The proof for this is our relationship with nature, space and environment, which is going to become unfriendly to [timi.ecimovic@bocosoft.com](mailto:timi.ecimovic@bocosoft.com), and Prof. Dr. Rashmi Mayur, International Institute for Sustainable Future, Mumbai, India

humans, and not a good friend, as it should be. Our civilization's anthropocentric philosophy, its present social order, its religious approaches/governances, profit-based democracies, local, national, international and United Nations' bureaucracies, totalitarian rulers, lack of tolerance between different people/s on the Earth, policies (from antique times until today) of divide and rule, bread and games, ruling by information monopoly – are organizational techniques, which need restructuring/transition/new approach for a better tomorrow. Whether our civilization will have a better tomorrow or not is a question, which we better answer before its breakdown will happen. We think optimistically, that tomorrow will enable our civilization to understand nature, space and environment/climate change, cosmos, and other systems. As a result this will open large doors to sustainable future for all of humans living on the planet Earth.

The current understanding of the climate change is limited by anthropocentric and other views, which is not the case, when using systems theory, thinking, analysis and synthesis, which could make us better understand the interdependences / interactions / mono/multi/inter/ and supra-disciplinary issues, all of them as an integral part of the inferior and superior systems, within the system of the planet Earth, and further on the Solar System, the Milky Way, and the Universe.

The Nature does not repeat itself, but it always goes in only one direction - dynamic evolvement ahead.

We humans, with all our beliefs, religions, natural, social and technical achievements, technologies, techniques, governances, local communities, families and relationships, sooner or later think we are Gods, which have to rule the nature, space and environment of the biosphere. When it comes to the point of joint action, “mutual interest” and survival of our civilization, many excuses are handy such as national interest / national security / national citizens' well-being, etc. But all of them are empty phrases defending/protecting individual/collective rulers, and national elites. We believe into the role of leadership, but we believe also into the moderate life style, which allows long life, peace, and stability, because Nature requires it.

How does the today's understanding of the climate change result from the anthropogenic influences, we may explain best with rule of international bureaucracies, who have sufficient monetary resources to pay scientists to speak and write as they wish. Redirection of scientific research, applied research, and theoretical work is hardly possible, as long as one-sided businesspersons, (their) politicians and bureaucracies are handling resources: they learned how to rule, but not how to make a holistic rather than narrow-minded progress in sciences and technologies of the planet Earth systems. How to explain the fantastic development of armaments, chemical synthetic products, 800 million motor vehicles, and many more explosive engines, such as aircrafts, ships, boats and agricultural machines motors, marketing and profit-making oriented products, transport system, promotion of “globalization” as a tool for making money, while scientists are not paid to do their basic research work, and must neglect the research needed for understanding issues of the biosphere system, which is threatening our civilization with responses of the climate change system and the whole Biosphere to human actions?

The pending big “tragedy of the commons”  
is overseen, that's how.

The climate change system is a macro system of the nature made of many interdependences and superior/inferior natural systems, and the climate change system is responding not only to our civilization's activities, but also to rules of other systems in nature. If we do not understand the climate change system, it is so due to the improperly directed research. This has nothing to do

with the common humans, but with the one-sidedness of the present social order, profit-based democracies, especially in nations of the G 7 countries leading our civilization, and international bureaucracies. They lack holism and make room for one-sidedness of human actions.

Let's us take the case of CFC's, the ozone depleting synthetic chemical products, which were produced because of the market-oriented research and production aimed at profit rather than benefit, and caused the climate system to react with its change, which may respond with a total destruction of our civilization: **we have to learn** how to manage ourselves. It is true that humans did not know of the side-effects of CFC's, but now we do: there is no reason to continue with the previous practice, such as the genetically modified organism's techniques, war technologies, uncontrolled development and use of new synthetic chemical products, and explosive motors, which are at present the most dangerous activities of our civilization, not to mention information techniques and energy transmissions influencing magnetic fields and basics of the Earth equilibrium.

Chapter by chapter we shall do our best to produce a basis for better understanding of the present and future of our civilization.<sup>43</sup>

## 1.TR.2 THE ORIGIN OF THE PLANET EARTH

From energy and gases to planetary explorations, that's how the process can be summarized.

The climate/the climate change is a system of the biosphere, which is responsible for the maintenance of living conditions. As a natural system it is inferior to Biosphere, planet Earth, Sun and Solar System, the Milky Way System, and the Universe. Later on we shall look into separate systems. The climate change system has many inferior systems like: atmosphere, seas/oceans, terrestrial, and other areas related to biosphere, and all the mentioned systems have inferior systems, which all together make a holistic biosphere system. All mentioned should be understood as moving/interdependent/interacting/dialectical and dynamic systems, which always evolve. The moving direction is **only dynamic evolvement ahead**. To an uninterested walking person the nature may look like chaos, but as the late Prof. Dr. Helmut Metzner wrote in "Chaos to Bios", that nature may look like chaos to us humans, but also our achievements may look to nature like chaos, and not like order, as we believe. It is holistic knowledge and ethics, which has to decide on right or wrong.

The climate change system is a very complex system, which is interrelated with a number of superior and inferior systems, and the main purpose of the climate change system is to maintain the energy equilibrium, mean temperature, moisture/water cycle system, composition of troposphere, atmosphere and ocean's currents. Many more subsystems will be explained later on.

Definitely the climate change system cannot be explained/understood/researched with the knowledge of one or two of the presently known scientific disciplines, but the scientific research approach should be holistic, supradisciplinary, multidisciplinary, and done by a team of scientist working for a common goal on an interdisciplinary basis. It is obvious that scientists need techniques of the system theory, thinking, analysis and synthesis, and complex problem solving to work successfully on the explorations of nature.

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<sup>43</sup> As we said, in chapters denoted with TR we will present data on nature's actual situation, in other chapters our solutions.

Supradisciplinarity in terms of our research, from the natural sciences point of view, is a precondition for the individual to be able to understand the complex problems of the complex systems. The supradisciplinary work/research is above the classical scientific disciplines, at least from the viewpoint of understanding the needs of research/work/action aimed at system functioning in regular conditions and otherwise, interrelated with the system itself, and its inferior and superior systems.

The main purpose of the climate change system is the maintenance of the living conditions within the biosphere, and is calling for explanation of life. From our research in natural sciences and other findings we think that the life could be explained by the hypothesis in the following equation:

$$\text{Energy (E) x Matter (M) x Information (I) + Time (T) = Life (L)}$$

$$E \times M \times I + T = L$$

The life should be understood here as life appearance on the planet Earth, which has a unique composition/place/physics/geography/biology and is permanently evolving its own nature, space, and environment quality, reflecting the present status of the system and its superior and inferior systems' qualities. An integral part of the evolvement in the biosphere is information, which is interdependent with energy and matter in defining the essence of a specific living creature and feature. Basic information connected with life itself is in their gene structures, which are composed by four amino acids in different combinations to systems, specific of every species for which it has been simultaneously (by evolution) composed. The first life information has evolved simultaneously by evolvement of the first life structure, and the later evolvements have been a reflection of the evolution.

The living conditions are not a set, but rather a system/entity of the biosphere environment qualities, and are preconditions for life to appear. The theory of evolution, the Gaia theory, the system theory, the known past and present, and status of the biosphere are proving the above hypothesis to be correct.

The origin of the climate system, and the climate change system are dynamics of the planet Earth – its appearance and existence, as a part of the Solar System's appearance and existence, and as a result of the Universe's dynamics.

The climate change system rules over the life status on the planet Earth, not by command, but by interrelations, interactions and consequences of the system dynamics. Here we may comment on the role of humankind/present civilization in the climate change system, which may be described as triggering the system dynamics by our activities. We shall comment on this later on.

### **1.TR.3 THE CLIMATE CHANGE SYSTEM IN THE PAST AND PRESENT TIMES**

The planet Earth appeared around 4,5 billion years ago (4.500.000.000). At that time the planet was something like energy and gases with temperature around 7.000 degrees Celsius. Within millions of years the planet was cooling down, and the firm matter was formed within two hundred million years. The oldest rocks on the Earth have been dated at 4.3 billions years ago (4.300.000.000).

The planet Earth is an inferior system to the Solar System, the Milky Way, and the Universe. Please see the Drawing no. 1 in the Atlas at the end of the book.

The Universe is the macro, largest, most complex of all the systems humankind may research and explore, and it consists of all matter and all light and other forms of radiation and energy. It consists of everything that exists anywhere in space and time. The universe includes the Earth, everything on the Earth and within it, and everything in the Solar System. Our Solar System contains nine major planets along with thousands of comets and minor planets called asteroids. It also contains the Sun, the star around which the planets revolve.

If we estimate the total existing information of the Universe as 100 units present now, our civilization's knowledge may stay between one and two units. We have to explore and research much more as we have until the present time. Of course, we should not forget the system dynamics and evolvments, which both reach beyond our present knowledge of the Universe. Understanding the holistic nature of the Universe, we have to understand that the Universe dynamics are present in countless forms, transitions, expansions, big and small bangs, appearances and disappearances, and all countless happenings/evolvments.

Second to the Universe is the Milky Way System, which is a limited part of the Universe within which we humans exist. It is our first exploration target and a system about which we have to learn as much as possible. The Milky Way consist of about 100.000 billion and more stars as systems of what ever form, and a countless number of planets, micro planets or asteroids, and all other forms of energy, light, matter, and particles of any kind.

The composition of the Earth, as a planet inside our Solar System, is "unique" because of the matter and energy at its birth. All forms existing at the moment of appearance are included within our Earth System, and so are many more other forms of the Universe such as lights, particles, rays and matter that over the time from the appearance until present collided with the Earth. Major influences on the Earth dynamics come from the permanent energy flux from the Sun, and from collisions with asteroids, which arrive from the outer space. It is important to have this knowledge, which may assist when researching and exploring the climate change system, because the first outside effect on the climate change system is coming from the outer space as asteroids and other dangerous collisions, which have been changing and may change the equilibrium of Earth System as well as the climate change system.

From the past we may learn about a number of occasions on which the Earth climate change system has been reacting with dramatic changes of the living conditions. They were recorded as Glacial or Ice periods, which were results of the downward direction of changes of mean land and ocean temperatures. Of course, we should not forget that land mass and salt water mass react to the change of mean temperature according to their abilities, which are different. Land mass reacts faster, than the salt water mass. Consequently, the life on the terrestrial part of the Earth (toting to 30 % of Earth surface) has been affected more than the marine life, during ice periods.

Interdependences of the life, climate change system, and biosphere are dynamic factors for the evolution of the life forms, and resulting environmental conditions. The primordial Earth, some 4.5 billions years ago, was lifeless and unrecognizable by our civilization standards. The air was oxygen free and many subsystems of the climate change system known today did not exist. The climate change system itself was evolving according to the components and relations of the system as it does even today.

The rise of the life on the Earth mirrored conditions of the primordial surface, and its physical and other contents. It took Earth something like 0.7 billion years to evolve the life. The first evidence of the life is dated 3.8 billions years ago. From microbial life of primordial time to final

evolving of the complex biosphere around 1.2 billion years ago there was the time period within which the biosphere evolved. The first biosphere energy transition from the anaerobic to the aerobic energy production by microbial life was responsible for the change of the atmosphere from the oxygen free to the oxygen rich one. The oxygen content was around 40 % and with time it has been diminishing to 21 % as it was at the end of the XIX century. Please see the Drawing no. 3 in the Atlas at the end of the book.

The oxygen content was the major improvement of life conditions, which made the difference from the primordial time to the time of biosphere, from 1.2 billions years ago till the present time. The concentration of the oxygen in the breathing air of life creatures should not come below 8 % that is somehow a minimum needed for survival. At present in some heavily human-populated areas of big cities, the concentration of the oxygen could come down as much as just above 10 %, and we are recommending monitoring of oxygen concentration as a precondition for survival of humans in the fragile and heavy polluted environments (big cities). Please see the Drawing no. 4 in the Atlas at the end of the book.

Our civilization's first settlements were built some 12.000 years ago, as a result of social life improvement of pre-antique humans. First settlements in Europe were built on swampy areas, for security, and population was up to 10.000 people. It was a result of the changed conditions within the biosphere that evolved after the last ice period, which was ending some 60.000 – 16.000 years ago. Since then the climate change system conditions on the Earth were almost at the quality of the present time. Of course, changes have existed but not as extreme ones, as the ones coming up now. The difference between today and 200 years ago is due to the extreme input of our civilization's output into biosphere such as: waste and side-effects of nuclear technologies, synthetic chemicals, human population explosion and its consequences, and destruction of biosphere due to the ways of covering the needs of humans. In short, and we shall work out the above-mentioned in separate sub-chapters, those are reasons/impacts, which cause the triggering effects of our civilization on the climate change, as consequences.

#### **1.TR.4 CONCLUSIONS FROM THE CHAPTER 1. TR**

The climate change system is a natural complex entity/system. It consists of several subsystems and is subsystem, too, of systems such as the Earth, the Solar System, the Milky Way and the Universe. It is very old and has been changing all the time, offering rather stable conditions to the life forms. In the current climate change system much more extreme changes have been taking place, over the centuries of industrialization and post-industrialization than ever before since the end of last ice age. We humans are not the only cause of this dangerous processes, but though an essential one, especially if our decisions and actions are based on a lack of systemic/holistic thinking.

## **2. HUMANKIND OF TODAY NEEDS A TOTAL<sup>44</sup> ENVIRONMENTAL QUALITY, AND HENCE A HOLISTIC MENTAL QUALITY<sup>45</sup>**

### **2.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 2**

In Ch. 1.TR we have seen how complex is the nature we live in as its human subsystem and partial system in a continuous interaction with the other nature.

We all want a **good life**, don't we? We differ in defining what this is, and how can it be attained. To the most influential part of the humankind of today, a good life means a lot of consumption, which causes them to make many oversights, including the one of their own natural environment. Data keep saying the consequences clear: the natural environment of humankind is shrinking, because humans are more and more numerous, building more and more towns, roads, other transportation and living facilities, factories etc., which all *ruins* the equilibrium of nature and the quality of human life – in the name of *making a better* quality of life (UNESCO Courier, 1999, 2000, 2001). Humankind of today needs a *total environmental quality*, not only a partial one, according to United Nations Organization's (UNO) proclamation of 1992 in Rio de Janeiro that the humankind of today badly needs sustainable development. This book finds, that such a total quality can be achieved by a (total = fully holistic) *mental* quality, attainable by the systems / systemic / holistic thinking more easily than by the one-sided one, which actually prevails. This may demand a lot of change and learning as well as de-memorizing of the old habits (see e.g.: Rebernik, 1994; Borgese, 1995; Sparrer, 1994; Kirn, ed., 1991; Ecimovic et al., 2000a; Ecimovic et al., 2000b; Hernandez and Mayur, 2000; Ecimovic et al., eds., 2001; etc.). Problems of the care for climate, including the ones showing up (again) in 2001, demonstrate that even some very influential politicians and not only businesspersons, do not possess and apply a holistic mentality. This happens even in the cases of countries in which systems thinking has been first made a theory (see: LvB, 2001; ISSS45, 2001).

The picture of reality in *Fig. 2.1* is supposed to clarify, why is a holistic thinking so important:

### **2.1 THE ENVIRON/MENTAL (TOTAL) QUALITY**

Quality (= the capacity to satisfy customers' requirements) has for long times been what people want to have and work on. It has been differently perceived and defined, though. In very old times, humans stopped living on their full adaptation to nature, and thus started to develop their difference from (other) animals. This might have been the time when the *nature / earth* started being viewed *divided* into *humankind*<sup>46</sup> and their *environment*, no longer as a *meta-system*, of which the humankind is only a (fictitiously quite independent) subsystem (better: a partial system, due to all the interdependencies and shared attributes), and so are their sources of survival – environment.

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<sup>44</sup> Total Quality Management is a concept, which has entered the scene of business behavior over the last decade or two, when the West (actually, the North-West) of the planet Earth found out that the Japanese endeavour for a high quality and a low price had been well supported by the Deming Prize Award since 1951. For good three decades, Japanese have been outperforming the West, very much on the basis of the Total Quality Management concept. The word *total* is a metaphor, of course, denoting two basic attributes of business: (1) attaining the best possible and required quality of working in all parts of the organization, not in the production units alone only, (2) meeting the customer's requirement on the best possible and required level. (see: Mlakar, in Mulej et al., 2000, etc.)

<sup>45</sup> Matjaz Mulej

<sup>46</sup> You may have noticed that we used the word *humankind of today* when speaking of the current times.

Fig. 2.1: Interdependence of human thinking and human survival

|                                                                                                |   |                                                                                                      |
|------------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------------------------------------|
| Sustainable development: an environmental total quality                                        | → | Survival of nature, incl. humankind of today rather than her / our self-destruction                  |
| ↑                                                                                              |   | ↓                                                                                                    |
| Seeing and treating nature around us and ourselves in interdependence and hence in interaction |   | Development of special skills and adding skills of interdisciplinary creative co-operation (of many) |
| ↑                                                                                              |   | ↓                                                                                                    |
| Overcoming of too one-sided / narrow / biased thinking of so far, because it causes oversights | ← | Holistic thinking, decision making, and acting (along with specialization in a single profession)    |

This development caused a *mental* change, a change of culture, awareness, cognition, emotion, and action / behavior, and it has from then on caused more and more of an **environmental and mental change**. The mentality has depended on conditions of survival, of course, which have taught the humans to develop their *strengths*, diminish their *weaknesses*, enhance *opportunities*, and work against *threats*. Sources have always been quite scarce, competition for them has been hence a precondition of survival, creation of sources an additional one.

*Creation of sources*, though, has also been hardly possible without *using the sources* from humans' natural environment. What has been changing over thousands of years and especially over the last few centuries with their industrial kind of production, is the mental capacity:

- To develop *knowledge* about how to reduce the need for the scarce sources from the environment, and
- To apply it by *innovation* in order to better meet the given needs, requirements and wishes,
- I.e. to have *quality* (being defined as compliance with customers, as it is put by the current Total Quality Management gurus, rather than as compliance with the entire nature, as Lessem /1991/ puts it).

Along with the long-term process briefed here, values, emotions, talents, knowledge, and skills have been collected and developed from experience, real cases, science, and education or other forms of their transfer. Their *quantity* has soon become much of an *overload* in terms of the individual human's capacities to digest and apply data, messages, and information, as well as of their felt needs for information, along with their increasingly narrow specialization. Thus the long-term development of the *distribution of labor* (rather than *division of labor*, as one usually calls it in the political economy /see: Cooper, 1994/) has taken place. An ever-growing *specialization* of knowledge (including differences in sub/cultures / ethics, values) has been a natural consequence. Life in small groups - tribes, families - used to take care of **holism by co-operation and co-ordination** well enough as long as the impacts by humans and their group/s have not gone far beyond *the local*, visible and tangible ones.

The briefed way of living and development of the productive capacity has allowed for *more and more people* to live. This was reinforcing the given develop/mental process and changing it into a new quality: the relative lack of resources has out-rooted the humans' compliance with nature, and after millennia of the hunting, gathering and the agricultural production it introduced *the industrial production* etc. Quality, including the environ/mental one, became, in terms of its definition, more and more dependent on *the market conditions* (See Fig. 2.2)

Real implementation of the concept *Sustainable Development* is still very much an open issue (e.g. Vezjak et al., eds., 1997; Ecimovic et al., eds., 2000; Stuhler et al., eds., 2000). People and their organizations find a **change of their habits** neither easy nor rewarding enough, especially when the current practice seems to provide profits and other benefits, in their perception.

Our **conclusions** read:

- The *environmental* quality essentially depends on the *mental* quality.
- The term *sustainability* suggests that mental quality must consider the long-term, not only the short-term viability.
- The environment, under such a consideration, becomes *nature / Earth*, i.e. holistically conceived again, but no more only subconsciously as it used to be in old times, but with a full / growing awareness.
- The one-sided and frequently quite superficial mental quality can no longer provide for the environmental quality needed. Hence it must be replaced by a holistic and deep culture, based on interdisciplinary creative co-operation of the interdependent ones, and called usually *systems thinking* (Mulej et al., 2000, and earlier; and many others).
- The *total quality* may be a philosophical and working *concept* representing systems thinking (but rather as a concept than as the modern practice – as criticized by e.g. Tom Peters (1995), and by several papers in STIQE '94, '96, '98, '00 (Rebernik and Mulej, eds, 1994, 1996, 1998, 2000, 2002).
- The Total Quality Management (TQM) may be a method and *managerial tool* assuring the total quality by *innovation* as a continuous activity, i.e. the practicing of Systems Thinking concerning the entire Nature / Earth incl. the human life incl. its economics incl. the production and consumption, if the concept of TQM is requisitely systemic (= holistic and deep by interdisciplinary creative co-operation). (See: Mulej and Kajzer, 1996; 1998)

In *business alone*, this is hard to make, given the modern tough conditions of the extremely severe competition. Mostly, environment is not included in the criteria suggested by the innovation management literature a whole lot (see e.g.: Robert and Weiss, 1989; Henry and Walker, 1991; Bierfelder, 1994; Dyck, Mulej et al., 1998, 1999; Likar, 1998; Likar, 2001).

But there is also a lot of the

real-life evidence, how *costly* is  
the *failure to consider the nature / Earth*,  
if this failure is looked at in rather systemic terms  
rather than in short-term, one-sided and superficial ones

(e.g. Hawken, 1994; UNESCO 1999, 2000, 2001).

E.g. in good twenty years since the lack of systemic thinking had caused the *thalidomide catastrophe* with the new-born babies – it disabled many of them rather than cured their pregnant mothers' aches – the marketing of new medical drugs has become subject of much more research and checking of a much more systemic type (including synergies, side-synergies, side-effects and side-preconditions along with the direct, linear ones). Hence the cost of innovating drugs has become higher, but the cost of medical treatment or life-long support to handicapped persons, and death, is more frequently avoided. The evolution of the market toward the *state supported buyers' market* makes it possible to define the quality, the total quality, and the total quality

*Fig. 2.2: Development of the market relations and environ/mental quality*

| Type of market                                                       | Basic relation/s between production and consumption                                                                         | Impact of humans over nature as their environment                                                                              | Human interdependence with natural environment                                                                                |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| RANDOM <sup>47</sup> MARKET                                          | Producer's own consumption & exchange of random surpluses                                                                   | Minimal, growing as humankind grows in number and needs                                                                        | Intuitive consideration based on experience in agriculture etc.                                                               |
| SELLERS/PRODUCERS PREVAILING POWER <sup>48</sup> = PRODUCERS' MARKET | Growing production for poorly considered, known & unknown, customers, who lack impact over suppliers                        | Specialization grows, so does narrow thinking, too, so do bad impacts over nature (esp. by industrialized production)          | Subordinated to profit, jobs depend less on nature, growing urbanization & industrialized agriculture                         |
| BUYERS / CUSTOMERS PREVAILING POWER <sup>49</sup> = BUYERS MARKET    | Growing impact of customers requiring pleasing / total quality of products & services, & conditions of life                 | Specialization & bad impacts over nature keep growing, so do science and its application, interdisciplinarity felt needed more | Still subordinated to profit, but less forgotten about due to cost etc. caused, and to growing interdisciplinarity of insight |
| STATE / GOVERNMENT SUPPORTED BUYERS' MARKET <sup>50</sup>            | Increasingly organized / legalized impact of customers requiring total quality of products & services, & conditions of life | Growing awareness of the terrible impact of one-sided humankind impact over nature & its dramatic consequences over survival   | Still as before, but world-wide official documents urge governments and businesses to be more holistic <sup>51, 52</sup>      |

management to be a lot more in line with the *systems thinking*. But, anyway, in 2001 again a number of serious problems showed up, including several deaths due to a lack of systemic thinking about medical drugs and equipment. At the same time, in 2000, the quality standards expressed in ISO 9000 and in EQA explicitly require systems, innovation and learning to be their basic attributes<sup>53</sup> (Mlakar, in Mulej et al., 2000).

<sup>47</sup> Unclear relation between supply and demand, selfsufficient economy prevails over the market economy. Unclear need for innovation.

<sup>48</sup> Suppliers and supplied quantities lag behind demand. Potential customers wait and beg for products supplied. Producers and suppliers / sellers need no care for innovation to diminish their cost and price, attain a higher quality, offer a bigger range, become unique, or even care for the natural environment.

<sup>49</sup> Big profits of the given producers attract new and new producers, until their total supply exceeds demand. Now, the potential suppliers wait and beg for buyers. This big change produces a growing care for innovation (both technological and nontechnological), which gives birth to the modern innovative society and economy. This phase has been typical of the most advanced economies and societies of the 20th century.

<sup>50</sup> In the more or less very recent period, in the most advanced countries, the big economic crises taught people that a free market tends to become a monopolized / oligopolized one, if there is no power controlling it in order to keep the more or less free market alive. Official standards of quality, food and drug control etc. as well as non-governmental organizations tend to diminish the one-sidedness of the suppliers and their growingly immense power, including the current process of globalization. (See: UNESCO Courier, Dec. 2001)

<sup>51</sup> But knowledge on how to attain more holism, in a best-case scenario a Bertalanffian holism, keeps lacking except in some parts. It is also developed per parts, which is a good first step, which needs synergies, and hence systemic / holistic thinking. But this thinking is rarely taught in current schools around the world, including the most advanced countries (see: ISSS45, 2001).

<sup>52</sup> Officially, the *environment* is less and less out of consideration, it now becomes a part of *legislation* all way to the UNO 1992 Conference on Environment proclaiming *sustainability* to be the development standard to be met. There have been a number of further steps in the same direction, including the topic of climate change. We are trying to make a contribution with this book, too.

<sup>53</sup> This change in international rules says also that the practice of using ISO 9000 and EQA of so far has not been systemic / holistic enough: capacity to bureaucratically follow the processes was found more important, and even

The mental quality, thus, *precedes* the environmental one,  
in both good and bad aspects, synergies and consequences.

This fact includes many sciences, as well as many practices. But one also says that the mental quality has made much more progress on the *general level* than on the concrete level of the daily practice, so far.

Therefore it makes sense to try to find a new concept, as this book is doing.

## 2.2 THE FIVE PILLARS OF TQM APPLIED TO ENVIRON/MENTAL QUALITY – A FIRST STEP TOWARD A NEW CONCEPT

We cannot and need not spend much time on defining the Total Quality any more. To have it brief, let us turn to B. Creech. The US general Bill Creech<sup>54</sup> wrote his book (Creech, 1994) after 37 years in the air force and 9 years as a worldwide consultant on Total Quality Management. His book is based on his experience and observations of others' good and bad experience concerning quality. Basically, his conclusion is that the

attainment of a total quality  
is a never-ending process  
of a *continuous all-round innovating*  
*by empowered and led* professionals under the auspices  
of the *five pillars of TQM*,  
which are interdependent, interactive.  
In synergy they actually take care of systems thinking  
informally, implicitly, without ever mentioning it.

The five pillars of TQM are depicted in *Fig. 2.3*.

*Fig. 2.3: The five pillars of TQM*

|                                           |   |            |
|-------------------------------------------|---|------------|
| Product                                   | ↔ | Process    |
| ↑↓                                        |   | ↑↓         |
| O r g a n i z a t i o n                   |   |            |
| ↑↓                                        |   | ↑↓         |
| Cooperative<br>management<br>(Leadership) | ↔ | Commitment |

Our **application** of the *Fig. 2.3* to the *environ/mental* TQM reads:

- The product: the *sustainable development and humankind's<sup>55</sup> survival*.

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enough, in many cases, rather than holism by creative cooperation and making invention/s and innovation/s on the basis of the insight provided.

<sup>54</sup> Gen. Creech started his carrier as an enlisted flier and ended up as a four star air force general, basically on the basis of his work on quality. (Creech, 1994)

<sup>55</sup> Not only the humankind of today, but also the future generations.

- The process: the *synergy of the soft and the hard systems theories / methods*<sup>56</sup> and many specialized kinds of knowledge and skills by a creative co-operation of all essential and only essential specialists, incl. the environment aspect (see: Brandt and Martin, eds., 1995; Strmcnik et al., 1995; Stuhler and O'Sulleibhan, eds., 1994; Mulej and Jan, eds., 1995; Stuhler and Vezjak, 2000; Vezjak et al, eds., 1997; etc.).
- The organization(al style): *we all think, we all work* in trans-functional teams (including the environmentalists, of course) instead of the Tayloristic / Fordistic provision of permission for everybody to be irresponsible and one-sided (by the concept of the division of people in the Thinking Ones and the Working Ones – the subordinated ones) (see: Creech, 1994; etc.). The Tayloristic / Fordistic management took care of optimization of the routine work and equipment, but left management, creativity of many persons and innovation aside, which makes their concept lack holism.
- The managerial style: leadership, which is *co-operative and supportive*, democratic rather than commanding whenever possible and needed for professional and timing reasons, combining the authorization and empowerment with accountability and responsibility, always including the environment. Its realization could well be based on J. Kralj's systemic model of business policy making and implementation (Kralj, 1995; Kralj, 1998, a number of versions earlier; Kralj, 2000).
- The commitment: by the led (rather than managed or even directed) *coworkers and associates* from all functional fields and levels because they are considered creative and capable of making their contribution to a *systemic culture*, including the care for environment in terms of sustainability of the Nature / Earth including humans themselves.

Again we see, that a *new mental* quality is a precondition of a *new environmental* quality. Since the humankind has so far – for very long times – learned and adopted a more one-sided mental and environmental quality, which is obsolete now, *a process of learning and innovating* is needed to make new *contents*. That's where the processes of learning, innovation and management styles come in, first as a topic of studying, and then as a tool to be implemented toward *de-memorizing* of the obsolete culture, *learning of new lessons and practicing of innovation* aiming at realization of the TQ product – the sustainable development.

Let us therefore learn from Lessem (1991) and try to build a new concept of *environmental* TQM on this basis.

### 2.3 THE RE/MAKING OF ENVIRON/MENTAL QUALITY - A PATH TO THE REALIZATION OF THE SUSTAINABLE DEVELOPMENT CONCEPT

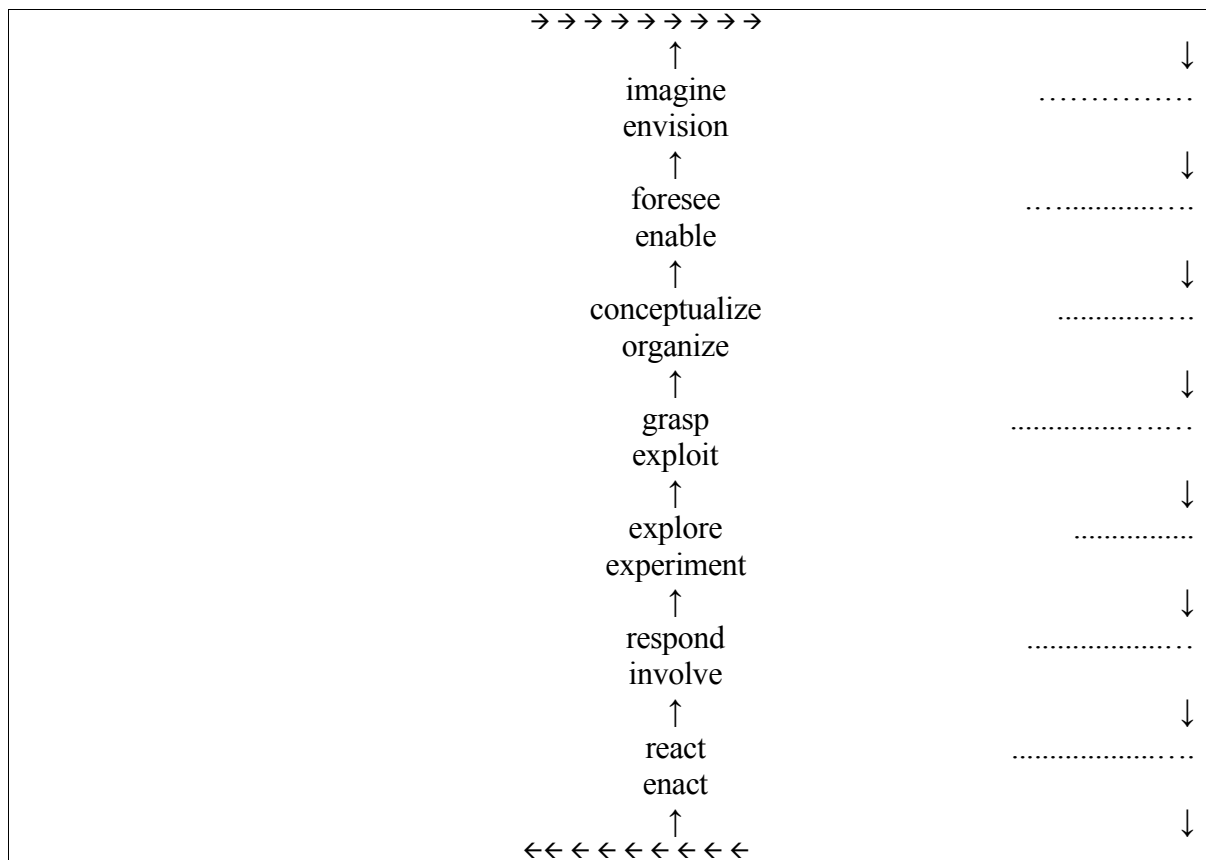
A **system of preconditions** to be considered surfaces, when we take a look into the attempts to build and/or renew the environ/mental quality:

1. In the given market conditions the new, deeper, order for the managers, is *quality and learning* rather than profitability and market share (being one consequence of the first ones).
2. The organization must be learning and innovative. To have holism, one may not consider only *cognition* (learning) and *behavior* (action), as the tradition following Aristotle, Descartes, and Newton etc., teaches to the Western culture, but also *emotion* (heart). Learning develops the person's personality, and innovation transforms her environment.
3. For a transition from one style of learning and innovating to another, you need a combination of your internal *will* and outside *preconditions*.
4. From the process viewpoint, the cycle from Fig. 2.4 comes into the scene, taking place more or less sub/consciously. One starts by physical reacting and goes through the entire cycle (if

<sup>56</sup> We will come back to them. See Ch. 4, 5.

the simplest version of the process takes place; if not, the dotted and other interactions may happen).

Fig. 2.4: The cycle of learning and innovating



5. Different *personalities* learn in different ways. There are the following types to whom an action of teaching / de/memorizing / educative / environ/mental quality creating should adapt itself in order to be effective:
  - The *established* learning styles are:
    - *Reactors* believe in 'ready, fire, aim', theory after practice, action first. But the entire wood is overlooked for single trees.
    - *Responders* are 'people people'. No solitude, learning in the practice (apprenticeship), the teacher's personality warmth is essential to their development.
    - *Deliberators* stand for logics and gradualism, link parts into round-off theories, put everything in boxes, tend to perfectionism. They may become narrow-minded and over-pedantic. Status, authority, authorization, formal advancement make important parts of their expectations.
  - The *emerging* learning styles are becoming more important along with the enterprise's change, development, and innovation:
    - *Energizers* respond to learning situation full of emotion, the learning material must be personally important and emotionally encouraging. They may become overly competitive, an obstacle to group learning. They need concrete awards of a personal and financial type, and their teachers must be top class.
    - *Experimenters* want to enter new learning experience, they have an open mind, a flexible approach, choose several different activities, projects and learning sources.

Repetition makes them tired. Hence they are receptive to the last educational fashion. They continuously search for fresh ideas and intellectual challenges.

- *Harmonizers* want to use their own learning potential along with the potential of others around them. They want to harmonize everything – different business functions, academic disciplines, theory and practice – for nothing to dominate. They think in wholes rather than in parts, they need a combination of knowledge and emotion in learning. They look for breadth and depth, risking a deviation from the reality.
  - *Inspired* learners learn along with creating, learning must engage them fully. They need people providing inspiration to them, and than provide it, too. They expect innovation from themselves. In learning programs they expect discovering of very unusual areas, go deeply into the essence of humans and things, cultures and institutions. They may leave established routes by far. (Lessem, 1991, for 1-5)
6. Learning is not enough. Innovating starts, as a permanent process, by making *the culture of pleasing / delighting the customer* in the organization (Rydz, 1986; etc).

On such a basis, one could put *criteria* on **when environment is considered requisitely systemically**:

- The Total Quality is equal to the concept *nature (including humankind<sup>57</sup>) / Earth* and to *prevention* of the lack of systems culture (such a terribly frequent lack so far), as well as its *consequences* – failures, mistakes and negative side-/effects over health, survival conditions and circumstances.
- The *customer* of the Total Environment Quality is the humankind<sup>58</sup> in general and every its member as a person and organization. One's style depends on one's nature in terms of learning, creating and other behavior.
- The *source* of the Total Environment Quality (or its lack) is all the humankind<sup>59</sup> as well, but mostly the most influential parts of it, i.e. public opinion makers, politicians, industrialists. Majority of others follow them. (See: Rogers, 1995)<sup>60</sup>
- The Total Environment Quality *management* is supposed to reach beyond the established expectations of humankind of today. This should be done by a (dialectical) system of measures undertaken by the UNO and other supranational, international, national, and local, political and professional organizations, bodies, and persons.
- The differences in *human personalities* shall be taken in account in the preparation and realization of measures, as well as the common trait that opposing innovation is more frequent than embracing it, when it is imposed.<sup>61</sup>
- The entire *process* of learning and innovating should be made a part of the general culture building of, at least, the most influential ones, so that it can be considered.
- The relation between the *environmental cost* and the *economic growth and development* should be based on the following view / prospective: **environmental damage is a very costly practice**. Though, processes causing damage to environment (and hence to society and every individual in it) grow faster than the ones generating new economic value. Data about economic growth provide for a **misleading, wrong picture**, if only direct costs are included, and the environmental / social costs ('external ones') are not taken into account. Humankind of today absolutely needs a **new eco-social compass** based on a

<sup>57</sup> Not only the humankind of today, but also the future generations, again.

<sup>58</sup> Not only the humankind of today, but also the future generations, again.

<sup>59</sup> Not only the humankind of today, but also the future generations, again.

<sup>60</sup> We will come back to diffusion processes later. See Ch. 6.2.

<sup>61</sup> Changing the adopted and established human habits concerning the environment, including the climate and its change, is a process of making a new invention an innovation. See Ch. 4. and 6.

sustainability considering eco-social accountancy. The new eco-social compass should consist of GDP + environmental indicators + social indicators + indicators of their synergies.<sup>62</sup> Market only provides data about prices, not about cost, and misleads. (See: Hawken, 1994)<sup>63</sup> <sup>64</sup>,

Every case of a good or bad, practical or theoretical, experience and consideration may contribute to the environ/mental TQ(M). Everybody participates as a creator, user or victim of all real life processes. **The more holistic thinking backs one's decision-making and action, the better is one's contribution**, as we will demonstrate in some detail later on.

## **2.4 DEPENDENCE OF THE (NEW) ENVIRON/MENTAL QUALITY ON HOLISTIC THINKING, DECISION MAKING, AND ACTION – CONCLUSIONS FROM THE CHAPTER 2**

It was and is the effort aimed at competitiveness<sup>65</sup>, which has produced most of the benefits of the contemporary humankind, but also most of its huge problems. The main cause of the problems is not the principle of competition on its own, but the fact that **the *obsolete economic theory* does not include the cost of nature in the cost of business**. Thus,

in order to save cost, one produces cost,  
and the really bad part of the story is that  
one does not see that cost and/or does not acknowledge it.

This results from the *lack of systemic, i.e. holistic thinking*, which is supposed to include everything, or everything essential, at least, in the picture of reality. This unfortunate fact applies to the calculation of cost, too. If there is a bad basis, hardly good outcome can result from the process. Thus, the environment in which humans of today are living is less and less healthy, etc., which causes huge cost.

**The climate change is a visible case of the  
dangerous consequences of the lack of systemic thinking  
with influential individuals and organizations:  
it reflects the “big tragedy of the commons”  
of all of us.**

Let us turn to facts about climate change, again!

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<sup>62</sup> This may help us prevent the »big tragedy of the commons« mentioned in the title of this book and later on.

<sup>63</sup> We will come back to environmental economics later. See Ch. 6.3.

<sup>64</sup> They speak of a balanced development, now, trying to balance the social, economic and environmental viewpoints of development (ib 2001).

<sup>65</sup> Basically, we can see two kinds of competition of humans: (1) with their natural environment, (2) between humans themselves. The point tends to always be double: (1) lack of resources compared to goals/objectives, (2) lack of chances to produce resources, e.g. by transforming land into an arable one, acquire customers, etc. (See: Grasby, 1999)

## ***2.TR THE EVOLVEMENT OF THE CLIMATE CHANGE SYSTEM***

### **2.TR.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IN THE CHAPTER 2.TR**

The climate change system as an integral part of the Earth biosphere is somehow between its inferior and superior systems; all of them together with the climate change system itself have a number of mutual interdependences/interactions, and co-operations. In this chapter we shall discuss the superior systems and their interdependences/interactions, and co-operation with the climate change system.

### **2.TR.1 UNIVERSE - THE SUPERIOR SYSTEM TO THE CLIMATE CHANGE SYSTEM**

As we have mentioned before, the Universe contains all matter and energy, particles, rays, information, and everything. To the Earth's climate change system the Universe may have a dramatic influence, in the case of catastrophic changes affecting the Solar System, and in the case of the Earth's collisions with space body/bodies influencing the Earth's existence. It happened and may/can happen again. There is e.g. the hypothesis that a collision of Earth with a cosmic meteorite some 65 millions years ago caused Dinosaurs to get extinct.

The most superior system is the Universe - please see the Drawing no. 1 in Atlas at the end of the book featuring interdependences between the Universe, the Milky Way, and the Solar System, which is the largest system known to us humans. The probability of a destructive interaction of the Earth with the Universe System is very small. Because there is a countless number of star systems and other forms within the Universe, the Earth has a little chance to experience major destruction caused by the Universe System activities. Of course the Earth system is just a very small part of it.

### **2.TR.2 THE SOLAR SYSTEM**

The Solar system is a very large system, from our civilization's point of view, but a very small one from the galactic point of view, and even much smaller from the Universe point of view. The Sun and its nine planets are one small sub-system of the Milky Way Galaxy. Actually the Milky Way Galaxy has hundreds thousands of billions of star systems, and our Solar system is just one of them.

The Sun is the central star of the Solar System, and has 99.8 percent of the Solar System's mass. It is the center of its system, and source of all energy and matter within it. Of course it is an inferior system to the Milky Way Galaxy, which is over 100.000 billion times bigger in mass as the Solar System. The Solar System revolves around the center of the Milky Way Galaxy at a speed of around 250 kilometers per second.

For our Earth planetary system the Sun is the source of everything from birth of the planet onward, and we exist because the Sun is providing us energy, warmth, light, and all other important inputs / physical and other components and interdependent matters. Our planet system is completely dependent on the Sun. Our present is mirroring physical, geographical and biological etc. statuses at which we are at this very moment.

Of course the influence from the Solar System is not caused only by the Sun, but also by a number of interdependent, interacting and co-operating relations with neighboring planets, planet-like bodies of different size, Moon and other forms of energy and natural powers. The most sunward planet is Venus and the outer planet is Mars. Together with Mercury they are presenting terrestrial planets of the Solar System. The other four planets Jupiter, Saturn, Uranus, and Neptune are gaseous gigantic planets of the outer part of our Solar System. The last planet is Pluto, but it is not always the last one, because of its oval shaped orbit, which places it sometimes before Neptune, but most of time it is the most distant one from the Sun.

The Solar System is stable, and changes in its system qualities are reflecting/influencing its whole system. The most important parts of the Solar System are the energy flow from the Sun to the planets, and the quality of each planetary system. Not only composition of each planet, but also its distance from the Sun is the deciding factor for the quality of the Solar System. The life stream of light and warmth from the Sun is making possible the life on the Earth. Both the quality of the Sun System and unique composition/distance from Sun of the Earth are interdependent parts of the life support system on the Earth.

Understanding of many unknown powers of nature, like magnetic, energy, matter transformations, rays and particles role etc., the movements (like a top, orbital, galactic, and of the Universe), the Solar System, the Sun and planets including our planet the Earth are important, and are putting together characteristics of the whole system.

The Sun has a diameter that is 109 times bigger than the one of the Earth, and 400 times larger than the one of our Moon. All nine planets, and all other forms within the Solar System are orbiting around the Sun. The Sun and all planets are moving like a top and all together are orbiting within the Milky Way Galaxy. All this movement should be more researched to allow us to understand the basic powers resulting in interdependences among parts of the Solar System. The Solar System as well as all other systems function according to their given systems<sup>66</sup> / entities of parameters, and our civilization is given the chance of exploring, researching and understanding our existence.

## **2.TR.3 THE PLANET EARTH SYSTEM**

The birth of the planet Earth could be placed around 4.5 billions years ago. At that time the Sun provided the energy and matter for shaping its subsystems, planetary systems and other bodies. The Earth appeared as a gaseous mass which, by rotation like a top and orbiting around the Sun for a few hundred millions years, commenced shaping the planet. The composition at its birth, its distance from the Sun, and its interdependences within the Solar System have been making the Earth for 4.5 billions years.

The Earth planetary system is very robust. At present we are having an inner core of 1.500 miles in diameter composed of iron and heavy metals, an outer core of 1.400 miles, a lower mantle of 1.400 miles, an upper mantle of 400 miles and the crust of 2 – 45 miles in diameter. Please see the Drawing no. 2 in Atlas at the end of the book.

On the top of the crust, there are permanent dynamic changes caused by the natural powers by which the Earth's surface was/is shaped. And the atmosphere is covering/protecting and

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<sup>66</sup> We say »system« rather than »set«, because in the systems theory a system consists of two sets, mathematically: the set of its elements, and the set of relations between them (and with its environment) resulting in synergetic attributes that the entire system has, but its elements alone do not. Hence, speaking of a set would mean the traditional oversight of relations and their crucial importance.

completing the biosphere of the planet up to 1.000 kilometers, where the Exosphere is ending into the outer space. The main subsystems of the Earth are: its planetary body, its Moon, and its atmosphere. Its planetary body has got 8.000 miles or 13.000 kilometers in diameter. The Earth is the fifth planet by diameter, the largest one is Jupiter with an eleven times larger diameter, and the smallest one is Pluto with around one fifth of the Earth's diameter.

The surface of the Earth together with its atmosphere is making its biosphere, where we live and where the life has been a part of its system for more than 3.8 billion years. At that time in history the first appearance of the microbial life could be placed.

Among the life supporting components of the Earth, oxygen is most important element. It forms

- two inorganic oxides - water and carbon dioxide, which are the life supporting molecules, and
- atmosphere with oxygen molecules in the breathing air, and
- the ozone layer as the protection against UV rays.

After setting such a support within the system of the biosphere the appearance of life on Earth was just a matter of time.

The outer supporting part of the Earth is the flow of light and warmth from the Sun, which is enabled by the Earth's adequate distance from the Sun, actually, and supports life on Earth rather than prevents it, which is the case on the Earth's neighboring planets Venus and Mars.

The unique composition of the planet Earth and its distance from the Sun are two major qualities that have evolved with evolvement of the Solar System and are making the basic possibility for the life to appear on the Earth at present.

The Earth crust surface at present is made of a terrestrial part, which is covering around 30 percent of the surface, and of ocean/sea waters cover taking the remaining 70 percent of the surface. The ratio between oceans and lands was changing with dynamic changes of the Earth surface evolvments. First appearance of the water on the Earth was the deciding factor for the formation of its surface and atmosphere. After cooling down the atmosphere was thick and much lower than now. The primordial atmosphere was oxygen free. A big change was the appearance of the first life forms, which were anaerobic microbial organisms living without oxygen. They were gaining the necessary hydrogen for their synthesis of different organic carbon compounds from dissolved inorganic compounds of carbon. It took hundreds of millions of years for them to change the primordial Earth from its anaerobic to its aerobic stage. Their significant contribution was the sink of carbon dioxide, when their dead cells sedimented to the bottom of the oceans, where they have been transformed into numerous carbon compounds, that we see today as fossil fuels. It was the time of the first energy transformation, actually those organisms transformed sugar molecules to gain two units of energy per molecule.

In the next generation microbes were able to split water molecules with assistance of the light from the Sun, and used the released hydrogen to reduce the carbon dioxide molecules. By this photosynthesis a rich biomass was produced. The end product of this reaction was the molecular oxygen, but its appearance was poisonous for the existing life creatures. It changed the life entirely, and the new generation of microbes was able to use oxygen as its oxidation of biomass by respiration. It was the first energy transition on the Earth, because with such a

transformation of the sugar molecule they gained 36 energy units or eighteen times more than the anaerobic microbes.

The carbon dioxide was a part of water due to its solubility, and oxygen that was not solvable in water, became an integral part of the atmosphere. The concentration of the oxygen in the atmosphere was increasing and changing, and settled at 21 %, with 78 % of nitrogen, and the remaining 1 % was made of carbon dioxide, methane, and some other gaseous elements. With appearance of oxygen in the atmosphere, with influence from the Sun radiation – please see the Drawing no. 5 and 6 in Atlas at the end of the book, the oxygen molecule was split down to the elementary oxygen, which in the upper layers of atmosphere made the three-valence oxygen molecule ozone - please see the Drawing no. 9 in Atlas at the end of the book. With time the ozone formed an UV impermeable screen or ozone protection layer against those rays from the Sun, which have been responsible for decomposition of the dioxide molecules – the UV rays. The biosphere on the Earth responded with evolution of life, its intensification and transition from water to the Earth's terrestrial parts. The bacterial life moved on the terrestrial part of the surface, formed on the crust top a carbon rich layer, which with time became what we today call soil. The Earth system evolved to the stage when complex life forms were able to appear. It was some 700 hundred millions years ago, and land mammals appeared some 350 millions years ago. The human predecessors are dated some 8 millions years ago, and Homo Sapiens, our predecessor, some 100.000 years ago.

## **2.TR.4 CONCLUSIONS FROM 2-TR**

So here we are - we have the Universe, the Milky Way, the Solar System, the Planet Earth System, and the life on the surface of its terrestrial and aquatic part as well as within its atmosphere. With the existing input/output effects from superior systems, especially the Solar System, with evolved parts of the Earth system, etc., the climate change system became the holder/guardian of living conditions within the biosphere.

The described facts, though, do not mean that there is no impact of us humans over the climate change system. We do have an impact, and its contents depend a lot on our own thinking and behavior. Our one-sidedness is quite natural and equally dangerous at the same time, potentially leading to our own extinction. We should better add something to it, which is called holistic / systemic thinking.

### 3. HOLISTIC THINKING BY SYSTEMS SCIENCE / SYSTEMS THINKING<sup>67</sup>

#### 3.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 3

We found in Chapter 2 (Fig. 2.1) that survival of humankind depends essentially on attainment of a total / best possible / requisitely excellent *environmental* quality, which in turn depends essentially on attainment of a total / best possible / requisitely excellent *mental* quality, which in turn depends on the **completing up** of the specialized / narrow / biased thinking with the application of the *holistic* thinking, etc. We will elaborate on that from the viewpoint of their links and the method/ology now a bit more. Let us first briefly take a look at the Local Agenda 21 as the representative of an agreed upon endeavor of so far, aimed at coming closer to a total / requisite environmental quality – by the way of an implicit / informal application of systems thinking. Then we will talk more about systems thinking and systems theory to find out what could we do to make the Local Agenda 21 and the LvB's concepts more/requisitely holistically alive and applied (see Ch.1 about LvB's ideas on GST).

#### 3.1 LINKS BETWEEN THE LOCAL AGENDA 21 AND SYSTEMS THINKING

We shall put it very briefly:

- The Local Agenda 21 (LA21) is a network of political and practical measures aimed at sustainable development (See: Ecimovic et al., 2000b). It has to do with local action along the idea “*Think globally, act locally*” concerning protection of the entire nature, i.e. the humankind and their natural environment. One should harmonize economic, ecological and societal aspects. (See also: IB, 2001) They ought no longer to be considered independently from each other, but rather *interdependently*. As we can see from the real life experience, this is a complex and real problem, which requires the best possible level of holism. – The LA21 is supposed to help quite many to tackle their share of the problem.
- Thinking and acting – be it globally and holistically or locally and one-sidedly – are consequences of the human approach, which is called the *subjective starting points* in the Dialectical Systems Theory (Mulej et al., 2000 and earlier, since 1974). According to the real life experience and to practically all systems theories, *thinking and acting have been too simplified / too biased / too narrow*, for centuries, and especially for decades during which the total amount of the available knowledge of humankind has increasingly required every individual to become a rather narrow specialist, and still keeps requiring it. – The LA21 is supposed to help start action and education supportive of holistic thinking and feeling about the entire nature. (Ecimovic et al., 2000b; Hernandez and Mayur, 1999, 2000; Okoljska vzgoja, many articles)
- As long as we have to do with *complicated* rather than *complex* problems<sup>68</sup>, a narrow specialization suits and helps understanding and solving the problem. The viewpoint of complicatedness of reality, which is dealing with its single parts alone, is a very important part of research and practical handling and control, which has been well covered by traditional sciences. – The LA21 is supposed to introduce dealing with complexity *along with* complicatedness.

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<sup>67</sup> Matjaz Mulej, and coauthors mentioned where appropriate

<sup>68</sup> Complicatedness of a problem tackles its attributes by single *components*, complexity by the *relations* between components as well as the ones with environment. Research on complicatedness results in knowing and mastering single *details*, the one on complexity in knowing and mastering *synergies*, which are new attributes that are not typical of single components alone. (Schiemenz, in Mulej et al., 2000, and earlier) We will come back to it. See Ch. 3.4.2.

- Specialization to single parts alone leaves *complexity aside*, because it does not pay sufficient attention to *relations* (although for good reasons, on the terms of specialists and knowledge of details). To cover relations, interdisciplinary co-operation would be required, which is not sufficiently normal with very many specialists, which frequently leads to important oversights. Consequences of this *oversight* include the *terrible experiences* of the two World Wars and the world economic crisis between them, in 1914-1945. Soon after the 2nd World War, Cybernetics and (The General) Systems Theory were established to support a more holistic style of thinking and acting.<sup>69</sup> (LvB, 2001; Bertalanffy, 1979) – LA21 is supposed to help us introduce *interdisciplinary teamwork*.
- In the case of the very crucial topics of humankind of today, which happened to be found important by and interesting to the big political superpowers of the current world, humankind of today is able to think holistically, when acting locally. What we have in mind are the good five decades of success in preventing the *nuclear weapons* from being used again after their deployment in the last phase of the 2nd World War over Japan, in 1945. – LA21 is supposed to create awareness that *small contributions matter, too*.
- Much less holistic have thinking, decision making, and acting been in the cases in which *economic interests* of both local and global power holders such as private and public capital owners and administrators / managers and entrepreneurs have been at stake. They tended and still tend to *misread the concept of Adam Smith, the first great modern author of economic theory*. They say that he advised them to be selfish<sup>70</sup> and care for their own interests only, since the invisible hand of the market and profit covers the public interest. A more precise reading recalls that Adam Smith was a professor of moral and ethics rather than economics and that he has written a book on moral sentiments before his famous book on economics. He presupposed *morality of altruism*, when developing his economic theory, rather than morality of biased selfishness. Where can we see that idea? Market does not consist of the suppliers only who want to make their profit, but it also consists of consumers and buyers who want their benefit, too. As soon as profits are high, the supplied quantity and diversity grow, and then profits diminish, and vice versa. There are not only suppliers in the scene, but there are also customers. If they attain their own benefit, they allow suppliers to attain their profit. Thus, suppliers do not depend on themselves only and must not be too selfish. Rather, they are *interdependent* with their customers. Interdependence is one of the central notions of systems thinking (Bertalanffy, 1979). – LA21 is supposed to help create *ethics of interdependence*.<sup>71</sup>
- The issue, which remains open, is not the principle, but its application: *which interdependencies come to be considered, which come to be forgotten about?* Obviously, most frequently, the ones, which are preconditions of profit, now and here, have a better chance to be considered than the others, by the economic/business decision-makers. The poorly considered interdependencies may be even more important sources of cost and profit in a *longer term*, but this is rarely considered as important as the nuclear weapons have been since the 2nd World War. *Natural environment belongs to such cases*, today. – The need for the Local Agenda 21 is one of the consequences: one should develop more holistic thinking as an *additional capacity*, which may be supported by systems theory, although not equally well by all its versions.

<sup>69</sup> The link does not seem to be expressed very directly. LvB worked in a similar direction a lot earlier, too. But we do not speak of authors only, there is a general audience to be addressed, and the GST and Cybernetics came to be accepted quite well. We will come back to it later on. See Ch. 3.2, 3.3, 3.4 and 5, in addition to Ch. 1.

<sup>70</sup> In reality, A. Smith spoke of selfinterest, not selfishness, thus including interdependence. (Petzinger, 2000).

<sup>71</sup> We will come back to it later on. See Ch. 3.4.5 and 4.

Application of systems thinking is, hence, crucial for solving the problem expressed briefly by the Local Agenda 21, and vice versa. Why should the situation about climate change be much / any different?

Climate is also a problem reaching *beyond*  
*the short term, easily visible and narrow horizons and objectives*  
that many businesses prefer to the long term ones –  
here and now is more important than then and there, to them<sup>72</sup>.

And reports about climate let us know that there is no small money involved. *The bigger is the money, the bigger is the need for holism, and the bigger is the real danger of oversights of holism.* But, as we saw, everybody defines which level of holism is the requisite one. We found in Ch. 1, that LvB provided good concepts, but they are hard to implement. There may be something else supportive of the same line of thinking, decision-making and acting. Let us undertake some more investigation!

### 3.2 SYSTEMS THINKING VERSUS SYSTEMS THEORY; FORMAL VERSUS INFORMAL SYSTEMS THINKING

The purpose of systems thinking, as expressed in systems theory in times of its establishment after the 2nd World War, expressed with words by LvB (summarized by us), was

to fight the exaggerated narrow specialization  
that makes people unable to *see the whole*  
because they concentrate on parts only

(Bertalanffy, 1979). He had very practical reasons to suggest so, in the time after the Second World War, as well as earlier. He started to publish important articles as a biologist back in 1928, and became later on important in a number of scientific disciplines, both in his home country Austria (in which he even lived through Hitler's terrible extreme one-sidedness), and around the World<sup>73</sup>. (See: Davidson, 1983; Davidson, 2001). There were several important authors later on, too, of course, and a variety of systems theories<sup>74</sup> became influential, not only the LvB's GST.

The basic few terms belonging to the concept of systems thinking, may in a summary include the left column, and fight the right column, in *Fig. 3.1*. (See: Mulej et al., 2000).

*Fig. 3.1: The basic seven terms of systems / systemic / holistic versus unsystemic thinking*

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<sup>72</sup> Every individual is a businessperson, when we/they try to assure resources for our/their own survival and a good enough / better life. One has to care for survival on a daily basis, hence one may forget about longer-term viewpoint/s and other results that are not easy to see and foresee on a daily basis. – The problem is of course even worse with big and rich businesses, which have much more influence and cause much more damage, if they choose one-sided options.

<sup>73</sup> These were times in which European countries still had colonies in Africa and Asia, in USA the African Americans still had hard times to enter school for the (now hardly important) difference in skin color, there was Korean South-North War on the basis of different ideologies, the countries of the so-called communistic Central and Eastern Europe had governments trying to block off international information and other contacts, they even preferred dictatorships to democracy. Not much better was it in South America. Etc. Best weapons in the Korean war were found to work poorly because of a poor concerting of their parts into one entity. Similar was the basis for organizational and managerial difficulties in enterprises and other organizations. Etc.

<sup>74</sup> We will come back to them. See Ch. 5.

| <i>Systems / Systemic / Holistic Thinking</i>               | <i>Unsystemic, Traditional Thinking</i>    |
|-------------------------------------------------------------|--------------------------------------------|
| Interdependence/s, Relation/s, Openness, Interconnectedness | Independence, Dependence, Closeness        |
| Complexity (+ complicatedness)                              | Simplicity, or Complicatedness only        |
| Attractor/s                                                 | No influential force/s, but isolation      |
| Emergence                                                   | No process of making new attributes        |
| Synergy, System, Synthesis                                  | No new attributes resulting from relations |
| Whole, holism, big picture (+ details)                      | Parts and partial attributes only          |
| Networking, Interaction, Interplay                          | No mutual influences                       |

Short comments to each of the lines in *Fig. 3.1* may be briefed as follows:

**1) *Interdependence/s, relation/s, openness, interconnectedness*** are attributes, which the entire biosphere including the entire humankind has always had very many of, in reality. They have not perceived all of them, as accidents, epidemic diseases, wars, etc. tell us. Over the last centuries humans have developed *science* to find out as much as possible about the biosphere, including themselves. In order to find out *details* of the given facts and in order to be able to use them properly, the *specialization* had, unavoidably, to make very big steps towards concentration on *selected* small parts of reality and its real attributes under the name of specific profession/s. The contemporary proverb reflecting this history reads: *What I know is a drop, what I do not know is an ocean*. It is good and crucial to know details, but it is bad to forget that **parts** of reality, details, **do not exist alone**. At a session of the Assembly of United Nations in Fall 2000, the then president of United States found it necessary to say explicitly: *We must not forget that we are interdependent*. Two centuries earlier, United States passed a Declaration of Independence. Both are needed, but observe and manage reality from different viewpoints:

**1.1) On legal terms**, independence is crucial for one to avoid being abused and misused to the benefit of somebody else, on whom one may depend. **On economic terms**, in conditions of specialization of professions and ownership of different parts of all necessary natural, financial, and human resources, independence is impossible, interdependence is natural, self-sufficiency as a clue to independence is quite impossible to attain.

**1.2) In nature**, there is no independence, because there is no self-sufficiency: no living being can eat and drink etc. her own body to restore energy and matter, neither can she learn from her own mind only to keep her information / knowledge / skills up to date. Interdependence is natural, but forgotten about by humans in the relations beyond the limits of specialization, frequently.

**1.3)** Especially the interdependence *between the humans and the other parts of nature* came to be forgotten about by humans crucially, all the way since the times when humans started feeling like and behaving like masters over nature rather than like parts, components of nature. Abuse of nature (including the one of and by the humans of today) results, causing medical and other problems to humankind of today.

**2) *Complexity*** is an attribute of reality (and, hopefully, of the human's mental picture of reality, too), which expresses one type of entanglement. It is the type, which results from relations, especially interdependencies. What complexity denotes are the *attributes resulting / emerging from relations, interdependencies*, which means that these attributes do always exist, but do not always enter the mental picture, if the observer of reality concentrates on parts of this reality and observes them in isolation from the other parts. *Complicatedness*, on the other hand, denotes the other type of entanglement, which covers *attributes of the parts alone*, seen as entities with no observation of their relation/s with other entities. *Simplicity* (of

picturing / modeling the reality and of thinking, basis of decision making and action, not of products) comes into existence, when there is no entanglement, or when one is unable and unwilling to observe reality with all / many attributes of its parts and their relations.<sup>75</sup> What follows for our topic under consideration includes the following:

**2.1) Specialists**, as resulting from the development of science and / by distribution / division of labor per professions, work much more on *complicatedness* than on complexity, because they concentrate on finding out and employ details. Complexity is overseen a lot, the mutual impacts of parts of real attributes, which are learned about and employed in mutual isolation, surface as surprises. They are frequently unpleasant, because they are neither expected nor reckoned with.

**2.2) Nature** is full of both complexities *and* complicatednesses. There is *no either or* between the two. Simplicity hardly exists, it seems to exist, when it is deemed to exist due to the lack of holism of insight and to the *plenty of oversight/s*, which tend/s to cause complex and complicated consequences, such as air pollution, etc.

**3) Attractors** – this is an expression, which we can more easily find in the Chaos and Complexity<sup>76</sup> Theories than in the traditional and other systems theory/ies. It is another expression for relations and their impact. It attacks the opinion that nature lives in isolated parts, and finds this opinion to be a crucial oversight. Especially interesting has been the notion of *strange attractors*, which basically denotes the surprise of narrow specialists when unexpected attributes showed up, which they did not foresee due to their specialization and lack of a broader interdisciplinary co-operation. What follows for our topic under consideration includes the following:

**3.1) The entire biosphere** can never be fully understood by employment of a *single* profession, even less so by employment of knowledge of a *single* person. It simply has too many attributes, and many of them are consequences of *mutual impacts of its parts and with its environment*, which can be expressed as attractors. – Oversight of them belongs on the list of causes of the climate change.

**3.2) A requisitely broad / holistic interdisciplinary co-operation** may help humankind diminish the showing up and impacting of the strange attractors. Scientists, engineers, and social scientists need to co-operate also concerning the issues of a sustainable development and future, including the climate change.

**4) Emergence** – this is again an expression, which we can more easily find in the Chaos and Complexity theories than in the traditional systems theory/ies. It speaks of the *process* resulting from interaction of interdependent parts, when they stop being independent and start to make an impact over each other. Attractors cause emergence of new attributes, which are not typical of individual parts as independent rather than interacting entities. Inside an investigation, which is limited to the entanglement called complicatedness, there is no emergence to be found, because relations are not the topic of investigation. Emergence does happen all the time anyway. We can discover it, if concentrating on *complexity, interdependencies, relations, attractors*, rather than on isolation. What follows for our topic under consideration includes the following:

**4.1) Investigation** of the given attributes in *isolation* is very *important* because it is able to discover details. But it is *not sufficient* because it makes the oversight of emergence and of attributes, which are caused anew by relations, interdependencies, attractors, and emerge from them. – Oversight of them belongs on the list of causes of the climate change, too.

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<sup>75</sup> There is a proverb reading: »When you feel capable of mastering a situation, and when you feel incapable of it, you are right.« - The same applies to admitting or not admitting the real complexity, complicatedness, or simplicity. It is your attitude which becomes your subjective starting point of your action, its process, and its result/s, in both cases.

<sup>76</sup> We will come back to them. See Ch. 5.1 and 5.2.

**4.2) A reorientation of investigation**, which would *add* endeavor to discover and employ *emergence* along the isolated details (rather than instead of them!), could be more holistic and hence more helpful. – In the case of ecology and sustainable future it is equally true as in other cases, that investigation, decision-making, and action take a process with many *sub-processes*. In some of them *details* are in the forefront, in others *emergence* is so.

**5) Synergy, system, synthesis** – these expressions denote in two ways the same reality: an entity is made of an ordered set, which is made of two sets, on mathematical formal terms. These are (1) the set of *parts*, which are considered components of the entity, and (2) the set of their mutual *relations* without which the entity could not be different from each and every part alone. Thus, synergy / system / synthesis results from the process of emergence of *new attributes*, which are caused by mutual attraction / impacting / influencing / relations / interdependencies of the parts, and which are not caused by the parts themselves and isolated from each other. What follows for our topic under consideration includes the following:

**5.1) Every entity can be called a system**, when only the mathematical definition of the system is employed. The system is thus supposed, by definition, to present an entity as a *whole*, or even to be such an entity. The problematic part of this story reads that no normal human individual of today, or even a normal-size team of today can think of anything as complex as a *total whole*, and hence of *totally all* attributes (which the notion of a whole certainly suggests / Webster, 1978/). To be fully holistic, one would have to employ all thousands of professions around (and they are estimated to be at least 15.000, some even speak of 100.000). – Oversight of them belongs on the list of causes of the climate change, too.

**5.2)** Due to the *unavoidable specialization* one tends to do something, which the establishment of the Systems Theory was supposed to fight, and which now happens under the name of the application of the Systems Theory, quite often. What one tends to do – for the unavoidable natural reason called the (limited!) human capacity – is a (tacit or explicit) simplification of thinking by a *selection of one's viewpoint/s*. On this basis, one selects the attributes to be considered important, and leaves the others aside. Thus, one still meets the *mathematical* formal definition of a system as a whole, but forgets about the *contents* of the notion *whole*. The one-sidedness of specialists survives – and does so with an additional problematic (!) consequence: specialists have a general scientific / mathematical formal basis allowing them to **feel holistic, while they really are one-sided, biased, partial** – in terms of *contents* of the entity under investigation / dealing with / management. – Calling the nature a system is correct inside the mathematical definition of the system (= ordered set), but it is incorrect in terms of contents of the system, if one does not say from which **viewpoint/s** one considers a selected part of the nature and its attributes. E.g. the biological, physical, chemical, economic, legal, etc. viewpoint/s allow the observer to expose only the part of attributes in which the chosen / selected profession is specialized.

**6) Whole, holism, big picture** – these terms are the central notions of systems thinking. The above discussion explains this: systems theory came into existence and received public support in times when it was very clear that the terrible destruction of the two World Wars and of the Big Economic Crisis in the period 1914-1945 had been caused by the *lack of holistic / systemic thinking*, which in its turn had been an unfortunate and unforeseen side-effect of the *unavoidably growing narrow specialization*. Narrow-minded individuals (such as Hitler, Mussolini, etc.) were entitled to make decisions with very broad consequences, including many ten million dead humans. As we did see in some more detail earlier, LvB, the father of the General Systems Theory, wanted to prevent the bad consequences of the over-specialization and wanted therefore to provide for

**holism** as a new *world view*

rather than a specialized science  
of its own narrow scope, e.g. in similarities, only.

A *science about systems thinking* should, like every other science, support its attainment and employment. But, as demonstrated above, the notion *whole*, on LvB's terms, has come to demand too much in terms of capacities and felt needs of most individuals as specialized persons and professionals. In addition, systems theory and cybernetics of those times did not try to produce *interdisciplinarity* and interdisciplinary creative co-operation, but rather tried to produce *isomorphisms*. Isomorphism (= similarities) did allow for transfer of findings and ideas from one specialty to another, but allowed mutually different specialists to go working on in isolation rather than in cooperation. What follows for our topic under consideration includes the following:

**6.1) The word *whole***, if taken literally, embraces *all* the existing attributes, although the development of science and professions and practical life has distributed them into separated units of knowledge and practical coverage, such as physics, chemistry, biology, economy, law, etc., not to speak of specialization inside them. Nobody can follow this definition of a whole totally, for natural reasons beyond one's will. – Oversight of them belongs on the list of causes of the climate change.

**6.2.)** Thus, one can speak (1) of a ***total holism*** as one extreme, which cannot be attained in reality, (2) of a ***fictitious holism*** as the other extreme, which is attained, if one observes and/or manages an entity from a single viewpoint inside a single profession, and (3) of a ***requisite holism***, which is attained, if one observes and/or manages an entity from all the requisite / essential viewpoints and covers also the synergies emerging from relations between these viewpoints, such as different professions. – In the case of climate change, many professions can make their contributions, but neither are all 100.000 of them, perhaps, equally essential, neither is any one sufficient on its own.

**7) *Networking, interaction, interplay*** – these notions express practical ways from the one-sided / biased / locked in / tunnel vision specialization to the requisite holism, if we speak of humans and human action. Of course, all three emphasized notions express the same process also from the biological, natural viewpoints with no human intervention: trees, bushes, other plants, animals of different kinds are networking / interacting / interplaying to make a wood, a river, an ocean, etc., and similarly do cells etc. in a living body, planets in the universe, etc. What follows for our topic under consideration includes the following:

**7.1)** Any kind of an entity as a whole, which really exists, exists in the way of networking / interaction / interplay of its composing parts. Of course, at the same time, it is a composing part of a larger entity. This is the ***organizational and process aspect*** of the emergence of synergies as a result of attraction/s among parts based on relations, especially interdependencies. – Oversight of them belongs on the list of causes of the climate change, too.

**7.2)** There is *no life without* these processes. And holes (in capacity, ***oversights***) rather than wholes (in capacity, ***insights***) are what results from the human negligence of the networking / interaction / interplay. This dangerous outcome results especially from a lack of extending these notions from the networking etc. inside a single specialization to an *interdisciplinary* level of holism. – The issues of sustainable development are complex enough to require ***democracy*** in dealing with them, i.e. networking in which every participant may and must be equal-footed in our / their interactions / interplays on an interdisciplinary basis, in order to produce synergies of skills and of findings from which requisitely holistic actions emerge to solve / prevent problems (and cause new problems, too, quite probably, due to lack of holism).

It is hence, if we take a case of mutual relations between humans,

*democracy* which makes room  
for (requisitely) creative and holistic  
thinking, decision making, and action

(if it is not a formality, in which one only defines, who are the individuals / groups in power and hence entitled to meet their own narrow interests rather than to serve as managers of networking, which targets holism). Democracy, hence, must be a *normal social relation everywhere, not only in politics*. – In terms of the issue of climate change, this is important as a way toward prevention of the prevailing of the one-sided viewpoints and interests over the broader ones. If this **change in social climate** does not take place, a beneficial change in natural climate can hardly take place, the experience of recent centuries and decades says.

Most commanding characters / persons and narrow specialists have never had much **education / feeling / appreciation for systems thinking**.<sup>77</sup> Very few around the globe had and/or have courses in systems theory. But very few versions of the General Systems Theory / other systems theories cover the seven groups of attributes of systems thinking with the conclusions presented above. What follows for our topic under consideration includes the following:

1) It is possible to use a system theory either as a tool of *systems / holistic thinking*, or as a *formality*, which allows its user to employ terms / vocabulary from systems theory – as fictitious words and bluffing expression – and to remain mostly one-sided, limited to one single profession and/or specialization, anyway. (See: most papers in conferences about systems theory / science, such as ISSS45 2001, EMCSR 2002 etc., which are not interdisciplinary, like Problems of..., STIQE, and IDIMT are, and not many more). – Oversight of these attributes belongs on the list of causes of the climate change, too.

2) It is also possible to employ *systems thinking with no employment of a formal systems theory*. There are many systems theories, and very few of them allow for, or even actively support, the interdisciplinary creative co-operation as a way towards a relatively high level of the requisite holism. There are, on the other hand, also practices and methods such as Total Quality Management (which we briefly discussed in the Chapter 2), Project Management, Business Reengineering, Work Simplification, etc., which can allow for systems thinking with no formal application of systems theory's language<sup>78</sup>.

3) Any analysis of the **backgrounds of success** and the backgrounds of failures, e.g. in business (see e.g. Collins, Porras, 1994 and many later editions), can demonstrate that success is backed by much more (informal) systems thinking than failure is. – The need for sustainable development and the acknowledgement by the broadest political body of humankind, the UNO (in 1992 in Rio de Janeiro) that the general environmental problem exists as a pressing problem, clearly demonstrate that

failures are backed by  
a lack of systems *thinking*,  
and they do so on a large scale,

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<sup>77</sup> If they had enough education to practice systems thinking, they would most probably be democratic, e.g. able to listen to and hear and accept views of their opponents as complementary rather than dangerous.

<sup>78</sup> However, the said methodologies do not support systems thinking automatically. If a formal insight into processes matters more than interdisciplinary co-operation, parts matter more than interdependencies, linear thinking matters more than consideration of complexities, routinization of the old habits matters more than synergy and innovation, etc., then the said methodologies do not support systems thinking as a holistic one. – Oversight of these attributes belongs on the list of causes of the climate change, too.

even half a century after systems *theory* has come to be established and recognized around the world.

The above conclusions let us see the **difference** between systems **thinking** and systems **theory** (from the viewpoints selected here):

1) Systems thinking is the practice of those who are *holistic enough* in their thinking, decision making, and action to cover *all essential attributes* because they are broad and interdisciplinary enough. They therefore attain more successes than failures.

2) Systems theory is, like every theory, an *abstracting generalization* of the practical attributes of systems thinking.

3) In the given contemporary practice, there is *no single systems theory*, because many authors / groups of authors have adopted a number of *different viewpoints* to investigate / manage their selected parts of the entire Nature / Earth / life reality. The issue of viewpoints and their selection has been neglected, which led to oversight of its crucial importance (to which we will return in Ch. 4 later on).

4) The negligence / oversight of the issue of the *selected viewpoint/s* and its / their crucial impact over the selection of attributes to be classified as essential on one hand and as unimportant on the other hand, led to another oversight: the importance of definition and agreement what does the concept *holism* mean in terms of *contents* of investigation / thinking / decision making / action. The consequence reads: one can have systems theory, in terms of mathematical formality, and still have no systems / systemic / holistic thinking, in terms of contents. (In Webster's Dictionary /1987/ one can find 15 groups of definition what a system means in terms of its contents; on the other hand, in another dictionary one can find only three /Hornby et al., 1962/, and in another Webster /1978/ only two).

5) The millennia old Chinese principle of interdependence *Yin-Yang*, ancient Greek philosophy of *dialectics* (= interdependence), and versions of dialectics in philosophy of the 19th century (idealistic dialectics by Hegel, materialistic dialectics by Engels and Marx) etc. reflect the real-life practice that some kind of systemic / holistic / systems thinking has been *around forever*. At the same time, their formulation as version/s of philosophical teaching as science about thinking and the general essence says that systemic thinking has always been a *rather rare experience* compared to the style of thinking, which is represented in the right column in the Fig. 3.1.

6) Most theories come later than the practice, which they describe / generalize, rather than prescribe. And they make the practice seem simpler than it is, because theories (by definition of their role) tend to concentrate on the *general*, most frequent, part of attributes, and leave the group-specific and individual specialties aside. (See: Fig. 3.2) A formal application of a theory has the good consequence that the *most expectable* part of attributes may be discovered and dealt with more easily, and the bad consequence that the *many less general attributes* may receive an exaggerating oversight rather than a requisite attention. This may happen in the case of systems theory, too. And this is why we prefer systems thinking to systems theory, but we also prefer **systems thinking based on systems theory** to the one with no such background and based fully / too much on an uninvestigated experience / intuition.

Fig. 3.2: The three-part system of interdependent attributes of every object under consideration

| The three-part structure of attributes of any object of consideration (by Dialectics Theory)                                 | The practical consequences of the three-part structure (in the real life)                                                   |
|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| <i>The general part</i> , shared by all components and relations of the object under consideration                           | <i>The general isomorphisms</i> , equality, attributes shared by all members of the object under consideration              |
| <i>The group-specific part</i> , shared by groups of components and relations (subsystems) of the object under consideration | <i>The grouping, partly dividing isomorphisms</i> , different from subsystem to subsystem of the object under consideration |
| <i>The individual part</i> , different for every component and relation of the object under consideration                    | <i>No isomorphisms</i> , only differences between components and relations of the object under consideration                |

Specialized practitioners tend to mostly or even exclusively consider the individual part in Fig. 3.2, managers are supposed to concentrate more on the group-specific part, theorists mostly on the general part. In reality, all three cannot be separated, they all exist at the same time, and all should be covered – on the basis of application of systems theory/thinking.

In terms of the sustainable development, LA21, and climate change, these findings may lead to a conclusion, that

systems thinking based on a **realistic** systems theory  
may be able to help humankind find a new way toward survival

more probably than the fictitious, one-sided, solutions of pollution, etc. can. As one comes to think of systems theory, one frequently recalls the General Systems Theory (GST). (Troncale, at ISSS45, 2001, orally; many in conferences on Complexity Theory, 1999, 2000) Let us, hence, spend some time on GST from the viewpoint of its applicability to a holistic (or at least a requisitely holistic) approach to the issues of the climate change, its causes and consequences!

### 3.3 HOLISTIC VERSUS (GENERAL) SYSTEMS THINKING

Jackson (1991) lets us know that there have been two big waves in the systems theory formation process. He groups the ones from 1940s to early 1970s as traditional, the newer ones as modern. The difference is basically two-fold:

- 1) The **traditional** ones aim at *generality* of their theoretical findings and keep to a *functional, hard-systemic*, very reliable dependence of a process outcome / output on the process input, which they used to see prevail in the (natural) sciences.
- 2) The **modern** ones aim at solving rather *specific* issues on the basis of the principles of systems thinking, at further elaboration and development of those principles, and they keep to *either a hard-systemic or a soft-systemic theory*, covering probabilistic rather than reliable dependence of the process outcome on the process input.

The switch does not mean that there is anything wrong with findings of the traditional systems theories, except the *exaggerated generalization, positivism* (= limitation to plain facts with no explanation, comment, individual interpretation, conclusions) and *functionalism* (= tendency to discover only the visible utility of findings and found attributes). In other words, **the traditional systems theory/ies is/are not so very generally valid as it/they used to be supposed to be**. It/they came to be too theoretical / self-sufficient to reflect reality realistically

enough. Still, as a (then new) science/s it/they did introduce a number of *basic notions*, which have an useful and equal general meaning in all the traditional and modern systems theories and include (by ABC order):

- 1) **Attribute** (= characteristic of the system or environment or element of relation under consideration).
  - 2) **Border** (= delimitation between the system and its environment).
  - 3) **Closed system** (= system/entity with no exchange of energy, matter, and/or information with its environment).
  - 4) **Communication** (= contacts, which transfer data, messages, information).
  - 5) **Control** (= manage, master, achieve a target-oriented behavior of a system or by it).
  - 6) **Data** (= signs ordered according to a syntax rule in order to potentially mean something to somebody; the syntactical level of making a potential information as its very first step).
  - 7) **Element** (= component, part of an entity).
  - 8) **Emergence** (= making of new attributes).
  - 9) **Feedback** (= response by output to the source of input).
  - 10) **Hierarchy** (= building more complex structures and entities / wholes from simpler ones).
  - 11) **Homeostasis** (= keeping the given attributes unchanged, although there are inputs over the system).
  - 12) **Identity** (= keeping the same basic attributes unchanged, although not all attributes).
  - 13) **Information** (= message, which influences somebody; any influence causing a change with its receiver).
  - 14) **Input** (= influence from environment over the system).
  - 15) **Message** (= data, which somebody perceives and ascribes a meaning to, the semantic level of making a potential information).
  - 16) **Model** (= mental or physical representation of a system; there are describing and prescribing models).
  - 17) **Negative feedback** (= response, which diminishes the change and stabilizes the given status).
  - 18) **Output** (= influence from the system over its environment).
  - 19) **Open system** (= system with exchange of energy, matter, and/or information with its environment).
  - 20) **Partially open / closed system** (= system with a limited exchange of energy, matter, and/or information with its environment).
  - 21) **Positive feedback** (= response, which enlarges the change and destabilizes the given status).
  - 22) **Purpose** (= functional reason of existence of a system).
  - 23) **Relation** (= root of impact between elements).
  - 24) **Synergy** (= new attributes caused by relations / interaction, and nonexistent with individual elements alone).
  - 25) **System** (= whole, entity<sup>79</sup>).
  - 26) **Systems typology** (= types of systems in terms of the selected attributes under special attention / investigation, such as the above quoted close, open, partially open / closed system; dynamic and static systems; functional and natural ones, etc.).
  - 27) **Transformation** (= changing the attributes of the system due to inputs).
- Etc. (See: Jackson, 1991).

In those times the difference between systems theory and cybernetics was also defined:

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<sup>79</sup> Although we did quote LvB saying (rightly) that a system is a mental picture of an object, many authors put the object under consideration and the system equal. LvB does so too. This means that they do not see that there are many viewpoints around and that each and every one selects another system to represent the same object.

- 1) The point of **systems theory** is to describe entities as systems, especially on an transdisciplinary level (= applicable to any discipline of science, and belonging to none of them exclusively).
- 2) The point of **cybernetics** is to control systems as complex, probabilistic / heuristic, dynamic entities by (feed-forward) information and feedback (information). In the 1st order cybernetics the observer of the system was considered to be acting from outside the system. In the 2nd order cybernetics the observer of the system came to be considered as an active component of the system, which means involvement and hence less objectivity of consideration. In the 3rd order cybernetics the observer of the system is considered no longer an observer only, but as an active component of the system that observes, decides and acts (See: Umpleby and Vallee, in Mulej et al., 2000). See Ch. 5.3.4.

Earlier, we briefly mentioned the issue of the *selected viewpoint*, and earlier the issue of the *unavoidable specialization*, along with which *holism is also unavoidable* for those who do not want to be in danger of making too serious oversights. Why are we now coming back to them?

If the point of systems theory is to *describe* entities as systems / wholes, this is easy to accept and understand as long as we stay within the very simplified picture of reality, which the abstraction in the *theoretical mathematics* offers us and makes us forget about the *real life complexity* (for good reasons that we do not oppose here, but we wish rather to concentrate on the other part of the story rather than on their selected viewpoints). So what?

- 1) We have already quoted, that *system is defined as an **ordered set**, i.e. an entity made of a set of elements / components / parts and a set of their relations / interdependencies*, on mathematical formal terms.
- 2) We have also quoted the real-life experience, that there are *too many **real attributes*** with almost every entity for a person to grasp, perceive, understand, and master all of them, especially in real time.
- 3) This fact causes unavoidable **specialization**, which has helped – by *reduction* of the really given amount of attributes of the entity under consideration to an amount, which one *selects* into the role of the essential ones while leaving others aside. The selection depends on the *selected viewpoints* (and is found so natural that very few authors of systems theory discuss it, thus letting their audience oversee the crucial consequences of this selection).
- 4) In this way, one namely creates a *mental entity*, which is **not equal** to the *real entity* – in terms of its *contents*, but still may be called a whole / entity / system in terms of the *mathematical formal definition*. From now on, the mental entity replaces the real entity as the information used in the further process of investigation, thinking, decision-making, and acting.<sup>80</sup>
- 5) The practical consequences include the fact that one **works** on a *reduced basis*, while one **thinks** that one works on a holistic basis. Reductionism is especially important in the case of the GST. We did to some extent demonstrate, what had LvB had in mind (see Ch. 1) and what has later on happened instead of his wonderful intentions.
- 6) It is namely the *generality* of **bases** of consideration and **scopes** of consideration what LvB had in mind (if we may remind you). And it is our understanding that LvB implied that *interdisciplinarity* is unavoidable, because he explicitly attacked *overspecialization* and warned against *oversight* of interdependencies<sup>81</sup>. Explicitly, of course, he spoke of isomorphisms rather than interdisciplinarity.<sup>82</sup>

<sup>80</sup> The German language offers a nice explanation: *to perceive* is expressed as »wahrnehmen«, which means to *take as real*.

<sup>81</sup> Interestingly enough, interdependence is not included in the above list of basic terms explicitly, but it is so implicitly by the terms relation and feedback.

7) This means **survival of *reductionism* under the name of GST as a science and worldview, which came into being to fight *reductionism* and to promote *holism*.**

Thus, we *may not be satisfied with the GST as practiced today*, once we are investigating ways to help humankind solve the problems of the climate change!

The GST as of today does not provide for holism,  
which it has been promising and established for!

Now, once we make such a strong conclusion, what is actually holism? We found no publications about the holism, it is deemed self-explanatory like the issue of viewpoint and its selection – one may conclude. Let us deal with it a bit!

### 3.4 SOME BASIC ATTRIBUTES OF HOLISTIC THINKING<sup>83</sup>

#### 3.4.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 3.4

LvB is the father of the GST, the oldest one among systems theories, which are many now. He found good seven decades ago, that the current human way of fighting our problems is also the cause of many of our problems. These problems are not as new as his findings. Humankind has developed, millennia ago, the attitude that humans are *masters over nature*, rather than a part of nature and adapting to our natural environment.<sup>84</sup> Since then, and especially in the 20<sup>th</sup> century, we have – as humankind – developed huge lots of insights into the laws of nature and the methods / technologies and techniques of using them. We benefit from them, we have never lived a better live, on our own criteria.<sup>85</sup> But we can no longer really understand and master our lives, because we – as humankind – know so much, that we – as individuals – must be narrowly specialized. And we do not live as humankind of today only, but as individuals and groups, mostly. *The whole is fragmented into parts, which might no longer be able to become a whole.*

So »Bertalanffy believed that the overall fate of the world depends on the adoption by humanity of a new set of values, based on General Systems *Weltanschauung* (= worldview). He wrote:

*»We are seeking another basic outlook: the world as organization. This [outlook] would profoundly change the categories of our thinking and influence our practical attitudes. We must envision the biosphere as a whole... with mutually reinforcing or mutually destructive interdependencies. [We need] a global system of mutually symbiotic societies, mapping new conditions into a flexible institutional structure and dealing with change through constructive reorganization.«*

... Bertalanffy advocated that we dare to broaden our loyalty from nation to globe..., that we become patriots of the planet, endeavoring to think and act primarily as members of humanity...

<sup>82</sup> If you take ISSS45 (2001) as a fresh case of an old tradition of dealing with the GST on a systems-scientific basis, you can easily see, that there are many very interesting contributions, but hardly any interdisciplinarity. The authors' endeavors at holism are limited inside their own viewpoints and professions, there are very few coauthored papers and even less papers co-written by authors of different specializations.

<sup>83</sup> Matjaz Mulej and Zdenka Zenko

<sup>84</sup> In the forms of very many so called natural disasters Nature / Earth / Universe keep telling us that this has always been and keeps being a wrong supposition, climate change included. See Ch. 6.8. for a brief illustration.

<sup>85</sup> Criteria what is a good life, are based on the practice and thoughts of the North-Western part of the Earth. This means that both criteria and results measured apply best to the upper 20% of mankind (See: Dyck, Mulej et al., 1998, 1999).

that we must begin protecting the individual and cultural identity of others. He advocated a new global morality: »*an etho, which does not center on individual goods and individual value alone, but on the adaptation of humankind, as a global system, to its new environment.*« The need for this new morality, he said, was imperative:

»*We are dealing with emergent realities; no longer with isolated groups of men, but with a systematically interdependent global community: it is this level [of reality] which we must keep before our eyes if we are able to inspire larger-scale action, designed to assure our collective and hence our individual survival.*« (Davidson, 1983, quoted after: Elohim, 1999).

In this part of this book, we will try to deal with the worldview cited above, although briefly (more in: Mulej et al., 2000). The selected problem will be some ways towards achieving a suitable (requisite) level of holism in dealing with the complex and complicated issues of sustainable development, especially the climate change. The selected viewpoint will be a comparative discussion of the notion holism, troubles with it and without it, and a rather theoretical plus a rather applied approach to dealing with the problem of holism, which will surface as a critical issue of survival – as LvB has already pointed out so well. He – as you did see – emphasizes *the whole* and *interdependencies*, rather than parts and independencies or dependencies.

### 3.4.1 REDUCTION, REDUCTIONISM, SPECIALIZATION, AND PROBLEMS OF CO-OPERATION

*The whole*, what does this mean, actually?

Dictionary says so: whole, *adj.* 1. entire; undivided. 2. undamaged, 3. *Math.* not fractional. – n. 4. entire amount or extent. 5. complete thing. (Webster, 1978). – In other words: **all the attributes**, no limitation to any single viewpoint, any single discipline, any single interest; totally everything.

How **deeply** does one tend to think about anything? How **broadly** does one tend to take it? Do we always try and work hard enough to cover **all the attributes**? Or do we rather reduce?

For millennia, humans have been trying to **assure** their **survival**, and a good enough quality of life, like all living creatures have. The difference is, that humans have happened to become *creative*, to start and continue to *change* the parts of nature in which they were living. Sometimes they were successful and sometimes they were not, on their own criteria. Thus, they *have learned* from their own and others' experience. They have learned more and more. Eventually and gradually, they have come to be *overwhelmed with the quantity of insights available*. And there is no visible end to this process, which provides both a solution (to many problems) and a problem (too much is too much).

The human way of solving the problem was and still is and will be obvious: every person has unavoidably to *specialize* in a selected part of the entire bulk of humankind's knowledge. This specialization, in the next step, unavoidably causes *reduction* of the entire quantity of insights into a rather manageable one. *Manageability* of one's life has been very appealing, it helped and still helps person/s and group/s produce insights and outcomes, which they find necessary and fine, but also others (about which the optimists try to forget, and pessimists do less so, or to even stress them).

Thus, the next step was to make the **reduction** *the right way of thinking and acting*, in the human attitudes. *Reductionism* became the dominant school about the way of thinking, especially in research, science, but also in the real life practice. It was very helpful, and still is so, when one tries to discover *details*, which are obviously very important for manageability<sup>86</sup>. By reduction / simplification, *mystery* has come more and more to be *mastery* (see: Flood, 1999), which was found great, of course, and still is so, even if fictitious.

But what about the whole, if everybody considers details only? **The whole still exists**. And it has attributes, which make it **different** from every individual detail, part. We define it this way (see: Mulej et al., 2000, and earlier; see Ch. 4.1 in this book) – *Fig. 3.3*.

*Fig. 3.3: Definition of the whole*

| <i>Viewpoint considered</i>                                | <i>Attribute of the whole found</i>                         |
|------------------------------------------------------------|-------------------------------------------------------------|
| Global attributes of the entity<br>emerging from relations | Systemic / Synergetic / Emergent /<br>Interdependence-based |
| Attributes of parts as entities                            | Systematic / Isolated per parts                             |
| Attributes of relations                                    | Dialectical / Interdependencies                             |
| Against oversimplification                                 | Materialistic / Realistic                                   |

All four viewpoints and resulting attributes of the whole are interdependent, of course.<sup>87</sup> And:

<sup>86</sup> It is interesting that there are proverbs *Devil is hidden in details*, and *You may oversee the forest for single trees*. They obviously oppose each other and are complementary to each other.

<sup>87</sup> If we accept that systems theory is about similarities of systems of any kind, and fights overspecialization, which is one-sided rather than holistic, then this »of course« should not be a point of debate. On the other hand, if we see that everybody is – by definition – actually entitled to define contents of a system according to his / her / their / our / your own selection of viewpoint/s, then the issue is less simple. In principle, one tends to consider a whole, but one's understanding of it may be quite different, as Mueller-Merbach (1992) has shown very well. He sees at least four different kinds of systems approaches (with which the definition of a system and application of systems theory / thinking begins):

- (1) The *introspective approach* concentrates on parts of the object under consideration, its internal attributes.
- (2) The *extrospective approach* is interested in how the object under consideration is embedded in its environment, its supersystem, i.e. in its external attributes.
- (3) The *constructivist approach* is interested in creation of objects under consideration, called systems, in a way, which will make the creation – in which due to division/distribution of labor and due to shared work process different experts work together – be holistic and play its role, function.
- (4) The *contemplative approach* tries to get the observer to put himself or herself in the shoes of the observed object, to do this deeply, and to perceive it as an indivisible whole.

In the case (1) the point is to find out attributes of the object from the viewpoint of a nature-scientific positivist cognition (i.e. plain facts, causes, causalities, effects, no interpretation of one's own).

In the case (2) the viewpoint is closer to social sciences and target-orientation (equifinality, the final goal is defined, the tools and ways and strategic purposes are adaptable).

In the case (3) the viewpoint is closer to designers and engineers, their science tries to understand and make the function (pragmatics, utility, reality).

In the case (4) the point is in the spiritual relation of the observer to the object under consideration, comprehension, internalization.

All four approaches are very different from each other:

- The approach (1) divides the object in its parts, reduces, analyses.
- The approach (2) links, integrates, synthesizes the object and its environment.
- The approach (3) combines (1) and (2), thinks and builds on their basis in order to create a new (artificial) object.
- The approach (4) goes deeply, meditates, works toward holism.

The (1), (2), and (3) are closer to the Western culture, the (4) to the Far Eastern philosophy.

- The approach (1) requires its user to observe from a mental distance.
- The approach (2) requires its user to understand interests.
- The approach (3) requires its user to take responsibility for his/her artifact, creation.

- I. *Holism* is attained if all these attributes are considered as a *total* system.
- II. The *requisite holism* is attained when a *dialectical* system of all these attributes is considered.

But can we individuals, being different specialists, consider interdependencies and the outcomes of their mutual influences, which make complexity, if we do not **co-operate**? We cannot, in general. How much have you been learning about *co-operation*, especially about co-operation with persons, who differ from you in their knowledge, skills, talent, emotions, and values, so far? Not much, if you have been in a usual school and/or practice organized and controlled by specialized departments. What is the consequence?

### 3.4.2 COMPLEXITY, COMPLICATEDNESS, RELATIONS, EMERGENCE, SYNERGY, VS. SIMPLICITY AND LOCKED-IN THINKING AND ACTION

The consequences of the lack of co-operation, especially of an interdisciplinary co-operation, are *oversights*, several kinds of blindness<sup>88</sup>: we do not see (all of) the real reality (Oshry, 1996).

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- The approach (4) requires its user to unite as observer with the observed.

It would be better to use more approaches than to limit oneself to a single one, the author pleads. We agree, and we add that their synergetic application would be even better and make more sense:

- It is good to use the approach (1) to find out the internal details.
- It is good to use the approach (2) to understand and control relation with one's environment.
- It is good to use the approach (3) to support creative co-operation of different specialists.
- It is good to use the approach (4) for a deeper understanding of the situation.

Mueller-Merbach states very well that the first three are very good for a *systematic* work, the fourth for a *systemic* one, being the only one of its kind.

In the case of an enterprise the four approaches would be differently useful for different jobs:

- The approach (1) would help coworkers with little contact with enterprise environment, such as the ones on the shop floor.
- The approach (2) would help coworkers in marketing etc. with lots of contacts with enterprise environment.
- The approach (3) would help planners, researchers in marketing and in technology, designers, inventors, and innovators who try to produce new benefit from new ideas.
- The approach (4) would help visionaries, (capable) leaders of organizations and societies, entrepreneurs, managers, poets and other artists, etc.

They all deal with the same reality, but select different parts of it into their own consideration/system, and produce a quite different picture due to differences in viewpoints selected, and therefore attributes selected. They all may speak of a systems approach, but they all deal with reality in a reductionistic style rather than holistically. In *asynergy*, all four of them together may be requisitely holistic, systemic and not only systematic, in order not to make too many important oversights and not to take too many risks.

<sup>88</sup> Oshry (1996) lets us see our blindness by drawing a point inside a larger round-off room and saying: you are the point, the entire room is the entity / whole / system of which you are a member. And he continues: we humans live in systems – family, class, friendly group, team, organization, church and other communities, sports leagues, national communities, states / countries. We experience joy and sorrow, good and bad relations, chances and disappointments. Many things happen to us in the systems life, but the system life remains difficult to understand anyway. We make many oversights, because *we do not see systems / wholes*, such as:

- Oversight of chances for mutual partnership
  - Lack of mutual understanding
- Making out stories about each other
- Having our myths and prejudices about each other
- Causing trouble to each other, even destruction
- Becoming enemies, when we could be co-workers
- Divorcing, when we could be happy together
- Becoming strangers, when we could be friends
- Chasing each other, when we could live in peace.

And it all happens without our awareness or intentional decision to do so.

Oshry (1996) sees four kinds of blindness in the background of such a behavior:

***Specialization without co-operation*** beyond the borders of that specialization locks us in its own arena. If we are economists, we are – for obvious natural reasons, such as limits of time and capability – not able to think and act in the role of mechanical engineers, medical doctors, cooks, etc., unless we learn another skill / profession. We do not have much of a chance to learn all the skills, which are around these days. So, we tend to go on specializing and getting more and more locked in our own cage in our thinking and acting. Thus, we achieve, that the reality around us is / seems to be *simple enough* to be manageable with our own capability.

But: is this ***simplicity true or false?*** It is locked in a *single viewpoint*. In the real world, we soon discover, that other people think and act differently, quite frequently. This does *not* mean, that we are *wrong* (inside our own /dialectical system of/ viewpoint/s), we may just be *oversimplifying* (by limiting ourselves to the selected (dialectical system of) viewpoint/s). The real life is much more complex and complicated. It is *complicated* in terms of the huge amount of attributes, which exist inside single parts of reality. And it is *complex* in terms of attributes, which are caused by *relations between parts of reality*. Reality is not as simple as it seems to be, if we consider it from a single viewpoint alone and forget about relations, emerging attitudes and synergies. Everything and everybody exists in relations, not alone.<sup>89</sup> But the above process has made humankind of today forget about relations too much. It is herein, that the **cause** for most contemporary human problems lies:

we humans tend to *oversimplify*  
*instead of thinking in systems, wholes,*  
interconnectednesses, interdependencies, big pictures,

we tend to **forget about real complexities**. And then we imagine, that we keep mastering our mysteries, managing (although with the unmanageable), and knowing (although we know of the unknowable) (see: Flood, 1999). And persons, who try to teach us to consider the reality with no simplification, are difficult to understand and accept (Oshry, 1996). That's why LvB was ascribed the uncommon sense by others, the simplifiers (see: Davidson, 1983). As a result, systems thinking has been created, but it remained poorly used, since it did not help to simplify, but rather to ***face complex and complicated reality*** (See: Molander, Sisavic, 1994).

We may need to ***know more*** than we are able to, by nature. And we try to produce routines, rules, regulation, to classify, etc., in order to handle our situation/s without having to know too much, because there is an *order*. Data, messages, and information – all of them contain some *order*, thus making the reality easier to manage, simpler. As long as the ***usual order*** reoccurs, and so do its circumstances, conditions, and preconditions, knowledge, data, messages, information are all helpful – unless they are too *one-sided, partial rather than holistic*.<sup>90</sup>

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1) *Spatial blindness*: we only see our part of the entire room, and we do not see what is going on in other parts, we do not see the world and life of others, their issues, their stresses, our mutual interactions as parts of the same whole.

2) *Time blindness*: we only see the present, not the past, history, causes of the present events and processes, which led the system / whole to the present state.

3) *Relational blindness*: we do not see that we only live in relations, we are sometimes subordinates, sometimes in the middle, sometimes bosses, sometimes suppliers, sometimes buyers, and we do not see all the resulting games.

4) *Process blindness*: if we are rather isolated than open, we do not see our systems as entities in their environment. Our oversight makes us miss the whole's processes with which the whole tries to survive. We do not see that processes make us interdependent and different and share responsibility, hence we tend to defend our small empires rather than collaborate and be in touch. Therefore we are vulnerable, all of us. – A dangerous climate change results, as a case of a tragedy of the commons that impacts all of us due to our lack of holistic thinking.

<sup>89</sup> Humans are social beings, first of all, only then individuals. (Mayr, 2001)

<sup>90</sup> If you see a lion or another wild animal, does it matter, whether it is on the other side of a strong fence or on your side? It certainly does. You better know the context, too, not only an isolated fact. Which level of simplification means an oversimplification? This is a crucial question with no general answer, because a realistic answer depends on

Contemporary professions tend to  
be ***one-sided*** rather than holistic,  
unless professionals develop the habit of systems thinking,  
which reaches *beyond the limits* of their own professions  
- by interdisciplinary creative co-operation.

Otherwise, relations, emergent attributes, and synergies tend to be overseen, complexities tend to be hard to comprehend / manage / control / master / cope with. How much can system theories help?

### 3.4.3 SYSTEMS THEORIES – TOOLS OF HUMAN ACTION AND/OR OF HUMAN FORMATION?

Relations, emergent attributes, and synergies, and hence the *context* are very easy to forget about.

We are all specialists in small parts of reality, and all other parts of this reality make us strangers almost everywhere. But we saw in reality, that parts of reality matter, and that they are also interdependent with other parts of reality. This means that **context matters even more than parts alone do.**

The development of specialization caused humans to *forget about contexts* of their own life, action, specialty, views, opinions, experiences.<sup>91</sup> Is it not interesting, that systems theory, as a theory of considering the wholes (and similarities, as a tool of it), has surfaced briefly after those decades in the 20<sup>th</sup> century, in which:

- humankind's ***knowledge*** has been ***growing tremendously***, and has been causing an increasingly narrow specialization into single parts of knowledge, with very rare and poorly developed habits of interdisciplinary co-operation;
- humankind suffered from the ***biggest crises ever***, having the form of two World Wars and a world wide economic crisis between them, in 1914-45?

E.g., Hitler, the Nazi boss before and in the 2nd World War, was using tremendous amounts of knowledge, tremendous amounts of order, tremendous amounts of products, innovation, science and its application as technology, but he obviously was not using systems thinking sufficiently. He lost. His opponents did a better job and won. Systems theory surfaced later on. It was a response to mistakes of humankind of the 20th century, such as letting one-sided persons such as Hitler to come to positions with such general and crucial influences.

Hitler's ideas were obviously very different from the ones of LvB, which we quoted earlier. So have been ideas of many others, over the history of humankind. LvB was denoted to work on the ***uncommon sense***, the others on the common one, the one-sided, biased, blind one. Even today persons of the LvB kind are rather hard to detect. And today systems theory is already around, and it has been so for half a century. What happened?

LvB wanted humankind of the 20th century (and today, and later) to change their/our worldview, we should all see the entire world and its entire biosphere as our only home, a very complex organization, i.e. a whole with many interdependencies. This was uncommon. This is what he

called the general systems. What many other authors call the general systems, is not so much a worldview, but rather a methodology (See e.g. ISSS45, 2001). It transfers knowledge, data, messages and information from one discipline to another discipline (see e.g.: Frank, 1962; ISSS45, 2001), but it leaves disciplines locked-in behind their own bars. It does *not* create *interdisciplinary cooperation*, but rather stays with **formal bridges** transferring insights between disciplines. They are called *isomorphisms*, which means attributes and tools of consideration, which one is able to apply – as equal enough for all – in several different disciplines.

From the development of systems theories, which we cannot consider in any detail here, we can see that

LvB wanted to produce systems theory  
as a tool of *human formation*.  
He tried to help the world to survive by  
establishing a broad worldview, a holistic one.<sup>92, 93</sup>

Other authors and practitioners mostly did not follow LvB (or UNO), and they changed systems theories into *tools of human action*. They disregarded what are the personal traits / ethics / values / cultures of these humans like. Tools came to be offered as a possibility to individuals and/or groups and/or organizations with potentially quite different knowledge, skills, talents, values, and emotions, e.g. killers or helpers. These tools are usable, mostly, for quite specific actions and/or investigations<sup>94</sup>. Their authors and practitioners sometimes achieved (even many) important results *inside single disciplines*, which came to be more holistic inside their own fields. Less has so far been achieved in interdisciplinarity and hence in consideration of *broader contexts*, although this would bring humankind closer to LvB's and Elohim and others' (including our own)

*warning*: humans of today are ruining more than creating  
a solution for humankind of today and the planet Earth,  
when using the common rather than the uncommon sense,  
i.e. the unsystemic rather than the systemic thinking.

Environmentalists, and many others share the same warning, even the highest political bodies of humankind do so – the United Nations Organization. But they keep staying short when facing the rather *narrow and concrete interests*.

Humankind of today keeps struggling between two kinds of human interests:

the broader and longer-term ones  
versus  
the narrower and shorter-term ones.

We might call this struggle the dilemma of holism versus one-sidedness, perhaps. Let us see.

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<sup>92</sup> So does the UNO by calling for sustainable development, including solving the problems of the climate change.

<sup>93</sup> In the first days of February, 2002, politicians from around the world were at the Davos Forum, held this time in New York City. When talking about fighting the terrorism of today, many also mentioned the need that the world biggest powers fight the poverty, unhumane globalization etc., as sources of terrorism. – This looks like a more holistic approach than the ones from the months after the 11 September, 2001, terrible events in NYC and Washington, D.C.

<sup>94</sup> See Ch. 4 and 5 about some of them.

### 3.4.4 HOLISM VERSUS ONE-SIDEDNESS AND OVERSIGHTS: REQUISITE HOLISM<sup>95</sup>

Holism is an easy word to use, as long as we do not try to exactly define it. Different authors tend to have different definitions (see: Checkland, 1981; Delgado, Banathy, 1993; Dyck, Mulej, 1998, 1999; Flood, 1999; Frank, 1962; Jackson, 1991; Mulej, 1979; Mulej et al., 1992; Mulej et al., 2000; Schiemenz, 1994; etc.), implicitly or explicitly.

In a strict sense, a whole contains *everything*, all parts and all their relations. But: **which – everything?** Experience demonstrates, as we already have noticed, that humans do not seem to be either able or willing to think and act in the breadth, which LvB goes for. To specialists of other disciplines the entire biosphere does not mean as much as it does to LvB, who was a biologist.

Everybody turns out entitled to *define*  
*what is a whole to him, her, or them,*  
*on their own criteria.*

The **mathematical** basis, which we quoted earlier, was introduced for some help, and it said that a whole (= system) is an ordered set, which means that it is made of two sets, the set of elements (parts) and the set of relations (interdependencies). This is a **generally valid isomorphism**. It serves us very well, as long as **content** is less important than the mathematical basis for its description. Then we see, that the same piece of reality can be **described** with many different and mathematically correct »systems«, i.e. as many different wholes, in terms of contents. If *wholes* can be so *many* and so *different* in concrete contents,

when is the approach holistic,  
and when is it one-sided?

If the LvB's concept did not take roots in the real practice of the contemporary humankind, which one did?

*No concept has attained a general validity*, the conferences about systems thinking and theory as well as their application let us find out. *Specialization* is too important to be forgotten about and sacrificed to a kind of *holism*, which might tend to leave specialization *aside*. Though, it is **not enough to be either specialized or a generalist only**. Both approaches, if alone, cause too many oversights, because each and every specialization can cover only a single viewpoint or a few of them, at best, other attributes remain outside the scene and the screen. On the other hand, a generalist view has either no focus or becomes a specialized one, too: it is specialized in the *general part* of attributes, leaving the group-specific and individual parts aside. (See: Fig. 3.2)

The consequence is the **dilemma**:

- Shall we have a complex approach, which causes quite a lot of work for insights to be rather holistic, but this work may predominantly result in outcomes, which are holistic enough and do not cause unpleasant side-effects and surprises? In other words: **a complex approach and work are hard to do, but they have simple / controled / controlable consequences.**
- Shall we have a simplified and simplifying approach, which does not cause lots of work for insights to be rather holistic, but may predominantly result in serious oversights, because its

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<sup>95</sup> Matjaz Mulej, Stefan Kajzer, Zdenka Zenko, Vojko Potocan

outcomes cannot be holistic enough? In other words: *a (too) simple approach is easy to do, but it can have complex / uncontrolled / uncontrollable consequences.*

Obviously, in each and every case a *decision* has to be made: *which level of holism is good enough* to solve the above dilemma well enough. One should **avoid** both exaggerations:

- **The total** holism tries to include *all attributes from all viewpoints, and interlink all viewpoints into the system of all viewpoints with no selection*. Its result may be a lack of focus and hence a lack of response, which insights and actions are making the point / are essential.
- **The fictitious** holism tries to limit *the concentration to one single viewpoint, which might be too much of a selection of a narrow kind*. Its result may be a good focus, leading to a lot of insight/knowledge, but about nearly nothing.

A *middle way* is close enough to reality in terms of both need and possibilities. This is what we called recently (Mulej, Kajzer, 1998; Rebernik, Mulej, 2000; Potocan et al. 2001; Potocan et al. 2002) the *requisite holism*. It turned out to be a law: successful persons and organizations (tacitly) live with this law (see: Zenko, 1999; Zenko et al, 2002).

What is the way to meet the law of requisite holism? Rarely, a single person can know enough to meet it, perhaps in the case of a very simple activity, such as a job on the assembly line. More normally, several specialists will need to co-operate as representatives of several mutually different viewpoints, e.g. professions. But: what is the basis for them to *agree to enter* into such a co-operation, which is much less simple to do than working inside a single discipline / alone?

#### 3.4.5 THE BASIS FOR (REQUISITE) HOLISM TO BE ATTAINED: INTERDEPENDENCE AND ETHICS OF INTERDEPENDENCE<sup>96</sup>

We said earlier briefly that Adam Smith was and is misread. It is time now to elaborate on it a bit. Humankind has been taught for millennia to act as the proverb says:

*Help yourself on your own, and God will help you.  
Depend on yourself and your own horse.*

It means: neither care for anybody nor depend on anybody! Be as *selfish* as everybody else is!

This notion entered the economic theory with a basic sentence of the political economist of the (early!) market economy Adam Smith that is still repeated all the time, today:

*Everybody is supposed to care for his or her narrow interests only.  
The invisible hand (of the market forces) alone takes care of the  
common good of the entire society, since it praises the ones who  
please their customers / buyers better than the others do,  
and punishes the ones who do not do so.*

But: if you read carefully, you see that the Smith's sentence says something else than the two proverbs quoted above, he seems to have not been well understood. He says that the supplier takes good care of his own interest only, when he or she takes into account that he or she is neither alone nor independent, but *interdependent*: he or she needs his or her customers (for profit and further working), they need him or her for goods he or she offers. (See: Petzinger

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<sup>96</sup> Matjaz Mulej, Stefan Kajzer, Nastja Mulej

2000) The same relation of **mutual need** exists between the managers, entrepreneurs, owners, employees, professionals of different professions and offices inside the same firms or other organizations, or inside different ones.

In a summary: what is **natural** is **interdependence** rather than independence or dependence as power holders tend to teach us. They consider the life from another viewpoint: who may and can impose something over the others, who may and can take something away from the others, because they depend more than the power holder does (or feels to do so). What is *interdependence* and what is its good consequence, is expressed by other *proverbs*, such as:

*Hands wash each other, they wash the face together.*

*Union is strength.*

*Single straws can be broken easily, a bundle cannot.*

Once interdependence exists and works, we *cooperate* and attain an effect reaching beyond the sum of single effects of single components - **synergy results / emerges**. It is so in nature, in machines, in human beings, and their groups and organizations of all kinds and sizes.

The problem arises with the natural difference between the existence of synergies resulting from interdependencies, on one hand, and the narrowly educated specialists tending to forget about their own interdependencies with other specialists. The traditional education of the industrial times<sup>97</sup> did not provide for *ethics of interdependence* (Kajzer, Mulej, 1997; Mulej, Kajzer, 1998a), partly because there has been no systems theory, until half a century ago. How important this oversight is, can be well seen from the following example (See: Balle, 1994):

*If we wanted to train a horse to run better and we used the traditional methods instead of the systemic thinking and theory, we would try to train each horse leg separately.*

*We might teach them something, but co-operation of the legs among themselves as well as with other parts of the body would be forgotten about.*

*The outcome would, most probably, not meet expectations.*

The same would apply to the issue of **climate**.

As long as humans may socialize/externalize the cost they cause to environment, and as long as profits do not depend on the care for environment positively rather than negatively, the **outcome cannot meet expectations in terms of sustainable development** – a healthy environment and a chance for humankind to survive sustainably. A big tragedy of the commons – surfacing as the dangerous climate change – happens instead of a sustainable development.

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<sup>97</sup> The preindustrial cultures were closer to nature, practiced solidarity, shared work and resources a lot more than the industrial ones (see: Grassby, 1999). Following the example of the Prussian emperor Wilhelm, who introduced social security a good one hundred years ago, gradually other industrial societies did the same in order to reduce the social tensions, which were caused by the lack of solidarity in the developed market economy. (See: Dyck, Mulej, 1998, 1999) But this important step does not cover interdependence of humans and other parts of nature, of humans of different professions, interdependence of findings, which different sciences discover, and hence of attributes, which exist in nature and are subject to differently specialized investigations and practices, etc.

But people used to live in *self-sufficient farms and small communities* with a rather small degree of specialization and division / distribution of labor. This fact did not teach them to consider specifically the great importance of interdependence. Anyway, to the successful ones it must have been the **subconscious way of life**. Their way to success was not called systems thinking and holism, but it was a case of it, implicitly. (See: Gundling 2000; Collins, Porras 1994 and later; etc.) On the other hand, a *superficial* reading of the A. Smith's sentence quoted above as well as of the proverbs quoted, was one part of the story. Its second part was the *experience that strangers might be dangerous*. Hence, if we enter some links or co-operations, we better choose persons similar or equal to ourselves, rather than the ones who are different<sup>98</sup>.

Of course, it is true that we cannot live and work together with those from whom we are mutually *different in all our attributes*. But it is also true, that we do not need each other, if we are *equal in all our attributes*. (See Fig. 3.2. again!) In the political part of human lives this natural fact is expressed by the experience that all unanimities<sup>99</sup> (religious, political tyrannies, economic monopolies) have failed, but democracies (accepting and growing the intertwining of both equal and different attributes) have survived:

**democracies** have permitted for more **creativity and holism**,  
because they admit differences and interdependencies and  
mutual interactions. This blocks one-sidedness and resulting oversights.<sup>100</sup>

The General Systems Theory was produced to support the blocking of such one-sidedness and to help prevent such dangerous oversights. It proved short of **ethics of interdependence** (in the practical use, not in LvB publications), as we found and described here earlier.

There have been a few authors, over the past decades, who have found **dialectics** a background of systems thinking (such as Delgado in 1950's, Churchman in 1960's, Mulej in 1970's - see: Delgado and Banathy, eds. 1993). Dialectics is the ancient Greek word for interdependence. Some new authors are now joining the band (such as Bai and Lindberg, 1998). But it is still unclear whether the latter are limiting what they call *contradiction*, *conflict*, *complementarity*, *opposites* and we call interdependence of mutual differences, inside a single profession, or put it in an interdisciplinary perspective, too. If a narrow view is used, holism is not attained on the level of the aspiration of the fathers of the GST, such as LvB, who found *holism based on interdependence* necessary for the science to overcome its fragmentation into rather independent and unrelated disciplines of inquiry per parts (and for humankind to survive!). What they attack is a tendency of specialists to forget about many *links* among parts, which actually do exist in both nature and culture, i.e. man-made products and society. Even more, those links are rightfully found essentially influential.<sup>101</sup>

<sup>98</sup> How many interdisciplinary professional associations do you know, e.g.? With whom do you find a debate easier to conduct: with persons of your own profession, life style, experience, age, interest, views, values, ethics, etc., or with different ones? But, on the other hand: from whom can you learn more, whom do you need more in a creation and innovation oriented process – the ones agreeing with you, or the ones completing you up with new insights?

<sup>99</sup> Around the world, from Ireland via Afganistan to Indonesia etc., we can see that powerholders and their oponents call for unanimity – agaist each other. Both groups are interdependent and their bosses live on making their followers hate and fight each other. It is no general unanimity what they are trying to have, in reality. (See: many articles and books commenting on the attack over New York and Washington buildings that are symbols of the USA as the superpower, or on the long decades and centuries of fight between roman-catholic and protestant Irish, roman-catholic and ortodox Bosnians, Croates and Serbs in Balkans, etc.)

<sup>100</sup> This empirical conclusion does not apply to national and international politics only, but to all human relations and organizations.

<sup>101</sup> It is exactly forgetting about them which, to a high degree, causes the emergence of *strange attractors* instead of the expected ones. See literature about the Chaos Theory.

Now, **what has *ethics* to do with *interdependence*?**

*Ethics* is a feeling rather than a component of the left-brain rationality, knowledge or skill. It enables us to distinguish right from wrong (Enciklopedija 1959; Sruk 1986; Schnaber 1998; Sruk, 1999; etc.). Empirical researchers consider that ethics is a *synergy of behaviors*, which tend to be *preferred* in a society or community, as a social group, for long enough periods of time to come to be kind of codified (Wilson 1998). *Moral rules* result, as a formal next step (Sruk, 1986). They co-create a *culture*, be it the one of social sub-groups, organizational units, organizations as wholes, or the one of regions, nations, social classes, professions (Mesner Andolsek, 1995; Treven, 2001). Thus, something, which is originally an individual characteristic, comes to be *objectified* as a component of the objective conditions (i.e. external to single individuals). It becomes a part of broader requirements imposed over the individuals, and tends to return, in this way, back to individuals as a part of their *values*, i.e. their emotional perception of the objective needs or requirements they face (see: Trstenjak 1981). Thus it enters (or re-enters) the individual's starting points, which influence perception, definition of preferences, their realization in the form of goals, later on – tasks, procedures of realizing the tasks etc. It means, that

ethics is equally essential and influential as the  
professional knowledge and skills are, for any human activity.

We have even found all three of them mutually interdependent (Mulej, 2000 and earlier, since 1974).

Our own experience, and quite probably yours as well, tends to practically confirm the observation made by Wilson (1998) saying that researchers find that the *ethical norms* have been *changing* in an evolutionary process based on the *interplay of biological and cultural factors*. This finding may hold of and explain many things, some of which may be quite relevant in the context of this book, such as:

- ***Ethical principles of the pre-industrial societies*** are based on their experience that the solidarity of the extended family (and community) helps them survive, and does so better than the ethics of the individualistic competitiveness of the industrial and post-industrial societies / communities do. This is so because the (pre-industrial, non-western) ethics of solidarity tends to keep interdependence<sup>102</sup> alive. (see: Fromm, 1994) – *Problems of climate change do not result from ethics of interdependence, but they hardly can be solved without such an ethics.*
- It is well known that **Adam Smith** wrote his book “Theory of Moral Sentiments” (1759) before his “An Inquiry into the Nature and Causes of the Wealth of Nations” (1776), from which his thought briefed earlier, is taken. He presupposed *ethics of altruism* would help people overcome their natural selfishness, which was and is making them forget about solidarity and interdependence, once they feel that a narrow individualism would help them better than solidarity. Today, altruism is no more appealing to the narrowly thinking and feeling, i.e. most people, than it used to be in A. Smith's times. But it can well be replaced, even in the hard very competitive business world, by ethics of interdependence which surfaces as *creditworthiness, trustworthiness, credibility, reliability*,<sup>103</sup> etc. (Kajzer, Mulej, 1997; Knez-Riedl, 1998; Thommen, 1996; Knez-Riedl, 2000; etc.). Partners who

<sup>102</sup> The fact that “in Japan an individual finds no acceptance if he or she does not belong to a group”, even in the very competitive times of now-a-days, may be a source of the current Japanese strength and troubles (Zenko, 1999; Mulej, Zenko 1998).

<sup>103</sup> See Ch. 6.3. for some details about these attributes.

are worth trust, cause much less cost of checking, control etc. (Palcic and Mulej, 1991). – *Problems of climate change result from selfishness much more than from self-interest, altruism, solidarity, and ethics of interdependence, but they can hardly be solved without them.*

- **Democracy** expresses ethics of equal legal rights of all men and women, if they are covered by its definition of the entitled members / participants of the democratic processes. In the antique Greece it covered slave-owners only. After the “Magna Charta Libertatum” feudal bosses and clergy came to be included. The French Revolution and other revolutions at the end of feudal times in Europe, brought the entrepreneurs, later on other professionals, later on broader masses of both genders in (the political!) democracy. All of them came to be included, once the previous power holders started to feel too much of *mutual interdependence* to keep forgetting about them and letting them cause troubles. Today, in the advanced parts of the world, at least, the political democracy is *completed up* by economic, organizational, family, local community, and similar kinds of democracy, in order to channel the human creativity away from causing too much trouble, etc. When ethics of interdependence is overseen, tunnel vision enters the scene again, and a new kind of trouble surfaces. – *What causes the problems of the climate change is rather a one-sided abuse of the so-called political democracy by the political power holders representing the rather one-sided interests of the economic power holders. Hence, transition to a more holistic democracy is a precondition of solving the problems of the climate change.*
- **Systems thinking** may, on these terms, be said to be an expression of the ethics and habit of *seeing the wholes rather than parts only* (see: Oshry, 1996). Like democracy, systems thinking suits better the persons with broader horizons and bigger flexibility, as well as persons, organizations, nations and other communities living in rather complex entities and circumstances, rather than the ones with narrower horizons, poorer flexibility, and living in simpler conditions. It is so because the background of complexity, open-mindedness and flexibility is *interdependence*, not only as a practice, but also as ethics and applied perception (a subconscious one, frequently), reflecting their practice. – *It is obvious that the problems of the climate change result from a lack of systemic / systems / holistic thinking on the part of the political and economic power holders. The taxation system has been and still is supporting them, and must take from them lots of money to cover the consequences of their one-sidedness (see: Hawken, 1994; UNESCO, 1999, 2000, 2001).*<sup>104</sup>

Once interdependence enters ethics, it enters *sub-consciousness*, which means that it becomes rather a *master* of our personality than our *tool* under our clear control (See: Kline, 2000). Then, it comes to be practiced automatically, as something very normal, *unquestionable*. This is why ethics is so crucial. And this is why it needs to include interdependence. This is better achieved, if there is a theory to respond to the need, not merely an experience, which is hard to transfer, teach, etc.

Thus, we may conclude:

Lack of consideration of interdependence  
in the 20th century practice became a problem, on one hand,  
and caused making of Systems Theory, not only  
systems thinking based on intuition and philosophy, on the other hand.

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<sup>104</sup> We will come back to taxation in P. 6.6.

Systems thinking (as a rare practice) has been around for ever (not so systems theory, of course), since the human *capacity to influence* had outgrown the human *capacity to holistically understand* the events, objects and/or processes under influencing. (Fig. 3.4)

Fig. 3.4: The difference in two crucial human capacities - the root of failures and of the need for systems theory supportive of systems thinking

|                               |   |                                            |
|-------------------------------|---|--------------------------------------------|
| Human capacity of influencing | > | Human capacity of a holistic understanding |
|-------------------------------|---|--------------------------------------------|

Then (informal) systems thinking became necessary for survival, but could not be always attained. Sometimes humans *happened* to be holistic enough in their thinking to **make a holistic impact rather than a mistake**, but frequently they/we have not been so lucky and caused new difficulties while solving some earlier ones (Mulej, Kajzer, Vezjak, Mlakar, 1998; Mulej et al., 1998; Knez-Riedl, 1998a; Mulej, N., 1998; Potocan, 1998; Mlakar, 1998; etc.). In the 20th century, two World Wars and the world-wide economic crisis made a series of events lasting for beyond one generation, i.e. about 35 years of permanent big trouble for very many humans, including a premature death of many ten million persons. These times demonstrated how terrible the consequences may be, if influential humans *lack systems thinking*, be it in societal affairs, business, science, education, engineering, etc.

It can hardly be a coincidence only that it was exactly at the end of these 35 years of culminating troubles when the efforts came to be supported, which were aimed at overcoming the prevailing of the *tunnel vision* (i.e. one-sidedness, one-handedness, biased attitude, instead of holism) of thinking, decision making, and acting. Conditions were ripe for (G)ST and Cybernetics to be born and established. Their intention and mission was to replace the tunnel vision for *holism*, i.e. to establish the science and ethics of the *requisite holism*. These words, though, do not seem to have been used. **Again: which holism?**

### 3.4.6 THE ABSOLUTE, FICTITIOUS AND REQUISITE HOLISM<sup>105</sup>

It turned out that the practice of **GST** went too far into the concept of isomorphisms based on natural sciences to be able to fulfill its mission (as defined by LvB) fully. Its definition of the notion of *system* was based on mathematics and said that the system is an *ordered set* and represents a *whole entity*. The notion was fine and simple enough to suit all viewpoints, sciences, and practices, which means the danger that the **tunnel vision returns to power** (because specialization is unavoidable). What the very creative and important authors, fathers of the GST and Cybernetics have left aside too much, was the self-evident fact that a system, as an ordered set, could let the specialists with a tunnel-vision kind of thinking and acting keep forgetting about their own *interdependence with mutually different specialists*. Namely, the same object under consideration and/or control can be looked upon from several **viewpoints**. Each and every one system uncovers a different *part of the really existing* characteristics of the object under consideration and/or control. Only an **absolute system**, which can normally not be attained, could make the system *really equal* to the object represented by the system, which is what the GST has actually and unsuccessfully tried to achieve (see: Checkland, 1981, and earlier; Mulej 1974, 1976, 1979, and later, incl. Mulej et al. 1992, Mulej et al. 1998, Mulej et al. 2000; Jackson 1991). But an absolute system in the sense required by LvB would, actually, presuppose *a system of all systems/viewpoints* (not only a single one, neither a system of all essential, nor one of all possible systems /

<sup>105</sup> Matjaz Mulej, Stefan Kajzer, Vojko Potocan

viewpoints). This is impossible to do for every individual, even for co-operating teams. This was overseen.

Two, at least, *unfortunate consequences* resulted from this oversight:

1. Systems Theory has not become really general or useful for linking different disciplines, or both at the same time, i.e. to be a *bridge* towards transdisciplinarity by *interdisciplinarity*.
2. Systems Theory has not become enough of a mass movement (Molander, Sisavic 1994) to come to be applied generally and to establish *ethics of non-fictional holism*.

Both developments replaced the intention, which used to make (G)ST surface and become important in last five decades. Instead, they limited (but not destroyed) its usability and usefulness and application mostly to the arena of the *inside-discipline-holism*. As long as scientists as well as practitioners of any discipline do not *feel interdependent*, but rather independent, the problem of a rather real holism can hardly be solved.<sup>106</sup> – *The same conclusion applies to the problems of the climate change: no single profession can solve them alone.*

In other words: times and conditions have come for

*ethics of interdependence* to be acknowledged  
as a part of the way out of the current crisis

of both systems theory and humankind of today, and to start prevailing in the best interest of humankind and each and every individual. Thus, one may have a chance to *come closer to the requisite holism*. Including the issues of the climate change.

*The requisite holism* is, in practice, obviously defined by individuals and/or groups defining the scope of their own observation and influencing (control, management). Thus, it is these persons who take *responsibility* for consequences, if the requisite holism is **not defined broadly, interdisciplinarily enough** (and is hence causing insight, thinking, decision making, and acting to contain holes rather wholes). This unfortunate consequence can easily happen, if these persons practice an application of systems theory, which is more oriented:

- I. to *formalities* and *internal attributes* of the event, process, person, group, organization, society, part of nature etc. dealt with, and
- II. to dealing with it inside *one single viewpoint* instead more broadly, including the ethics and practice of interdependence,

rather than really holistic. This can happen quite easily due to the normal human need for specialization.

*Including the issues of the climate change, of course.*

The background making this problem surface, and the one of its solution need some more of our attention. We may understand the situation more profoundly and therefore find a way out of the blind alley more easily.

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<sup>106</sup> The same finding holds of business functions in organizations, business partners in markets, individuals in families, organizations and communities, regional units such as counties, states, countries, European and other Unions etc. The longest step toward ethics of interdependence seems to be made by the organizational paradigm *network of autonomous units replacing the commanding hierarchy* (Schmidt 1993). Schmidt compares this network with the network of reliable friends, on the basis of his own life and consultancy experience.

### 3.4.7 THE MODERN (MATERIALISTICALLY) DIALECTICAL THINKING – A FORERUNNER OF SYSTEMIC THINKING AND CONSIDERATION OF INTERDEPENDENCE

Once upon the time, when there were many less persons on this planet Earth, and there were also many less contacts and mutual impacts among persons. Thus, it is not too difficult to understand that in the pre-industrial times the common denominator of the style of thinking used to be quite different from the one, which was summarized by the philosophy of the 19th century as a picture of the industrial times. In a summary, four attributes express the difference. See *Fig. 3.5*.

*Fig. 3.5: A summary of the pre-industrial and the modern basis of thinking*

| MEDIEVAL METAPHYSICS    | CONTEMPORARY DIALECTICS        |
|-------------------------|--------------------------------|
| 1. Isolation            | 1. Interdependence             |
| 2. Harmony, no adverses | 2. Unity and fight of adverses |
| 3. No changeability     | 3. Continuous changing         |
| 4. Total negation       | 4. Dialectical negation        |

The above philosophical differences reflect different life realities and cause essentially different consequences, when applied today. Both are summarized in *Fig. 3.6*.

Fig. 3.6: Practical grounds and consequences of the medieval metaphysics and contemporary dialectics

| MEDIEVAL METAPHYSICS                                                                                                                                                                                                                                                                                                                       | CONTEMPORARY DIALECTICS                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Isolation = reflects the old times practice of a <i>lack of contacts</i> , impossible today = makes a basis for a <i>lack of cooperation</i> badly needed by almost all specialists today.                                                                                                                                                 | Interdependence = reality of most specialists as well as of most parts of both nature and society, applies also to technical products; independence of parts is quite unusual, we all are parts of larger entities.                                                                                                                                                           |
| Full harmony = monolitism and monopolism, unanimity, i.e. the <i>boss cannot be wrong, subordinates must not think</i> = makes a basis for the group-specifics & individualities to be overseen, and only the general attributes to be admitted, and for a <i>basis for mutual complementarities of different ones to be disregarded</i> . | Unity and fight of adverses = one part of the attributes is common to all parts of the entity, other parts are mutually different and complementary due to their differences, because of which they both need and influence each other; both parts of attributes are natural, so is their interplay and its permanence, resulting in no final harmony, but only in processes. |
| No changeability = reflects the old times <i>routinism</i> , favoring tradition to novelty (the latter being is “illogical, uncommon sense” because it opposes tradition) = provides for a <i>lack of room for creativity and innovation</i> .                                                                                             | Continuous changing = due to influences and interplays changing is normal, its speed, etc. may differ; new needs cause creation of new possibilities, which along with new troubles create new needs, creativity, invention, and innovation, incl. new human attributes/traits.                                                                                               |

|                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Total negation = reflects <i>the fear that everything changes if any part does so</i> , leading the entire (!) old, accustomed practice to disappearance = provides for <i>opposition to innovation, even the incremental one</i> . | Dialectical negation = in the process of changing the obsolete parts of attributes disappear, the still valid, usable and useful ones, survive; the change may be evolutionary (step by step) or revolutionary (leap frogging). |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Let us summarize the process of working of the four *laws of modern dialectics*<sup>107</sup> in Fig. 3.7.

*Fig. 3.7: The four laws of modern dialectics as a continuous process*

|                                                                                                                                                                 |   |                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------|
| Background: interdependence                                                                                                                                     | → | Surface: unity and fight of opposites                                                                                         |
| ↑                                                                                                                                                               |   | ↓                                                                                                                             |
| Dialectical negation: consequences of the process <i>in one phase</i> of it: a part of the old attributes is still around, another part is off because obsolete | ← | Process caused: gradual transition of the given quality via quantitative (= unessential) changes to a new quality (= essence) |

See the process pictured in Fig. 3.7 with words of the modern systems theory in Fig. 3.8.

*Fig. 3.8: The four laws of modern dialectics in the language of the modern systems theory*

<sup>107</sup> There are also *categories of dialectics* which also help us understand interdependencies better. But we do not have room and time to deal with them here.

|                                                                                                      |   |                                                                              |
|------------------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------------|
| Background: interdependence                                                                          | → | Surface: (strange) attractors                                                |
| ↑                                                                                                    |   | ↓                                                                            |
| Dialectical negation: a new synergy / system / entity / whole, with some old and some new attributes | ← | Process caused: emergence of new attributes of the whole under consideration |

A brief comment to *Fig. 3.7* and *Fig. 3.8*:

- 1) One cannot master the reality, if one perceives and impacts only some parts of reality rather than all of it. With the oversight of interdependencies, one cannot see reality, and mistakes are normal. New solutions are needed, therefore, again and again.<sup>108</sup>
- 2) One cannot master reality, if one expects no combination of unity (in one part of attributes) and opposites / adverses / crucial differences (in the other parts of attributes) as well as their mutual impact (called “fight” by philosophers).<sup>109</sup>
- 3) One can neither master the reality, if one expects the given solutions to be useful forever, because no new conditions are supposed to surface. Mistakes are again unavoidable.<sup>110</sup>
- 4) One can neither master reality if one expects completely all attributes to disappear, if any change comes (“total negation”).<sup>111</sup>

But narrow specialists as well as routinized lovers of unchangeable tradition and isolation have it easier in the world<sup>112</sup>, as long as there is *no innovative business, no innovative society, no global economy, information network and life*. But they are all here, they all denote the same situation: interdependence is a growing daily practice. Thinking in terms of interdependencies, i.e. modern dialectical thinking is the **realistic choice**. But the dialectical thinking is also **more demanding**:

- It shows the reality in a less simple light, but demonstrates its real complexity.
- It allows for less room for one-sidedness, and leisure, and a lazy, routinized behavior.
- It does not allow e.g. specialists to run away from co-operation with other, different specialists, but rather requires them to seek mutual impacts *because* of mutual differences.
- It allows no boss to be sure that he or she is the only person entitled to think and capable of doing and fixing things, but rather find that he or she is capable of running one part of the entire process to be mastered while his or her subordinates are actually his or her team members and partners, who *complete each other up in a shared process*.

<sup>108</sup> Interdependencies also change, in reality. As a child, one is interdependent with one’s parents, later on with one’s lover and spouse, later on with those helping the old and disabled persons out, etc. What about a product, the first phase sees interdependencies of the designers and investors, then of the supply offices and suppliers, then of the stock and production, later on of the sales office and production, and the sales office and buyers, etc.

<sup>109</sup> Parts making an engine, must be mutually different and complementary to make it. The engine is their synergy, the system made of those parts (in the above mathematical perception of the system). Members of a sport team do the same. And so do two competing teams in a game: both team’s unity is their kind of sport, they are adverse to each other as competitors for the victory. The same philosophy holds of parts of a body, of an organization, United Nations, etc., everything.

<sup>110</sup> Would you like to receive the same kind of a birthday gift at the age of 2, 20, 80?

<sup>111</sup> If this expectation was true, one could make a good wooden house from rotten iron waste, e.g. Etc.

<sup>112</sup> There has never in the known history been so much of changing as today, so much science, so many data and chances of information (i.e. data making sense and impact). The generation has not yet fully retired, which was trained to serve the conveyor belt in mass production rather than to be creative and even innovative on their jobs. Even in USA they are not satisfied with the adaptation of the education to the current needs of the manufacturing and other industries (see: SCANS, 1991). The same applies to Europe (see: EU, 1995; EU, 1996; EU, 2000; etc.) and Japan (Zenko, 1999). The remaining 80% of humankind are much more traditional in their practice (see: Dyck, Mulej et al., 1998, 1999; etc).

Thus, dialectics suits the complex modern life much better than the medieval metaphysics, does, but not in totally all cases<sup>113</sup>. By letting us see reality in more complex terms, dialectics does not make our life more complex, but the opposite: it solves the problem of an exaggerated oversimplification, which may end in very unpleasant surprises. The consequence may look as a paradox:

*(over)simplification causes complexities and complications, but  
a requisite consideration of complexities and complications, in time, simplifies.*

Interdependence, if included in thinking, decision-making, and action, makes a more **complex**, but hence more **realistic** picture of reality and a more realistic basis of both perception and action. It does *not cover ideas only* (as the Hegelian “idealistic dialectics” used to teach, being limited to the world of ideas and disregarding the real life’s causes and roots of ideas, although being brilliant otherwise), but **in the entire nature and / including society**, including the world of ideas (which is expressed by the notion of “materialistic dialectics” in philosophy (Britovsek et al., 1960; Bahm, 1988; Waldrop, 1992; Delgado and Banathy, eds., 1993; etc.)). Thus, we no longer separate the world of thinking from the world of practice, but see their interdependencies. We can do the same, if we use the modern systems theory, but not as a formality of a one-sided description.

### 3.5 CONCLUSIONS FROM THE CHAPTER 3

Realities briefed in Figures 3.2 – 3.8 allow us to conclude that the

*problems of climate change can be attributed to the prevailing of  
the unsystemic / traditional thinking over the systemic / modern one.*

We can summarise the comparison<sup>114</sup> of the two thinking modes in *Fig. 3.9*.

Why did we choose exactly the Dialectical Systems Theory (DST)? We created DST exactly to help solve the problems resulting from the traditional, unsystemic thinking, which we found unsolvable with the GST and other systems theories we investigated (See Ch. 5). The difference in thinking modes is especially important in relation with the modern, i.e. innovative business (See Ch. 4.6) and society (See Ch. 4.7) which are rapidly replacing the traditional ones. This process requires the prevailing thinking mode to change to a modern dialectical /systemic / holistic one as quickly as possible, especially with the part of the humankind of today, which has started this process later than the so-called most advanced 20% of humankind of today.<sup>115</sup>

Here we want to apply the systemic thinking to climate change system, so we need to collect some more knowledge about it.

<sup>113</sup> Cases in which the thinking and acting in terms of isolation, full harmony, no changing, and total negation, is the appropriate one, are rare, but they do exist. In a medical blood lab, blood of different patients may never be mixed up, e.g. Similarly, a worker on the conveyor belt is interdependent with other workers, but he never intervenes outside his own job, unless something very exceptional happens. Etc.

<sup>114</sup> Such comparisons tend to be extremistic, in a black and white style. This one is no exception. Reality may sometimes be somewhere in the middle.

<sup>115</sup> See Ch. 6 for some details about methods supportive of the acceleration of such a change in thinking mode.

Fig. 3.9. The essential attributes and consequences of the (dialectically) systemic versus traditional thinking

| <b>Traditional / unsystemic thinking</b>                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Modern / (dialectically) systemic thinking</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reliable rules, determinism (»hard systems«) everywhere                                                                                                                                                                                                                                                                                                                                                                                                                      | Stochastic rules, probability (»soft and hard systems«)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Analysis = breaking a whole into independent parts                                                                                                                                                                                                                                                                                                                                                                                                                           | Holism, no independent parts of an entity (in relation to the entity and other parts of it)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Consideration without interdependencies / relations between parts (nor environment)                                                                                                                                                                                                                                                                                                                                                                                          | Consideration of relations / interdependencies between parts (and with environment)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Statics, the given state, status                                                                                                                                                                                                                                                                                                                                                                                                                                             | Processes, dynamics, changing, development, evolution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Simplification of one's picture of reality (due to lack of insight), narrow horizons                                                                                                                                                                                                                                                                                                                                                                                         | The least possible / only the unavoidable simplification, lots of insights, contacts, influences, broad horizons                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Simplification of one's picture of reality by filtering data and by specialization (due to data, messages and information overload)                                                                                                                                                                                                                                                                                                                                          | The broadest and deepest possible taking of the whole into account, only the unavoidable simplification, transdisciplinary views and interdisciplinary co-operation of different (mono/singledisciplinary) specialists                                                                                                                                                                                                                                                                                                                                                         |
| One-sided, partial insights and actions, no emergence or synergy perceived                                                                                                                                                                                                                                                                                                                                                                                                   | Emerging network of findings and actions, their synergy central. Dialectical insights                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Dangerous lack of co-operation of specialists because their 1) talents, 2) knowledge on contents, and 3) on methods / skills, 4) values, 5) emotions, hardly enable them to creatively co-operate and support co-operation; therefore they risk oversight of rather than insight in important attributes; in its turn, this causes strange attractors, unpredictable synergies and other consequences, deviations from expectations, errors and troubles, problems, failures | Dialectical Systems Theory – a methodological support to synergy of essential specialists through a system made of: 1) law of hierarchy of succession and interdependence <sup>116</sup> , 2) law of requisite holism <sup>117</sup> , 3) law of entropy <sup>118</sup> , 4) guidelines for subjective starting points supportive of creativity and holism in the phase of defining the goals <sup>119</sup> , 5) guidelines for maintenance of creativity and holism in the phase of realizing the goals <sup>120</sup> , 6) modeling of creative co-operation <sup>121</sup> |
| Complex and complicated consequences caused by a too narrow specialization, i.e. (too unrealistic, reductionistic) simplification of the picture of reality, principles and processes of thinking, decision making, action, and behavior                                                                                                                                                                                                                                     | Networking of insights and impacts (on the requisite level of holism), hence simplification of consequences of thinking, decision making, action, and behavior, because they are all requisitely holistic                                                                                                                                                                                                                                                                                                                                                                      |

Here we want to apply the systemic thinking to climate change system, so we need to collect some more knowledge about it.

<sup>116</sup> See Ch. 4.2, 4.3.1 for some details, as well as Ch. 3.4.

<sup>117</sup> See Ch. 3.4.4, 3.4.5, 3.4.6 for some details.

<sup>118</sup> See Ch. 4.3.1 for some details.

<sup>119</sup> See Ch. 4.3.3 for some details.

<sup>120</sup> See Ch. 4.3.4 for some details.

<sup>121</sup> See Ch. 4.5 for some details.

### ***3.TR THE CLIMATE CHANGE AS A SYSTEM AND ITS INFERIOR SYSTEMS***

#### **3.TR.0 THE SELECTED PROBLEMS AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 3.TR**

The climate change system is an integral part of the Earth biosphere. It has no clear-cut borders with other systems in the nature, like we humans are used to think and see. The climate change system is rather a part and complex natural system that actively takes / uses / puts / gives inputs / influences / impacts, receives outputs / influences / impacts from all inferior and superior systems, and reflects the present ones – as living conditions at the very moment of observation. Observer can go back in the history of evolvments, but cannot go in the future, due to countless possibilities involved. In this chapter we shall brief the climate change system itself, and its inferior natural systems.

#### **3.TR.1 THE SYSTEM OF IMPACTS ON THE CLIMATE CHANGE SYSTEM**

The difference between the human's traditional thinking and the system thinking could be described as follows, when concerned with the climate change: When observers look at our civilization's achievement from the viewpoint of building and construction heritage, it looks nice, everything is in order, the arcs are arcs, lines are in a geometric order, and the whole construction follows a certain tradition/style/architect's mind work. Of course not as a total rule, because e.g. the great architect from Catalonia, Gaudi, has demonstrated his innovative approach to churches and other constructions. Also our houses, exterior and interior arrangements, agricultural activities, communications, roads/railways etc., are following a certain order, which does not look like the virgin nature. To us humans from this civilization the virgin nature looks like chaos, and we are not in position to see that it sees us vice versa. It is also difficult to comment whether the distance between nature and the human life style is now big or small, but it is obvious that we humans have made many different interventions / innovations, which are not a natural way of acting. So, for the conventional thinking chaos of nature is chaos, and our life style is all right. On other hand the system theory/thinking may allow us humans to see the natural chaos as order and the human's order as a sort of chaos. When not only scientists, but also common people in the local communities will have this ability, we shall have much more of a natural habitat as we do now.

When we apply the above findings to the climate change system, we may understand "chaos" as interdependences/interactions/co-operation of many different systems of nature resulting from parts of the very complex climate change system. Of course we should not forget that this thinking is the thinking of human beings, and it has all good and bad attributes, which we humans have.

The climate change system is a composition of a permanent evolution of the natural systems, which support the biosphere as the space for living creatures within nature. We have seen dependences of the climate change on its superior systems, and let us first list the influences, which may occur from them to the biosphere.

All changes/evolvments of the Sun System have an absolute impact on the biosphere. They have a strong impact on the Earth, and most probably grave consequences when changes at the Sun System evolve. More scientific research should be directed towards understanding of

effects from the Sun on evolvments of our biosphere. As the major provider of warmth and light the Sun has a strong influence on our biosphere.

The Moon/Earth equilibrium has also a high ranking.

The meteorites from the Universe, the Milky Way and the Solar System as well as other forms of matter/energy/particles/rays and the forms/powers/systems not yet known to us humans have influenced and will influence our biosphere. Fortunately, their impacts are not so frequent.

The planet Earth's attributes studied by physics/geography/biology have a most important position. Due to permanent evolvement, interactions, interdependences, co-operation, etc., the powers of nature have created our biosphere, and keep creating it. We humans can see its past and present. We can understand dynamics of some of the mentioned systems/powers, but not of all of them. Our knowledge at present is lacking system thinking, as a possibility to better understand the system's inter/dependencies and dynamics.

The inner core of the Earth has some 1.500 miles in diameter and is moving like a top with a different speed as other parts of the planet do. Any change in the revolutions and directions of the movements could have a strong impact on the Earth system. More research is needed, to understand this subsystem, and its interdependences, interactions and co-operations with other subsystems.

The rest of the Earth – outer core, lower mantle, upper mantle and crust totaling some 3.200 – 3.250 miles in diameter have a number of common interactions, which influence the biosphere. Earth's permanent changing under its surface is broken into numerous crust plates, which are in constant motion with respect to each other because of the powerful internal forces. Volcanic activities and earthquakes are products of large-scale crust plate collisions or separations. Both activities have complex impact on our biosphere, from the local direct disastrous impacts by lava, ashes and land movements, to the even tougher impacts in cases of strong eruptions and large inputs of ashes into our atmosphere. They result in impacts on the biosphere as a whole.

The natural powers such as gravitation, magnetic force, electricity etc., circular movements like a top and joint movement within the space of the Solar System, the Milky Way, and the Universe are extremely important and not yet fully understood by our civilization.

The climate change system – the provider/guardian of living conditions within our biosphere is composed of a large number of systems, which interact/co-operate and evolve into the present condition at the place of observation, all at same time. Thinking globally, the climate change system could be observed in some of patterns or expressions or variations, which show up in different values of the temperature, moisture, and currents.

The biosphere is composed of terrestrial, aquatic and atmospheric subsystems. The characteristics of those are basically the frames, within which the climate change system has the role of the provider/guardian of living conditions.

Very well known geographical knowledge of the Earth, such as latitude, longitude, and altitude are qualities decisive for warmth and light, which are reflected in the quality of local environment. On the other hand the distribution of this quality depends on the basic characteristic of land or aquatic environment. Of course when differences meet, at bordering

environments, their quality is more complex. And it is not so simple, when taking into account complex interdependences/interaction/co-operation of all different systems together, which have something to do with the climate change system.

### **3.TR.2 THE CLIMATE CHANGE SYSTEM - ITS INFERIOR SYSTEMS**

#### **3.TR.2.0 THE LIFE ON PLANET EARTH**

From the selected viewpoint, the most important inferior system of our biosphere is life on the planet Earth. As soon as the primordial Earth was ready to host life, it appeared. In ocean waters the anaerobic bacterial life was the first to influence all later evolvments. Due to the exceptional reaches of ocean waters full of inorganic compounds the first bacterial cells had an excellent living environment. The ocean waters protected them from UV rays and the temperature of waters was suitable. The light and warmth from the Sun were at a lower radiation as today. All phases of the anaerobic life lasted from its commencement on for around 3.8 billions years ago until the appearance of oxygen in the atmosphere around 2 billions years ago (please see the Drawing no. 3 in Atlas at the end of the book). The bacteria have changed the Earth's biosphere from an oxygen-free to an oxygen-rich one, from an environment unprotected against UV rays, to environment with ozone layer as UV protection zone. Sterile terrestrial lands changed to lands rich with life. After the change from the anaerobic to the aerobic life the biosphere changed, and many complex life forms evolved (please see the Drawing no. 4 in Atlas at the end of the book). The water cycle, the oxygen cycles, the carbon dioxide cycles, the sulfur cycle, and waste of organic compounds together with life itself have been an integral part of the biosphere's environment. The basic influence was transferring the fragile environments to life-friendly environments, and resulted in protection of the Earth surface against erosion and consequences such as destruction of lands, ocean water currents, and air movements that have been established as regular or temporary. The biosphere was evolving and became the space for life and living creature. Physical, geographical, chemical, biological and systemic interdependences/interactions and co-operation provided a possibility for an environment supportive of evolvement of life. Today, we may find at the same time within the Earth biosphere primordial conditions as well as any later evolvments, which followed them in time. Our present biosphere has a countless number of biological sub-systems, which are along with their synergies, ensuring the life continuity in the present and many other possible and changed environments.

The terrestrial lands, from the frozen Arctic/Antarctic environments to the tropic conditions, are home of a large number of different living creatures, which all together make a comfortable living as long as they follow the system interdependence/interactions and co-operation. All ethological differences are a part of the maintenance of environmental matter exchange, in which numberless biosphere sub-systems evolved for the life to continue. The changes/evolvments are consequences of interdependences/interactions and co-operation of all systems involved. The same apply to the evolvement of the aquatic and atmospheric environments. The biological system is a moderator of living conditions within the biosphere.

#### **3.TR.2.1 ENERGY EQUILIBRIUM**

The Sun is energy – light and warmth provider. The planet Earth protection systems are ozone protection zone in the Stratosphere (15 – 24 kilometers) and the green house effect (the natural parts of which are carbon dioxide, methane and nitrogen oxide). Both protection systems are filtering/transporting radian energy to the surface of the Earth and back to the outer space. The geography of the Earth at present has around 30 % of terrestrial and 70 % of

water areas (oceans/seas). The energy equilibrium is a result of inputs and outputs of energy - please see the Drawings no. 6 and 7 in Atlas at the end of the book. Changes within inputs and outputs are interfering with energy balance, and their consequences are cooling or warming. But due to the complex system characteristics of the Earth such as: changes in the atmosphere, changes at the terrestrial part, changes at the oceans/seas waters, changes within the biology of the surface, and anthropogenic inputs, the reaction of warming or cooling has different patterns. The air movements and oceans/seas currents have an additional influence adding to this complexity.

The energy balance is a most important life supporting system, and the changes within it are very destructive for the biology of our biosphere. Changes result in extinctions of animals, plants and bacteria, and appearances of new forms of the life. Drastic changes are known as glacier or ice periods; in the past the Earth experienced a number of them. On the Drawing no. 3 in Atlas at the end of the book, please see glacial times painted blue.

### 3.TR.2.2 THE WATER CYCLE

The water cycle - please see the Drawing no. 20 in Atlas at the end of the book - makes the difference between the planet Earth and the other terrestrial planets Mars, Venus, and Mercury. It is a part of the biosphere and has been provided at the birth of the Earth. The water cycle is a sub-system of the biosphere, which provides the basis of quantity/quality of the biosphere environment. After birth of the Earth, as soon as it had become cool enough, water appeared in liquid, ice, and gas forms; the water cycle commenced its permanent action / evolvments. As an environment it has excellent transport and interaction abilities, which probably together with other sub-systems: cloud formation and movements, lightening and natural electricity, assisted the birth of life. Life appeared in aquatic environment, and it took almost two billions years for life to move from the aquatic environment into terrestrial lands. 97.3 % of the Earth water is there in oceans/seas, 2.1 % in glaciers, 0.6 % in aquifers, and insignificant quantities are lakes, rivers, soil moisture, and the biological life. Yet the water is a needed quality of biosphere, which has been a precondition for life. A majority of living creatures has between 75 and 95 % and more of water content within their bodies. The water is the main transport system within cells, tissues and body itself. The water is the main environment for chemical processes in nature. The water is the main architect of nature, when carving mountains, lakes, rivers, and shaping the Earth surface.

Life and water,  
Water and life,  
Life,  
Water.

From the book "Slovenia Yesterday, Today and Tomorrow, Water Management Challenge to Slovenians in the Third Millennium" Ecimovic/Jan/Vrhovsek, Ljubljana, Slovenia, 1998 (in Slovene).

Water movements/currents of oceans and seas – please see the Drawing No. 21 in Atlas at the end of the book – result from the temperature and salinity difference, trade winds and interdependences/interactions and co-operation of other Earth systems – gravitation, Earth movement, air movement, energy balance, Moon and Sun gravitation, etc. Large oceans currents are seen in the drawing No. 21.

Air and water permanently co-operate when the water changes from liquid to water vapor, which is transported by air. When temperature changes in the processes, assisted by the air particles (physical or biological), the water vapor changes into ice and liquid form and comes down to the surface as precipitation.

The mountains are water towers of the terrestrial surface, and the forest is the primary filter of water and its transporter to the underground. The rivers take water to lower altitudes and with their biological system they are secondary filters/conditioners of water. The river waters are the main transporter of mineral components from mountains and higher altitudes to lower altitudes and finally to the seas.

When waters from higher altitudes do not find their way to lower altitudes, the lakes show up, and with their biological life they form the lake waters systems. Of course, lakes can have river water input and river water output, but the lake water body is placed under the level of water outtake. Lakes are the water storages at higher altitudes.

The swamps, swamp-forests and swampy areas are best biological filters of water, and they usually are placed at lower altitudes and as estuaries. At all locations where water (fresh or salty) and land meet there are the biologically richest regions. The planet Earth matter exchange is possible due to water's active transporter role, and the activity of environment with biological richness, which helps our health by purifying the terrestrial surface waters.

The underground waters transport water under the Earth's surface and provide water in water springs. There are large underground waters at deeper levels of terrestrial and ocean/seas bottom levels, which are there because of the Earth crust movements. They are underground lakes of waters rich with minerals and usually sterile.

The terrestrial surface water movement result for both the altitude and gravitation, and water has the golden ability to move downward (gravitation), and it has a leveled surface when staying.

The terrestrial, biological and atmospheric waters are less than one percent of total waters on the Earth, but due to water cycle they are an important sub-system of biosphere.

### 3.TR.2.3 THE AIR SYSTEM – ATMOSPHERE

Between the Earth body and outer space reaching up to 1.000 kilometers there is a large environment of gasses, rays, particles and nature powers called atmosphere. The first ten to fifteen kilometers is the troposphere, the lower part of the atmosphere. It is the weather-impacting region where the air movement is most frequent. It is here that clouds form and move and one can find living creatures, from birds to microbial life forms. Troposphere ends into stratosphere reaching 15 – 50 kilometers from the Earth's surface, including the ozone protection band (15 – 24 kilometers). Mesosphere (50 – 85 kilometers) and thermosphere (85 – 400 kilometers) end into exosphere, which ends into outer space at the altitude of around 1.000 kilometers. Please see the Drawing No. 8 in Atlas at the end of the book.

Atmosphere is a gaseous cover of the Earth surface and it is an integral part of the biosphere and of the whole Planet Earth System. It takes/transport/rebounds/transforms the band of the Earth for the Sun's rays of light and warmth, as well as for any rays/particles/outer space bodies/nature powers meeting the Earth as a whole.

Two main two gases make 99 % of the atmosphere: nitrogen 78 %, and oxygen 21 %. As everything in the nature their distribution, movement, and content change within limited possibilities. The remaining one percent is made of the natural presence of carbon dioxide, methane, water vapor, nitrogen oxides, argon etc. The oxygen is present as dioxide, ozone, carbon dioxide, and water vapor. As a contribution from our civilization additional contents of gases have been put into atmosphere such as: additional carbon dioxide, additional methane, nitrous oxide, chlorofluorocarbons CFC's, hydro fluorocarbons HFC's, perfluorinated carbons PFC's as green house gases. As photo chemically important gases there are carbon monoxide, oxides of nitrogen and nonmethane volatile organic compounds NMVOC's, which indirectly contribute to the green house effect.

The catalytic ozone destruction cycle in stratosphere – please see the Drawings 10, 11, 12 and 13 in Atlas at the end of the book - show some of common reactions in the atmosphere.

The atmosphere as the largest part of biosphere has an important role of making life possible due to oxygen concentration, which is the life-supporting gas amongst the atmosphere gases. Secondly it is the area of water vapor transport, cloud formation, and the main transporter of the water cycle, important from the biology point of view.

The air movement in the multidimensional space has regular and irregular patterns, and at present during the climate change system movement the extreme air movements are recorded. For the biosphere, the air movement is of great importance as a transporter of life forms, moisture supplier, and local weather maker. On the other hand it is antagonistic to the human constructions, which are usually demolished if they are constructed at lower standards of the wind/tornado/typhoon strength, when it occurs.

### 3.TR.2.4 CARBON CYCLE

This was probably the most important cycle during the primordial Earth times, because it caused the crust formation and carbon cycle deposition at ocean/seas bottom and land surface. It is a direct in/output of biology, and partly of the biosphere chemistry processes. Please see the Drawing no. 22 in Atlas at the end of the book.

Carbon is a constructing element of the biosphere. A very fast (less than 1 year) exchange of carbon is within plant life. It is today the second carbon exchange, which takes the first place when thinking of the very fast carbon exchange. Fast (1 – 10 years) carbon exchange comes from soil and oceans/seas surface. Slow (10 – 100 years) is exchange of carbon within the forest systems. Very slow (more than 100 years) carbon exchange is important in the biosphere as deposition of carbon by microbial life and Calcium carbonate sediments/rocks. Due to the relatively slow processes within the carbon cycle in nature, and the relatively fast input of carbon from our civilization into our biosphere, we have a situation, which the existing processes in the biosphere are not able to compensate. It is one of the reasons for the global warming.

### 3.TR.2.5 SULPHUR CYCLE

Sulphur cycle has been a less important cycle in the nature during the time when our civilization did not exist. It has its important role within nature, but our civilization causes damages in nature by increased quantities of sulphur (acid rain) that became fast a damaging

factor. Sulfur is an essential element for the life to exist on Earth. Please see the Drawing no. 23 in Atlas at the end of the book.

### **3.TR.3 CONCLUSIONS FROM THE CHAPTER 3.TR**

Be it any inferior or a superior system of biosphere, planet Earth, Solar System or Universe, our civilization is a small system, but an integral part of the whole. Today we are discussing our problems of nature, space and environment protection (protection against whom?), but even the great Greek philosopher Plato more than 2.000 years ago stated:

“When there were still forest growing in the mountains of Attica, the rich soil received water and stored it, so that the absorbed mass slowly became distributed from the heights, feeding fountains. But now the fatty and rich soil has been washed away and just the meager framework of the landscape is still present – comparable to the skeleton of the body attacked by illness”.

They have not been properly named “important and unimportant systems”; they all are systems and interacting/interdependent and co-operating to produce the results present in the Biosphere now. But we humans did not follow the nature’s instructions that we should think of interdependences, interactions, and co-operations enough, so far. The Dialectical System Theory may offer a more promising possibility/tool than the General Systems Theory that we have discussed earlier in this book.

## 4. SYSTEMS THINKING: BY THE DIALECTICAL SYSTEMS THEORY<sup>122</sup>

### 4.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 4

The Chapter 3 lets us see that

- 1) There is hardly a way out of the problems of climate change, if no systems / systemic / holistic thinking is applied.
- 2) There is a poor chance for systems thinking to be applied in terms of requirements rightly put by LvB, if one tries to support systems thinking – as a worldview – with the GST, because the later authors of GST as a methodology (see: ISSS45, 2001, etc.) have not attained the level of holism and interdependence, which LvB used to require.

Therefore, one needs a version of systems theory, which pays most attention to attainment of holism by interdisciplinary creative co-operation of mutually different, and hence interdependent specialists<sup>123</sup>. This is the Dialectical Systems Theory (DST).<sup>124</sup> We will briefly present basics of DST in this chapter. We will also try to make them applicable with no serious background in terms of knowing all the theory (in Ch. 4.5), and we will try to understand the modern conditions of life on its basis (in Ch. 4.6 and 4.7) and to link it with the issues of the climate change (in Ch. 4.8).

### 4.1 THE DIALECTICAL SYSTEM (DS) VERSUS THE SYSTEM

The **traditional** definition reads that a system is a complex or very complex feature made of a set of elements and a set of their relations; it may have an environment and relations with it, as well, or not. Due to its relations / interdependencies, and hence interactions<sup>125</sup> the system is more than a sum: the whole system has properties, which single elements do not have, it has synergies. In mathematical terms, a system is an ordered set. Systems form a hierarchy (Schiemenz, 1994).

The point of the original introduction of the system's concept was to make an **end to the oversight of synergies**. The systems view's holism replaces one-sidedness due to which the humankind has suffered terribly for ever and especially in the first half of the 20th century (two World Wars, world economic crisis between them, poorly working composed products, etc.). Decades of application of such a concept of the 'system' demonstrated that it is a good concept in its very general, philosophical contents, but its aim is hardly attainable if no methodology supports holism well enough. This fact demands *human attitudes and behavior* to modernize: a narrow specialization is still unavoidable, but no longer enough, because it oversimplifies, if there is no interdisciplinary creative co-operation.

*What we humans of today need, is both a narrow specialization  
and (the requisite) holism achieved by interdisciplinary  
co-operation backed by ethics of interdependence.*

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<sup>122</sup> Matjaz Mulej

<sup>123</sup> Everybody can make a contribution, nobody can know and do everything alone.

<sup>124</sup> There are a number of other systems theories, which are coming quite close, but they specialize in something else. We will come back to them. See Ch. 5.

<sup>125</sup> The terms "interdependence" as the background of interaction was used by the first author of the General Systems Theory, LvB (Elohim 1999), but it does not seem to be frequently used later on until the Dialectical Systems Theory by Matjaz Mulej (1974 and later). Given the conditions of the time, Mulej introduced this term into his texts before having a chance to read LvB (see: Mulej, 1970; Mulej, 1974), using the ancient Greek word for interdependence, which is *dialectics*.

If the selected approach causes an *exaggerated simplification*, the usual oversight causes *complex consequences*: it is not reality, which is simplified, but only the human dealing with it.<sup>126</sup> That's why we must be able to be systemic in our thinking, feeling, decision-making, and acting. All of us, in a best-case scenario! But, systems theory has never been able to become a mass movement instead of being a rather closed-in science worked on and used by a few only (Molander, Sisavic, 1994; see: ISSS45, 2001; etc.). There were several attempts to solve the said problem such as the General Systems Theory, Cybernetics, Soft Systems Methodology, Living Systems Theory, Viable System Model, Fuzzy Systems Theory, Critical Systems Theory, Autopoiesis, to name but a few. Each of them made a different contribution.

Close to thirty years ago, a specific systems theory was produced in Slovenia, too: the **Dialectical Systems Theory** (DST) (Mulej, 1974; Mulej, 1976; Mulej, 1979; Mulej et al, 1992; Mulej et al, 2000; Mulej, 2000; Mulej and Zenko 2002). It starts from the notion that a system does not exist, but the object does, and the system reflects it<sup>127</sup>, but partially: it exposes the part of object's characteristics, which is relevant from the **viewpoint selected**, only. Thus, a system is supposed to support holism, but it is *fictitiously holistic* in its own traditional definition:

1. From the **formal** mathematical viewpoints, a system is an ordered set, hence **holistic**.
2. In its **contents**, a system embraces **only a part** of the really existing characteristics, hence it is **not holistic**; its scope is limited to the viewpoint(s) / aspect(s) selected by the observer(s) / manager(s) of the topic in question.

DST defines **holism**<sup>128</sup> as a system (= ordered set) made of

- *Systemics* (= consideration of the global part of the given characteristics of the event, object or process under consideration, i.e. in a synergy/synthesis), and
- *Systematics* (= consideration of the detailed part of the characteristics of the event, object or process under consideration per parts with no synergies, i.e. analytically), and
- *Dialectics* (= consideration of interdependencies among mutually partly equal and partly different or even opposing elements of the object, event or process under consideration, and of processes, which are caused by these processes and cause the transition from the sum of systematic characteristics of the object, event or process under consideration to the systemic ones), and
- *Materialism* (= consideration of reality rather than self-bluffing about the characteristics of the event, object or process under consideration).<sup>129, 130</sup>

Holism normally includes consideration of the environment of the event, object or process under consideration, of course. This is called an open system concept. The **open system** concept, on DST terms, does not simply include environment from the specific selected

<sup>126</sup> Recall Fig. 3.9. a few pages back.

<sup>127</sup> According to Dubrovsky ( in ISSS45, 2001) such a notion of a system can be found already with Aristotle and Kant. LvB also required the same. Not everybody among systems theorists follows them/us (see: ISSS45, 2001)

<sup>128</sup> See Fig. 3.3.

<sup>129</sup> See P. Checkland's classical example: water is a real object; it has two basic elements, hydrogen and oxygen, from the chemistry viewpoint; they are interdependent and their synergy makes water's chemical characteristics, which are quite different from the ones of its components. See also the example about training a horse by Balle cited earlier.

<sup>130</sup> The same analysis of attributes applies to climate and the issues of the climate change, too. E.g., there is a part of attributes allowing us to speak of the Mediterranean climate (systemics), there is another part, which let us see climate/s of Egypt, Marrocco, South of France, Istria in Croatia and Slovenia, etc. alone, there is a third part, which links their attributes to cause emergence of the ones called Mediteranian climate. Human thinking, decision making, and action, are all impossible with no models, but they must be realistic enough / requisitely holistic, to make sense.

viewpoint only, but also a **system of all different viewpoints**, which might be **relevant, essential** for achievement of a **requisite** holism.<sup>131</sup>

The problems caused by the lack of systems thinking in the first half of the 20th century and later, including the climate change problems, cannot be solved by a fictitious holism. The solution suggested by the DST is called the **dialectical system** (DS). Its definition reads

*DS is a system of all relevant and  
only relevant / requisite viewpoints / systems.*

The concept 'relevant / requisite' is worth additional consideration.

## **4.2 THE DIALECTICAL SYSTEMS THEORY AS A DIALECTICAL SYSTEM CLOSE TO REQUISITE HOLISM**

What is relevant? It depends on a **subjective decision** what is *found* relevant, and varies in time etc. Different characteristics of e.g. climate and climate change are of a different relevance to different sciences / practices / viewpoints (aspects) selected; the same holds of an enterprise and anything else. There is **no one single truth**, unless each and every aspect is made a part of a *total* aspects / viewpoints system, which is a total synergy. This would reach beyond human capacities. A DS is a reduction still making sense because it does not go all way to a one-sided and superficial approach of one viewpoint / system from the old times.

*DS makes a both necessary and sufficient  
- requisite holism possible.*

To make the DS survive as a concept, we produced and employed the DST.

It is no mere coincidence that the Systems Theory surfaced first as a General Systems Theory and after WWII: the post-industrial and post-world-war period made the human existence of today increasingly and clearly depend on **holism and creativity** applied for **innovation**, which demands holism on its own. But the General Systems concept, a very important one, has not always proved viable in practice<sup>132</sup>. Its basic ideas need to be revitalized because they are still very accurate principles, but lack a **methodological support**.

This means that the **starting points** of defining a DS must support *creativity and holism* instead of a routinized and one-sided behavior / work, and let creativity and holism no way disappear throughout all the way from the starting points definition to the final step – the goal attainment. The alternative is clear and very bad: the **entropy** as the permanent natural tendency toward destruction of everything may become reality, not only a threatening tendency any longer.

The DST making the DS concept (instead of a General System one) methodologically supported is hence made of **three elements and three relations**, in general.

The three relations are:

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<sup>131</sup> Let us remind again: A total holism is actually impossible due to natural limits of human mental capacities. Remaining inside the framework of one / too few single viewpoint/s causes a fictitious holism. They are both hardly helpful.

<sup>132</sup> See many conferences on systems and cybernetics such as European Meeting on Cybernetics and Systems Research, Problems of ..., etc.

- The **law of requisite holism**. It demands the author/s of the definition of a system representing the object under their consideration and/or control to clearly state what part of attributes of the object is included into his / her / their system, being the mental picture of the object under consideration and/or control. He / she / they must do his / her / their best to fight oversimplification as well as too much complexity and complication, by using all available knowledge and skills as well as by ethics of interdependence.<sup>133</sup> See Ch. 3.4.4.
- The **law of entropy**. It reflects the reality that everything exists having a permanent tendency toward destruction / change into something else, which demands holism and innovation permanently, putting them preconditions of survival since the times humankind has given up man's own adaptation to nature.<sup>134</sup> See Ch. 4.3.1.
- The **law of hierarchy of succession and interdependence**. Later events depend on earlier events of the same process crucially. Processes and events interact when and because they are interdependent, interaction is a precondition of survival, too, for without it processes stop<sup>135, 136</sup>. See Fig. 4.1.<sup>137</sup>

The three elements are:

- Ten guidelines **defining / impacting the subjective starting points**. Values and emotions, knowledge on contents, and knowledge on methods, are one (dialectical) system / entity aimed at making a work process happen, which may go for creativity and holism rather than for routinism and one-sidedness.<sup>138</sup> Talents are the in-born part of the subjective starting points, the ones mentioned here are the acquired part of them.

<sup>133</sup> Example: a general manager must consider the company with a very broadly defined (dialectical) system of all essential viewpoints. That's why he or she tends to have supporting offices and a team made of best professionals advising him or her. A lower manager is both obliged and entitled to consider the same company from a narrower viewpoint or (dialectical) system of viewpoints. Even more so is the position of an assembly-line worker. But each and everyone of them must seriously judge the limits he or she defines in order not to oversimplify and not to cause mistakes. – The problems of the climate change belong to results of such oversimplifications.

<sup>134</sup> Mistakes mentioned above may result in failures, and failures in turn in realisation of entropy. Entropy is more frequent in a situation best described by a closed system having no environment to renew its resources from. Thermodynamics teaches so. Economic experience demonstrates clearly that this is true (a prisoner has no chance of survival, no closed-in economy can have all necessary resources of material, energy, and information, etc.), but the same danger applies also to a too open system. Namely, openness is a two-way route. You cannot only take from environment, you must expect members of your environment to consider you their environment, too, and try to get resources they may need against their own entropy, at your detriment. Simple example: usually, families like visitors, but they still lock their doors against the undesirable ones, such as thieves. – The problems of climate change are clear examples of entropic processes.

<sup>135</sup> Once you have decided to study business, you no longer have much time for books of all other schools. And once you have acquired a certain amount of knowledge in one field inside business, you can combine it with information in other fields. Etc.

<sup>136</sup> In nature everything exists in such processes and interdependencies. In organizational relational of humankind, one tends to speak of subordination to bosses, which certainly does exist. But in terms of division of labor and of possession of data, messages, and information, bosses also depend on their subordinates, not only the way around.

<sup>137</sup> The problems of the climate change result from the human interventions, which do not take this law in account sufficiently, i.e. on the level of the requisite holism. Especially influential is the oversight of the phases, which one must take care of with a lot of holism, i.e. the ones before the definition of objectives/goals.

<sup>138</sup> In the same situation, different persons can see different needs and possibilities on the basis of their different conscious and subconscious parts of their personalities (personal traits system). Since the process of thinking and acting starts here, we call this the “subjective starting points”. E.g.: an optimist sees in a glass that it is still half-full, a pessimist sees that it is already half-empty. In the same glass a physicist sees a different content than a chemist or a lawyer, an economist, a cleaning person, etc., on the basis of their talents, emotions, (professional) knowledge and skills, as well as their values, and on the basis of interdependence of all of them. There is also their interdependence with the so-called objective (outer, independent on the person) starting points, as you see in Fig. 4.1 and in reality behind it. We will come back to the definition of the guidelines helping the starting points to be supportive of innovation and holism – see Ch. 4.3.3. We will demonstrate its link with solving the problems of the climate change there.

- Ten guidelines on **assuring / enabling the policy to survive after it has resulted from the first ten guidelines**. In the later steps of the working process several more narrowly specialized and routinized persons normally enter the stage.<sup>139</sup> Both (dialectical) systems of guidelines apply to different phases of the human process of thinking, decision-making, action, and behavior. Hence, they are mutually complementary / interdependent.
- A **method of creative co-operation** aimed at making all the said components viable in the daily practice by a shared framework programming of the creative activities. This can be e.g. our own method called USOMID in Slovene acronym<sup>140</sup>.

All three components / parts and all three relations (laws) that make the Dialectical Systems Theory can be seen in the daily work process, if one watches / investigates it carefully<sup>141</sup>.

In Fig. 4.1 we can see in which way all components and relations of DST work and show up in the case of the human work:

- The work starts by finding out and/or definition of *starting points*.<sup>142</sup>

<sup>139</sup> In an organization, the generally valid starting points are defined by top management and owners. According to the usual division of labor, other persons are supposed to take care of parts of the process. The general picture may be lost quite easily, in their phase of the work process, which may lead to failures. Special attention needs to be devoted to the care for survival of the starting points, holism and creativity, hence. We will come back to these guidelines. See Ch. 4.3.4. We will demonstrate its link with solving the problems of the climate change there.

<sup>140</sup> It is good to know the basic theory, but many are happy to know the know-how with not much of know-why. We will come back to this method. See Ch. 4.5. We will demonstrate its link with solving the problems of the climate change there.

<sup>141</sup> With a quite usual simplification many tend to start by stating their goals / objectives and speak of *desired goals*, which may mean that they do not think much about the background of their goals. Disappointment may result due to oversimplification, lack of holism, and frequently does so. This is why we (especially: Mulej, 1974, and later on) have paid a lot of attention to the phases of the human work process, which take place before the goals are defined. – If solving the problems of the climate change remains only a desired goal / objective, the interdependence of the needs, possibilities, and human attributes (= acting as the subjective starting points) can hardly become visible and influential enough for the solving to create solutions rather than efforts only.

<sup>142</sup> The objective needs are as they are, but may also change. Development causes new needs to show up, e.g. the industrial and open market economy caused the need for more transportation, science, research, education, etc., including the need to do something about the climate change. The same finding applies to the objective possibilities. They tend to be found in nature, such as natural resources and talents, and/or created, such as results of science, research, education, production, services. The subjective starting points are the human attributes, which evolve and develop under the impact of the objective ones, and have their impact over the objective ones, too. Humans of different professions, e.g. can discover different needs to be worked on, and different possibilities to do such a work. Humans of the same professions, but with different values and emotions, can evaluate the same data (= »objective facts, information, knowledge«) differently and cause different actions, such as giving up when facing a trouble, or investing more effort when facing the same trouble. Etc. The objective and the subjective of starting points are interdependent all the time.

*Fig. 4.1: The law of hierarchy of succession and interdependence, applied to the case of the work procedure in general*

|                                                                                |
|--------------------------------------------------------------------------------|
| Influences, preconditions, circumstances                                       |
| ↓                                                                              |
| Definition and development of starting points as a requisitely holistic system |

|                                                                                                         |                                                                                                                                                                        |                                                                   |
|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| The objective starting points,<br>part 1: objective needs                                               | The subjective starting points:<br>1. Values and emotions <sup>143</sup><br>2. Knowledge on contents (what & why)<br>3. Knowledge on methods (how & why)<br>4. Talents | The objective starting points, part<br>2: objective possibilities |
| ⇓                                                                                                       | ⇓                                                                                                                                                                      | ⇓                                                                 |
| ⇓                                                                                                       | The dialectical system of<br>(essential/requisite) viewpoints                                                                                                          | ⇓                                                                 |
| ⇓                                                                                                       | ⇓                                                                                                                                                                      | ⇓                                                                 |
| ⇓                                                                                                       | The selected viewpoint/s                                                                                                                                               | ⇓                                                                 |
| ⇓                                                                                                       | ⇓                                                                                                                                                                      | ⇓                                                                 |
| ⇓⇐-----                                                                                                 | ←-----→                                                                                                                                                                | -----⇒⇓                                                           |
| Selection of the perceived<br>= partially objective needs                                               | ⇓                                                                                                                                                                      | Selection of the perceived =<br>partially objective possibilities |
| ⇓                                                                                                       | ⇓                                                                                                                                                                      | ⇓                                                                 |
| ⇓⇐-----                                                                                                 | ←-----→                                                                                                                                                                | -----⇒⇓                                                           |
| Selection of preferential needs                                                                         |                                                                                                                                                                        | Selection of corresponding<br>possibilities                       |
| ⇓⇒-----                                                                                                 | →-----←                                                                                                                                                                | -----⇐⇓                                                           |
| ⇓                                                                                                       |                                                                                                                                                                        |                                                                   |
| Definition of (well grounded, not merely desired!) objectives:<br>What do we want (with good reason/s)? |                                                                                                                                                                        |                                                                   |
| ⇓                                                                                                       |                                                                                                                                                                        |                                                                   |
| Definition of tasks system/s: what do we have to do in order to attain objectives <sup>144</sup>        |                                                                                                                                                                        |                                                                   |
| ⇓                                                                                                       |                                                                                                                                                                        |                                                                   |
| Definition of work procedures for every task: how must we proceed to perform                            |                                                                                                                                                                        |                                                                   |
| ⇓                                                                                                       |                                                                                                                                                                        |                                                                   |
| Operation: performing all the tasks according to procedures prescribed / foreseen                       |                                                                                                                                                                        |                                                                   |
| ⇓                                                                                                       |                                                                                                                                                                        |                                                                   |
| Results comparable to tasks, each of them contributing to attainment of objectives                      |                                                                                                                                                                        |                                                                   |
| ⇓                                                                                                       |                                                                                                                                                                        |                                                                   |
| Influence over the foregoing phases of the process where needed                                         |                                                                                                                                                                        |                                                                   |
| (Returning to the beginning of the entire process, or a phase of it, as appropriate)                    |                                                                                                                                                                        |                                                                   |

- The *subjective starting points* in turn (should / do / tend to) cause a quite broad definition of the dialectical system of (essential/requisite) viewpoints, e.g. on the level of the top management of an organization, in order to make no serious oversights possible.<sup>145</sup>
- Individual sectors of the organization are represented in the top management, but they tend to limit their own efforts to their own *sectors' / partial viewpoints* only, once they

<sup>143</sup> To psychologists, values and emotions differ, as parts of the human personality. We agree and we anyway put them together because they are both influenced by motivation, a lot. (See: Trstenjak, 1981) We will come back to them. See Ch. 6.4. – In the case of the climate change, values causing damage to climate have been prevailing over values caring for a healthy climate, in the centuries and decades of the industrial society. Shortterm effects of human actions have been preferred over the longterm ones. Etc. Growing entropic dangers result from such values and emotions, and a change in values and emotions must become the next step.

<sup>144</sup> Usually, for every task the procedure differs from the ones for other tasks. The responsible person or team, hence, limit themselves to their own tasks, this is their own level of requisite holism. Coordination between them is with their superiors who take care of the requisite holism of a broader type, and so on all way to the very highest level of the organizational hierarchy. – On the worldwide basis, the broadest type of the requisite holism belongs to the General Assembly of the United Nations Organization. That's why it is important, in the case of the environment protection, including the issues of the climate change, that it was UNO which proclaimed the *sustainable development* as the necessary way toward survival of humankind of today and in future.

<sup>145</sup> In the case of the climate change, UNO provided for a very broad definition of the dialectical system of viewpoint by their documents on the *sustainable development*.

return from the top management session to their own respective sectors. They are neither responsible nor entitled to be broader, in order too meet their own requisite holism.<sup>146</sup>

- Their selected viewpoint defines, therefore, what they perceive and find *preferential and corresponding* (i.e. suitable to their preferences and specialization).<sup>147</sup>
- The requisite holism is thus limited quite a lot, but only now an operational definition of the objectives / goals<sup>148</sup> can take place, that leads to meeting / satisfaction of the preferential needs by using the corresponding possibilities / resources, later on.<sup>149</sup>
- Later on steps come, which have been usually considered for long times much more carefully than the foregoing ones. The *tasks* make a new dialectical system, and a specialist (or a group / team of them) works on each and every one of them, often in separation from other groups / specialists.<sup>150</sup> This natural fact is due to unavoidable specialization and division / distribution of labor. For such a specialist the law of requisite holism, the law of entropy, and the law of hierarchy of succession and interdependence show up with contents, which are quite different from the ones with the general manager, sector manager, researcher in R&D department, etc. Often they are defined much more narrowly.<sup>151</sup>
- Therefore, the *impacts* over the subjective starting points must include every individual / co-working group, but these impacts must *consider their respective roles, positions, and situation/s*, in order to make an impact which will fight rather than support entropy of themselves and the entire whole to which they belong.<sup>152</sup>
- The USOMID method, or another suitable method, may help all these individuals / groups think, decide, behave, and work in a requisitely holistic / systemic style without the vocabulary of the systems theory.<sup>153</sup>
- All parallel definitions (components of the starting points; perceived needs and possibilities; preferential needs and corresponding possibilities; processes done on parallel tasks) as well as all definitions and other activities following each other are interdependent<sup>154, 155</sup>.

<sup>146</sup> In the case of the climate change, the different professions dealing with nature in frameworks of their own selected viewpoints, tend to select quite different features into the role of the essential/requisite ones. The financial and other business aspects tend to select differently, in their turn. Nobody is fully right, nobody is fully wrong, nobody is holistic enough to be the only one to make an impact.

<sup>147</sup> See e.g. the differences in insights offered in Ch. 6 (diffusion, measurement, values, universe, taxes, quantitative and other methods). Nobody is fully right, nobody is fully wrong, nobody is holistic enough to be the only one to make an impact, indeed.

<sup>148</sup> The so called *desired* objectives / goals are hidden in the values inside the subjective starting points. The objectives / goals about which we are talking now, after the definition of preferences and corresponding possibilities, are more / requisitely holistically grounded, no longer desired only, hopefully.

<sup>149</sup> In the case of environment protection / problem-solving, including the climate change, the LA21 may be an example of the generally defined model of preferential needs and corresponding possibilities, and the plans per local communities may be examples of the resulting definitions of objectives.

<sup>150</sup> The *selected task* tends to make the usual, frequently rather narrow, horizon for most specialists. In the case of the sustainable development, including climate change, the task of e.g. cleaning the liquid waste alone is such a case. A very important task, but not at all a sufficient one.

<sup>151</sup> If these tasks were not defined on a that much more narrowly defined basis, the *important details* could hardly be taken care of!

<sup>152</sup> Governments, which do not want to join e.g. the Kyoto Protocol, tend to cause much more entropy than solution of their own problems. Onesidedness causes cost to all (Ecimovic et al 2002)!

<sup>153</sup> As we said above, we will come back to it in Ch. 4.5. We will add Ch. 6.9, too.

<sup>154</sup> It makes no sense, e.g. to define objectives that do not meet a part of the preferential needs. It makes no sense to define objectives, that cannot be fulfilled in the task performing phase because there is no equipment, skill, material etc.

<sup>155</sup> In the case of the issues of the climate change, they found so much interdependence that they found a series of international conferences necessary. The rather poor success of most of these conferences demonstrates how very different the perceptions and preferences and definitions are, depending on the differences of the starting points, both the objective and subjective parts of them.

Let us **summarize**:

The concept was labeled a DS, and the theory DST in order to demonstrate the difference from the other concepts. Dialectics, in principle, expresses **interdependence and changing based on interactions of the interdependent** components of an entity (and its environment). They are interdependent because they are *partially equal and partially different, and they need each other therefore*. Interdependence is what replaces isolation and therefore one-sidedness, and *creates relations*, makes them (sometimes more, sometimes less) felt and found relevant, therefore also studied and considered. Hence, it is interdependence, which results in synergy toward (more or less of) holism. A specific interdependence exists between the both **different and complementary** ones (e.g. man and woman; tools and raw material and labor; flowers and bees; suppliers and customers in a market). It is their interdependence which causes them to **need each other** for their own success and survival, beating their own entropy, at least for the time being and to the detriment of others who want / try to consume / use the same resources; that's why they all permanently both compete and co-operate.

Thus, DST makes a useful **general ground of human interventions**, including the ones concerning innovation<sup>156, 157</sup>. It is a systems theory, which offer tools for both human formation and human action.<sup>158</sup>

### 4.3 THE DIALECTICAL SYSTEMS THEORY: GROUNDS OF HUMAN INTERVENTIONS

#### 4.3.1 THE GENERAL GROUND: ENTROPY VERSUS EVOLUTION, AND HUMAN INTERVENTION

Every action aimed at survival and/or innovation is undertaken in order to combat difficulties and/or to prevent them from growing and becoming impossible to master. *The natural tendency of everything eventually to be destroyed is called entropy*.<sup>159</sup> Life is continuously made of both struggle against entropy and causing entropy as *interdependent* attributes of the process; it is *evolution*, which results, either in society or in other parts of nature. Human intervention tends to support or even direct evolution away from one's own entropy (by having food, shelter, heating, etc., producing and trading goods and services, etc. having friends and other emotional connections, learning, etc.). But at the same time we use some resources, and this act adds entropy. *Entropy and evolution are interdependent*. Sometimes we succeed in blocking entropy, and sometimes we fail. Holistic / systems thinking is obviously meant to block entropy, for a while, at least, but it is a rare capacity and event. So is innovation, but

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<sup>156</sup> Introducing a basically and/or incrementally new approach to dealing with the climate change and its consequences is a novelty, which is supposed to become an innovation, i.e. a beneficial novelty, which fights entropy of humankind as a part of nature on Earth. This novelty faces all the troubles of a novelty, fighting the established habits. In addition, the climate change has no easily visible competitors, which otherwise push the users of a novelty to change their behavior in order to meet a short-term benefit of their own that is easy to see and comprehend.

<sup>157</sup> That's a part of our reasons to discuss the concepts of the innovative business and the innovative society, later on. See Ch. 4.6 and 4.7. That's also a part of the reasons for inclusion of the Ch. 6 in this book.

<sup>158</sup> After prof. Mark Davidson, the author of the famous book about LvB (1983) had studied a Mulej's book, which we are also using as a basis here (Mulej, 2000), he wrote in his e-mails to Mulej on 05 Feb., 2002: »This book should be studied at all major universities around the world. It provides a major contribution to human thinking.«

<sup>159</sup> In thermodynamics, as a part of the research about nature from the viewpoint of physics, entropy stops being a natural tendency and shows up as the actual state, when there are no longer any differences between parts of an entity, and therefore the dynamics – based on mutual influencing – stops. In the language of dialectics this means that there is no interdependence any more showing up as no unity and fights of adverse, but only unity remains. Life stops. – In social relations, that's why democracy serves humankind of today better than unanimity, monolitism, monopolism, etc.

invention often fails to become innovation (the risk level is about 92%), and innovation often fails to be holistic enough to cause no new difficulty / entropy, along with the solution provided for the old one.

The **climate change** is a very visible case of the entropy process, which is caused by many rather small human interventions<sup>160</sup> as their synergy. Humans tend to be reductionistic for natural reasons discussed above, and their lack of holism causes, among other consequences, a dangerous climate change, too.

#### 4.3.2 GROUNDS FOR HUMAN INTERVENTION: OBJECTIVE AND SUBJECTIVE STARTING POINTS

Every action, be it routinized or innovative, is undertaken on the basis of some premises, visions, objectives etc. But there is something, which establishes their **background**. First, there is the *objective reality as it is, making the objective starting points*, like it or not; on one hand there are needs, on the other hand there are possibilities (like debits and credits in bookkeeping). Second, there are *persons' own characteristics, active as subjective starting points*, and made of our

- *inborn attributes*, such as *talents*, including bases for *creativity*,
- *gained attributes*, such as *sentiments* (wishes, desires), *values*, and our *knowledge and skills* (to understand *what* is going on, and to know *how* to master processes occurring).

In one or another form, the seven components of the starting points (see Fig. 4.1) can always be found. Moreover, individuals in the same situations have different opinions and ideas, which means that their subjective starting points let them see and judge **equal** objective reality **differently**, define different priorities, goals, tasks, and ways of meeting them. Dialogue, experience, education by school and/or public and other media conveying data, messages, and information, etc., may change them, so our conclusion is that:

*subjective starting points*  
**can be influenced.**<sup>161</sup>

The issue now is: in which direction do the subjective starting points get formed and change, and in which direction should they do so *to be in line with the contemporary processes*, including the problems of climate change?

#### 4.3.3 DST'S TEN GUIDELINES CONCERNING MAKING OF THE SUBJECTIVE STARTING POINTS

##### 4.3.3.0 QUESTIONS TO BE ANSWERED TO DEFINE THE STARTING POINTS

Consciously or subconsciously, humans tend to address the following ten questions when preparing themselves to undertake an activity, by defining their own subjective starting points:

1. What are we trying to create in order to **avoid** our **entropy** (= general purpose in the given conditions)?<sup>162</sup>

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<sup>160</sup> See Ch. 6.8 to perceive the difference between the impacts of humans and the ones of Universe, Nature.

<sup>161</sup> For centuries, they used to say that personal traits cannot change, and to try to influence them by education in school, church, public and private communication, practical experience, both at the same time. That's why it has always been so important to the rulers that they possess power over media and school.

2. How, in general, should we **approach** our activity?<sup>163</sup>
3. What is the **problem** that we are trying to solve, what is therefore the **goal** that we are trying to attain, and what are the **tasks** we will therefore have to be able to take care of? All three are *interdependent*, hence: are they compatible or do they block each other, and therefore something must change in anyone of them?<sup>164</sup>
4. What are the **procedures** for each and every task to be performed, on a framework basis, at least?<sup>165</sup>
5. Having responded to questions 1-4, a new question arises: **how holistic** have we been? Have we attained the requisite holism by a *dialectical system of viewpoints and their relations* considered? What actually makes the dialectical system in this case?<sup>166</sup>
6. Having found out the dialectical system of viewpoints making the requisite holism possible, we usually do not possess all skills, knowledge and values. Hence: have we developed **ethics of interdependence** with other, different specialists, by application of the **modern dialectics**, consciously or subconsciously?<sup>167</sup>
7. Having developed the capacity mentioned in the question 6, do we have the **organizational possibilities** to use this capacity? If not, how can we find or produce them?<sup>168</sup>
8. Having the partners to join us in the organizational possibilities mentioned in the question 7, are we sure that both our and their subjective starting points are **up-to-date** enough? If not so, what do have to do in order to up-date / modernize / innovate them sufficiently?<sup>169</sup>
9. Having to take care of the up-dating process, are we aware of the **interdependence of the rational and emotional** parts of human personality, i.e. of the knowledge, skills, and values, emotions, as well as talents? In what form is this interdependence surfacing in the given case?<sup>170</sup>

~~of the climate change and solving them on the basis of the dialectical systems thinking.~~«

<sup>163</sup> In the case of this book the answer may read: »With a requisitely holistic / dialectical system of several sciences.«

<sup>164</sup> In the case of this book the answer may read: »The problem is the rather poor success in both the world-wide and local attempts to solve problems of the climate change. Our goal is to offer a new model as a potential way to a new solution. Our tasks are to study references and experiences and to write the book, find a publisher, etc. Solving these tasks may change the definition of the problem. A failure in solving these tasks may have to result in a redefinition of the goals or even of the selected problem, and to deal with another one.«

<sup>165</sup> In the case of this book the answer may read: »We have been authors of a number of books so far, hence we know the general procedure of writing. We may need more knowledge about the phase of diffusion of the book, if the publisher requires us to help him about it.«

<sup>166</sup> In the case of this book the answer may read: »We decided to make a part of the book describing the problem of the climate change, and a part offering methodological solutions about it. We hope that this is requisitely holistic, given the usual size of a readable book.«

<sup>167</sup> In the case of this book the answer may read: »It was actually exactly the experience of our interdependence as authors which brought us to the team aiming to write this book. It include a lot of mutual respect.«

<sup>168</sup> In the case of this book the answer may read: »Authors and coauthors live in several different places, even countries, even continents. Hence, our organizational possibility of cooperation is mainly e-mail, completed up with a few meetings in person.«

<sup>169</sup> In the case of this book the answer may read: »We find it necessary and possible to exchange references, including previous books, which we wrote separately. We also find it necessary and possible to trust each other as specialists in different viewpoint of the issues dealt with.«

<sup>170</sup> In the case of this book the answer may read: »We all strongly feel that the issue dealt with is crucial for survival of the humankind of today and of future generations, including our own children and grandchildren. We also know quite a few data about the problems of the climate change, and they motivate us to work on this book, i.e. they make our feelings even stronger, which in turns makes us study the issues dealt with even more. Etc.«

10. Having to take care of the up-dating process in both parts of the human personality, are we aware of the fact, that its attributes have been **formed before** our current efforts, and are hence no blank sheets? In what form is this history showing up in the given case?<sup>171, 172</sup>

Let us now make brief comments to each guideline.

#### 4.3.3.1 *PURPOSE: TO CREATE SOMETHING NEW AGAINST ENTROPY*

Ensuring inventiveness, holism, and innovativeness instead of conservatism, one-sidedness, and routinism in the phase of definition of starting points already: We know from experience, that the modern world is a world of rather spoiled, demanding customers. They accept only offers meeting the **systemic quality**, which requires **excellence**, which is attained by **innovation**. Keeping to the old criteria (= conservatism), forgetting about holism (= one-sidedness) in the form of routinism instead of ensuring a permanent working on new inventions and innovations on the basis of the requisite holism, such a purpose would hardly lead to creation of something new. Of course, in a concrete case this general principle must be defined more concretely.

In the case of climate change the conditions have changed dramatically and have come to require dramatically new interventions, rather radical innovations accompanied by many incremental ones (See Agenda 21 and Local Agenda 21; see Ch. 3.1).

#### 4.3.3.2 *APPROACH: TO REACH THE PURPOSE IN A NEW WAY*

Ensuring a methodological, not only methodical knowledge in the phase of definition of starting points already: A methodological knowledge includes formation and employment of rather new methods, not merely the established ones. It includes a creative, not just a passive and routinized approach, which would be covered by a methodical knowledge. Practice changes most when theory changes, and theory changes when the method changes. The established methods, hence, require criticism and creativity, up-dating, renewal, replacement with new ones, to make the transition from the **methodical** (= **routinized**) to the **methodological** (= **creative**) approach in terms of methods applied. A new purpose can hardly be achieved with old, obsolete methods.

In the case of the climate change, it has become obvious that the humankind's general approach to the natural environment no longer promises success against entropy. The one of so far was negligence and it failed. Our analysis of climate and environmental care may no longer be based on traditional methods only, either, because they hardly can show new insights and solutions.<sup>173</sup>

#### 4.3.3.3 *WHAT, PRECISELY, IS THE SYSTEM »TROUBLE/S, OBJECTIVE/S, AND TASK/S«?*

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<sup>171</sup> In the case of this book the answer may read: »Authors and coauthors teaming for this book have very different backgrounds. It is impossible to expect a specialist in business economics, such as Mrs. Knez-Riedl, to write a chapter on the impact of the Universe over the planet Earth, or the top-class specialists on observing the stars, such as Mr. Korljovic, to write a chapter on measuring creditworthiness of business partners.«

<sup>172</sup> The question 10 about the history brings us back to question 1, etc. in a non-stop process. It is no linear process, it is just organized in a seemingly linear circle to be easier to cope with.

<sup>173</sup> In the case of this book, the motto addresses human attitudes. Now we see why: they are an essential component of the starting points of any process. What is important to add, is the newly reconfirmed statement / experience that an impact over the human mental attributes, such as changing them toward more innovative ones, is not only of a primary importance, but also very difficult to cover by the traditional policies (Nauwelaers, Reid, 2002).

Ensuring an as clear as possible definition of the problem considered, objectives, and tasks in the phase of definition of starting points already, and as a system: The problem, objectives, and tasks are interdependent rather than linear. The problem of this book, e.g., is the current critical climate change. It was forgotten about in the prevailing economic and social realities. Our objective is to provide new insights on ways of making humankind / individuals of today capable of their self-transformation into more innovative and entrepreneurial ones, including the climate change. Our tasks are desk and field research and attracting as many coauthors as possible and needed for the objective to be met well enough, writing the book, publishing it, and trying to make an impact making a difference in reality.

Purpose (see 4.3.3.1) and approach (see 4.3.3.2) tend to show our path in general terms only. In all cases backing this book the authors cannot stop at this level. We are defining quite precisely what is the *difficulty* to be resolved (e.g. having too many entrepreneurs who do not see that they cause their own cost by neglecting climate, e.g. in the form of medical insurance, etc.) by avoiding the cost of fighting entropy of the natural environment, including the climate change. Our authors' *objective* is to try to make some / most / all of these persons see their own situation, including their cost, requisitely holistically, for humankind to survive. What our *tasks* are you can see from the description of the project briefed in the book – summary of chapters. Of course, **not everything is fixed in advance**, it neither can nor must be, but it helps to have it all **as clear as possible as soon as possible, prior to action**.<sup>174</sup>

#### 4.3.3.4 HOW, PRECISELY, DOES THE PROCEDURE GO WITH EACH TASK?

Ensuring an as clear as possible definition of the procedure of performing the tasks defined and solving of the problems surfacing, in the phase of definition of starting points already: In general, the procedure was briefed above when we spoke about the law of hierarchy of succession and interdependence (see Fig. 4.1). But this is not enough.

In this book, we actually deal with problems, which have been surfacing for centuries, especially in the industrial society / period. They let us see how very wrong a beautiful idea can go, if one starts with a wrong definition of *how to proceed* to execute the tasks, attain the objectives, and master the problems. Other cases show that sometimes the decisive persons can do a better job and sometimes a worse one, because they have or have not observed and analyzed reality well enough (= requisitely holistically) to be **prepared to act correctly in timely ways**.<sup>175 176</sup>

#### 4.3.3.5 COVERING EVERYTHING IMPORTANT

Ensuring the inclusion of a dialectical system of viewpoints, in the phase of definition of starting points, already: We are trying to meet this need by bringing many, but only relevant / requisite co-authors in our co-author's team, and by interlinking their contributions into a synergetic one.

In the books about climate change quoted earlier no situation pictured / investigated in their cases was simple. *Many viewpoints as well as their mutual impacts* were needed from the very

<sup>174</sup> Tasks seem to be the last step in the row. But: if tasks cannot be executed, e.g. because resources lack, the problem and/or the the objective need to be redefined, e.g. toward assuring the resources first.

<sup>175</sup> In factories, the preparation of procedures of production is done in specialized departments. Less careful they have been about activities outside production. Organizational innovations have therefore lots of room to take place. See e.g. dr. Ben Graham Jr.'s »Paperwork Simplification«, our Mulej's USOMID, etc. (See: Mulej, ed., 1999)

<sup>176</sup> In the case of e.g. LA 21, quite precise framework procedures have been developed (See: Ecimovic, 2001).

beginning on. But in most actions undertaken, the actors have not covered the requisite holism in the form of a dialectical system of viewpoints, e.g. viewpoints of law, business, economics, sociology, several technologies (of mentoring, training, educating, manufacturing, trading, supplying, financing, medical care, etc.), natural and social environment, etc. *Interaction of viewpoints* covers what single viewpoints do not. For example, there was a lack of **interaction in the preparatory phase** of the industrialization of the Northwest of the planet Earth, of its transfer into the so-called second (which means the Central and Eastern Europe of the Soviet Bloc and Yugoslavia) and third worlds (most of South of the Planet Earth and Asia). Climate change towards new problems of viability of the humankind of today is one of the consequences.

#### 4.3.3.6 HOLISM ON THE BASIS OF CAPABILITY OF CREATIVE COOPERATION (BY DIALECTICAL THINKING)

Ensuring the individual's capacity for mutual understanding, tolerance, and creative co-operation, especially an interdisciplinary one, in the phase of definition of starting points, already: If we stayed with the *medieval metaphysics* principles of (1) mutual isolation, (2) full harmony with no essential differences or opposites, (3) no changeability, and (4) total destruction in the case of any change, we could perhaps work well in a routinized activity, but not in a creative one. (See: Figures 3.5 and 3.6).

In most schools we have been trained for individual work and competition, rather than for co-operation, even less so for creative co-operation. Some persons are lucky to be co-operative by nature / talent. If not, bridges between specialists have to be built. Then, the unavoidable / requisite holism can be attained, to some extent, at least. This does not apply only to schools, but to our entire lives. All cases in e.g. (Dyck, Mulej, 1998, 1999<sup>177</sup>), when successful, demonstrated the *capability of creative cooperation* on part of their active participants: they understood that different persons need each other because they are **different and able to complement each other**. In other words: they are and feel *interdependent*.

The problem of climate change, on the other hand, results from a lack of the ethics of interdependence and hence a lack of dialectical thinking, replacing the one-sided approach.

#### 4.3.3.7 DIALOGUE AND ORGANIZED COOPERATION MAKING HOLISM POSSIBLE

Ensuring the possibility of an (interdisciplinary) co-operation, in the phase of definition of starting points, already: Once the capacity, as a human attribute<sup>178</sup>, is around, there is a need to have or create a possibility to employ it. This is an objective characteristic. In a usual setting, such a possibility is provided for by **meetings and sessions**, which are well organized for a real mutual impact of all group members to be achieved. In the case of making this book this was done by our editorial contacts with our co-authors and our meetings.

In other words: once we know that *we all are narrow specialists*, unable to cover all the ground, and therefore interdependent, the next issue is the *technique* of mutual complementing. Meetings are supposed to make this possible, as an organized form of *dialogue, teamwork*. No case in e.g. the book (Dyck, Mulej, 1998, 1999) demonstrated a serious lack of dialogue except the Atlanta Project, which failed. On the other hand, one can read in public media that in the cases of conferences about climate change, the dialogue has

<sup>177</sup> Pozdniakov (2002) suggests the World Bank to use the approach of this book as their new approach to solving the economic development problems of their consulted countries.

<sup>178</sup> This is what we talked about in p. 4.3.3.6, of course.

been blocked off again and again. The narrow **interests**, not only the narrow professional **specializations**, cause this situation again and again. This means that a lack of dialectical thinking (p. 4.3.3.6) causes a lack of **teamwork**, and causes also a further growth of humankind's entropy in the form of the climate change towards worse conditions of life.

#### 4.3.3.8 CONTINUOUS UP-DATING

Ensuring a permanent modernization of the (subjective) starting points in order to avoid their becoming obsolete, in the phase of definition of starting points, already: Persons, organizations, regions, countries who keep staying with starting points lagging behind the more advanced ones, are now-a-days losers in the market competition. They need to catch up in order to avoid realization of their entropy. In usual modern settings, this is achieved by a **permanent refreshment** of knowledge, values and feelings according to changes in one's environment.

In the case of the problem of this book, it is obvious that many influential persons and organizations have not been using the process in Fig. 3.3.7 and 3.3.8 as the basis of their thinking process, and thus caused the climate change tending to cause entropy to grow beyond viability. They maybe did not have to care for environment so much as today as long as there were many less **factories**, much less **population**, many less **towns, roads**, etc., and much more **green nature** to produce rather than consume oxygen and to swallow rather than produce nitrogen. Emergence of new complexities creates new synergies and thus new attributes – the nature of the planet Earth only *seems* to be remaining *the same* and unaffected by individual actions of individual car drivers, airplane guests, factories, heating chimneys, waste disposals, etc. Continuous up-dating of the starting points of many / most / all humans is badly needed for them to play a positive role in the humankind's struggle for survival, including the issue of climate change, including its effects over themselves.

#### 4.3.3.9 INTERDEPENDENCE OF KNOWLEDGE, VALUES AND EMOTIONS

Ensure the consideration of interdependence of values and feelings, and both knowledge on contents and the one on methods, in the phase of definition of starting points, already: For several recent centuries, humankind has been taught **to be rational**, i.e. to forget about emotions / feelings as something, which is not scientific and makes objectivity impossible. Now we know that this request is **not scientific**, it does not consider reality requisitely holistically.<sup>179</sup> In reality, both rational and irrational components of our personalities exist and influence each other, since they are interdependent. In the case of this book, we felt that the forgotten about issues of the climate change are a serious problem. Hence, we started searching for knowledge on both its essence and methods of solving it. The findings reinforced our values and emotions, i.e. our motivation for dealing with the topic, which in turn reinforced our knowledge and our talents, and our search for more of it all.

Education, experience, and other information influence *both knowledge and sentiments*, including values, at the same time (left and right brain are interdependent parts of the same brain). In the case of the problems of climate change, especially political leaders and other opinion makers have to rethink their skills and sentiments, even basic values, under the pressure of the current survival situation. *Knowledge, talents, values and emotions interact.*

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<sup>179</sup> It was and is equally wrong to require people to be believers with no critical thinking of their own. This blocks their left brain in basically the same way as the rationalism blocks their right brain (»heart«).

#### 4.3.3.10 EVOLUTION AND INTUITION

Ensuring the consideration of dependence of the current starting points on the foregoing ones, in the phase of definition of starting points, already: Before working on this book we have been experiencing the problems dealt with in this book, in different ways. We lived and worked in different areas, studied different literature and experiences, etc. They **resulted** in our interest in the topic, in writing this book, in our knowledge of our need for co-authors. We also could re-employ our experience of arranging co-operation to make it all happen.

Many initiatives let us also see that there are individuals, who have had an *intuition* that something should and could be done about the climate change. Once this project was underway, the *initiating steps influenced the next ones* (although not exclusively). Many experience the issue of medical cost and disabling of humans, and find that it is due to climate change and to work environment, lacking regard for holistic thinking. The difficulties cause a culture more supportive of holism to show up, but the old experience has not been fully forgotten about. **No** politician is right when he or she says: “We will do **everything** **anew**, there was nothing before us.” *Evolution is reality*. Revolution only tries to jump over evolutionary phases, but they happen anyway, although under a different label. Nobody can be 50 before 15. Acceleration is possible, but no jumping over the phases is natural.

#### 4.3.4 DST’S TEN GUIDELINES CONCERNING IMPLEMENTATION OF STARTING POINTS

##### 4.3.4.0 QUESTIONS TO BE ADRESSED AFTER THE END OF DEFINITION OF STARTING POINTS

The critical persons of e.g. most, but not all, cases in (Dyck, Mulej, 1998, 1999), when defining their starting points, followed the logic of DST because it is **plain natural thinking**. It has had a decisive influence. The successful ones did it much better than the others. In addition, DST considers another critical situation:

*making the starting points is one affair,  
implementation of them is another.*

There are two reasons for this, at least:

- (1) In the *later steps* of the process when one must concentrate on *details*, the big picture steps back or even completely out of sight.
- (2) Later steps are frequently done by other persons who are *specialists* for one or another kind of necessary details rather than for coordination as generalists.

Thus, it makes sense to *remind* them of the original starting points by guidelines concerning their implementation.<sup>180</sup>

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<sup>180</sup> In the case of climate change and sustainable development, UNO had their basis in the starting point of their teams of professionals preparing the conferences and resolutions by investigation/s. The resolutions, as results of the conferences of the highest political bodies of humankind of today, published the general starting points for UNO member states to act upon. Their governments, as we could see in ten years since the UNO conference in Rio de Janeiro and its resolution on sustainable development, have mostly not opted for equally broad starting points of their own as the entire UNO / humankind of today did. The same trend is naturally true even more of many local communities and most companies, etc. – Still, the holistic orientation of humankind of today should remain alive, which is not easy to attain because the scopes of the above participants etc. are so different. This is the point of this, second dialectical system of ten guidelines of DST.

To do this, the following questions need to be addressed, according to our experience<sup>181</sup>:

1. After the division / distribution of labor / jobs / activities among specialists has taken place, are we **still** taking care of the **entire entity** under consideration and/or control requisitely holistically rather than one-sidedly?<sup>182</sup>
2. After the division of labor among specialists has taken place, are participants **open** to each other and their environment **enough** in their daily work life rather than isolated?<sup>183</sup>
3. When the daily work on implementation of the starting points prevails, do we sufficiently consider **life dynamics** rather than statics, unchangeability, lack of **adaptability** of thinking, working and behavior?<sup>184</sup>
4. If we are trying to be holistic, open and adaptable in terms of the three above questions, do these attributes cover only contacts with persons of the *same* profession, emotions, concepts, views, or do they involve **interdisciplinarity**?<sup>185</sup>
5. If we are trying to be requisitely holistic and do our best in terms of all four above questions, do we therefore expect a deterministic reliability of our ideas and actions in our daily lives, or do we rather expect some **risk**, probability?<sup>186, 187</sup>
6. In order to meet requirement in terms of all the five questions of so far, interdependence of different job performers should better be considered, also after the division of labor has been introduced. Application of **materialistic dialectics** in terms of Fig. 3.3.5, 3.3.6, and 3.3.7, 3.3.8 is a good solution. How is it practiced, if at all?<sup>188</sup>
7. When using materialistic dialectics, interdependences may tend to make it hard to see the **necessary clear limits** between the interdependent and cooperating ones. Application of a clear definition, what is meant by a “system” and application of the internationally agreed systems typology allows for a *mathematically precise* delimitation / demarcation. How is it practiced, if at all?<sup>189</sup>

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<sup>181</sup> We are putting these questions on the basis of experience in organizations. In it, the top management and owners define the starting points for the entire organization, and managers and staffs of the individual departments / units are supposed to make them reality. Their level of requisite holism is naturally limited to their own scope of duty and impact, but should anyway make a contribution to the goals of the entire organization.

<sup>182</sup> In the case of writing this book the answer may read: »The authors and coauthors of single subchapters are supposed to concentrate on their own topics, and it is up to the three authors to think of the entire book, including providing information about the framework to their differently specialized coauthors.«

<sup>183</sup> In the case of writing this book the answer may read: »All authors of different chapters do not even know all the other authors in person, until the three authors find it necessary to get them in touch for mutual influence. But each and every one of them is well open to the environment under investigation.«

<sup>184</sup> In the case of writing this book the answer may read: »All authors have dealt with the topic under consideration on earlier occasions (see: References). But we found that the humans of today have found themselves in a blind alley concerning the issues of the climate change. A new model of solution is therefore what we offer with this book.«

<sup>185</sup> In the case of writing this book the answer may read: »Every author and coauthor of this book comes from a different profession, but we are all able to listen to and hear each other, because we are mutually different. It takes some argument, of course, but it is a clarifying one rather than an excluding one.«

<sup>186</sup> In the case of writing this book the answer may read: »We have been around long enough to know from our own experiences that nobody can provide a fully reliable answer to the problems of the climate change, because they are too complex for any team to produce a total-system solution. We still think that we are providing something helpful to the humankind of today.«

<sup>187</sup> These five questions address, **what** are we wanting and trying to achieve when we are implementing the defined starting points (more general rather than detailed and adapted to single narrow jobs) in the form of attending partial, specialized jobs, frequently with no links and interdependencies easy to see. In the implementation phase, though, the **how** is equally important as the “what” and “why”. Therefore, further five guidelines follow.

<sup>188</sup> In the case of writing this book the answer may read: »Authors and coauthors of this book are lucky enough to have learned of our interdependence and of emergence of our shared insights from our mutual impacting. We decided to share the work on this book, because we know differences, interdependencies and complementarities among all of us. We also know that working on a book is a many-steps process.«

<sup>189</sup> In the case of writing this book the answer may read: »Authors of the book drafted its potential contents roughly, first, and then in more details, until the list of chapters became a dialectical system. From it we all could see clearly

8. When specialists are attending the entire job and hence work on it in partial lots, single outcomes might be both *partial and many*, normally. A **generalization** may be needed for specialists to share outcomes and for the text to have an acceptable amount of data, etc., instead of a too big or too poor one. Is the generalization done in a way allowing for **realistic** information to result?<sup>190</sup>
9. When the generalization is being taken care of, and/or new task distribution is under way, there is a chance / risk of a rather one-sided approach, but an approach on the basis of a dialectical system takes a better care of the **requisite holism**. How is it practiced, if at all?<sup>191</sup>
10. Traditionally, one has tried to prevent too much superficiality by putting *analysis before synthesis*. Analysis is supposed to bring insights, synthesis to produce outcomes. But we are putting another question, on the basis of the law of the hierarchy of succession and interdependence: what is the **basis of analysis**, if analysis is the basis of synthesis? In terms of the above law, definition of the starting points of analysis must take place, i.e. synthesis of them, before analysis can take place. How is this process practiced, if at all?<sup>192</sup>

Let us add comments to individual guidelines.

#### 4.3.4.1 HOLISM THROUGHOUT THE ENTIRE PROCESS

Ensuring of a holistic rather than one-sided thinking and behavior in the daily work and life: The authors of a policy / strategy, especially of a broadly holistic one, normally need several more narrowly and hence deeply specialized co-workers to work on parts of the entire job needed. A single person may cover a single viewpoint and reduce his or her own requisite holism to it. Without a well-arranged co-ordination the initial, larger, broader holism may thus go lost. In the case of this book every co-author was advised a concept of elaboration of his or her chapter, and received editors' **framework insight into the entire story**.

The authors of e.g. single company solutions of their own environmental problems have, most frequently, considered their own views / viewpoints only, actually *a fictitious holism*. To quite some extent something similar seems to come through on e.g. the part of politicians and businesspersons in the case of the climate change problem. *Total holism* is not possible, of course. DST defines holism as a *system of both general and detailed characteristics, their mutual interplay and the interaction with their environment, and realism of thinking* (See: Ch. 4.1). It is up to the decision makers to find their way between the (damaging) fictitious and (unfeasible) total holism. If more of the many influential politicians and businesspersons, as well scientists, practiced more of the requisite holism (once they cannot attain the LvB's level) on the level of the UNO declaration on sustainable development (of 1992), and the later

where to every one of us belongs, as a coauthor.«

<sup>190</sup> In the case of writing this book the answer may read: »The list of references at the end of the book allows every reader to see, that each and every author and coauthor on the team of this book has published quite a lot by now. We could offer only a reminder about that work in the list of references, not in the contents of the book itself. Here our available information is adapted to the particular topic of this book. We hope the book is going to be acceptable in terms of its clear information and accessible size of reading for the audience targeted to take it in their hands, heads and hearts.«

<sup>191</sup> In the case of writing this book the answer may read: »Findings and statement in single chapters are linked by remarks in footnotes and other text.«

<sup>192</sup> In the case of writing this book the answer may read: »The first phase was actually a dissatisfaction on the part of Timi Ecimovic that the work of his Institute is not as influential among the humans and organizations of today as it should be for the humankind of today to solve their shared problems of the climate change. His conclusion / synthesis was that there is a need for a different / new approach to be offered. His analysis, on this basis, was aimed at finding out what is the new approach, which might make sense. The outcoming synthesis was the suggestion that we all work together on this book. Etc.«

related documents, the problem of climate change would be much less of a serious problem. Thus, they behave too much on an isolated basis, causing entropy to keep growing, including to their own detriment.

#### 4.3.4.2 OPENNESS

Ensuring an open system concept instead of one's isolation and self-sufficiency in thinking and behavior in the daily work and life: Experience with work division and its organization per professions and business functions, demonstrates the tendency of many persons to avoid the open system concept. This is a consequence of their specialization and their feeling that they cannot perceive, accept, and digest all influences available, for very natural reasons: we all have limited capacities, if compared to real life information etc. available now-a-days. In the case of this book our co-authors were asked to elaborate their chapters in an open system concept in terms of their **own professions** and in terms of their **relation to other** chapters. The synergy still remained our own task, as authors, coordinators, and editors.

Openness may help the decision maker. However, it does not cause the same results, if we are open to others **within** the framework of *one single viewpoint*, or to *other, even opposing viewpoints*. In the case of the conferences concerned with climate change, the countries and companies with a quite comparable attitude (e.g. a negative one, trying to stop intervention supportive of inclusion of the environmental cost into company and country cost) were uniting rather easily into their one-sided lobbies. And they were hardly open to the ideas, proofs, and arguments of those in favor of intervention.

Openness (e.g. listening to and hearing of differences) and changing (e.g. action) may be two different points. This brings us to the next guideline.

#### 4.3.4.3 DYNAMISM

Ensuring a dynamic system concept rather than a static one in thinking and behavior in the daily work and life: For long centuries it was good enough to learn a professional skill etc. once for a lifetime. No change, adaptability, or even flexibility used to be considered good ethics. This is a principle, which is still around, especially with the four-fifths, i.e. the huge 80%, the less advanced<sup>193</sup> part of humankind. This is a part of sources of their troubles. The innovative society is much more dynamic, changing, it needs reliability, of course, but **no obsolescence**, especially not under the cover of reliability. This is a kind of the red stripe of this book, too.

Dynamics as a characteristic of human thinking, decision-making, and acting is usually thought of as reduced to *changing in time*. Only a part of statistics teaches about interaction. What about *flexibility, and sometimes even one's **adaptation** to views of others?* It has obviously helped in living and working together, the traditional pre-industrial way of life must have been better at this than the industrial life, when consideration of nature is the topic. The advanced market economy requires producers and suppliers to use a lot of dynamics in terms of **flexibility**, not only dynamics as a statistical category, which considers time only.

#### 4.3.4.4 INTERDISCIPLINARITY

Ensuring interdisciplinarity rather than singledisciplinarity or multidisciplinarity to realize the transdisciplinarity in thinking and behavior in the daily work and life: A single discipline is what an individual can normally cover given the huge amount of knowledge and other information of today. Multidisciplinarity makes a **set** of single disciplines, but no **system** of them, because relations and impacts among disciplines are left aside<sup>194</sup>. The third way, transdisciplinarity is important in research of some disciplines such as mathematics, philosophy, or a systems theory aimed at the shared general attributes (i.e. isomorphisms, similarities). Even with it in mind, hardly anybody comes **close to real holism** without interdisciplinary **co-operation** of monodisciplinary specialists, who are both willing and able to look beyond limits of their own disciplines (a good way of transdisciplinarity). The first three guidelines, which we have discussed right now, may also in reality happen to be limited and exclude a real holism: one may be:

- (1) holistic inside a single viewpoint,
- (2) open to persons of an equal orientation rather to the others such as one's opponents,
- (3) dynamic without reconciliation of different opinions.

Thus, **interdisciplinarity** is worth specific stressing, too. In the case of this book its co-authors are from different disciplines. And it is our **editorial task**, again, to make the entire book a system rather than a set only.

Isomorphisms<sup>195</sup> were the topic asking for interdisciplinarity and they were one of the traditional requests put by the General Systems Theory, already, but it has tended to be forgotten about, time and again. Specialists *talk to each other* more easily than to **mutually different specialists** (e.g. economists to economists vs. lawyers to engineers). But, if in the course of projects implementation in any case we know of, its authors and implementers tend

<sup>193</sup> In terms of the measures of the Northwest of the Globe, of course. E.g. in the rainwoods they may be happy with no impact from Europe, North America, and Japan.

<sup>194</sup> That's what the word multi (= many) says in its Latin original.

<sup>195</sup> Isomorphisms showed up as a way toward interdisciplinarity, which has proved to be neither the best nor the only one possible, as we have seen in this book so far. Co-operation is better, an interdisciplinary and creative one even more so: it provides for emerging synergies which are much more than isomorphisms.

to choose one viewpoint only rather than an interdisciplinary system of essential / requisite viewpoints, they are less than others able to cover everything essential. Having *multidisciplinarity* instead of *interdisciplinarity* might mean a lack of mutual impacts and hence a lack of consideration of *synergies*.

We see this entropy danger in the case of climate change, too.

#### 4.3.4.5 PROBABILITY

Ensuring consideration of probability instead of expectation of a deterministic reliability in thinking and behavior in the daily work and life: For quite long times, only the deterministic / hard-systemic laws and solutions were called **scientific and good enough**.<sup>196</sup> This case of an oversight has to do with the finding of the Hegelian and Engelsian/Marxian dialectics (from the 19<sup>th</sup> century) that in reality every object is a system / entity made of **three interdependent parts of its characteristics** (See Fig. 3.2):

- (1) The *general* part of them is **shared by all** objects of the same kind (animals, persons, products, produces, etc.), and repeats itself in every case.
- (2) The *specific* part of them is **shared only by partial groups** of objects of the same kind (female and male animals or persons, mechanical and other products, vegetables and fruits, etc.).
- (3) The *individual* part of them is **not shared at all** and is owned by individual objects of the same group and kind only (first and family name and date and place of birth, the concrete car or refrigerator, the concrete apple, etc.).

Determinism cannot be realistic fully, but statistically, i.e. with a level of **probability**. In the case of this book we do **not** imagine, that all solutions from all insights and experiences from all around the world will **for sure** be able to be transferred and to work well in quite different local settings. We are still reminding of them, because we **neither** imagine that they can **no way** apply in some new settings.<sup>197</sup>

We humans do not like our cars and other tools to be only *probable rather than fully reliable*. But they cannot be so. Even less so can be the nature, including humans. Some risk remains, even if we try to be very holistic. Not everything can be foreseen. The so-called side effects are a normal part of consequences, therefore (recall the »strange attractors«!). The climate change is more or less a case of the side effects rather than an intentional central purpose and outcome. This fact is important to consider, when we work on measures to be taken.

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<sup>196</sup> Ilya Prigogine, physicist with a Nobel Prize for chemistry and philosopher provided to the science the principle of indeterminism. He was recently quoted to say: »For centuries, humankind has worked on attainment of determinism. The laws of dynamics predict that one can in a certain moment in certain conditions precisely determine what is going to happen. But determinism is not in line with nature, but rather with the human desire to have a predictable environment. That is where the theory comes from, that in the moment of the big bang, when the Universe came into existence, there have been all the informations concerning everything that will be and has been. But the contemporary empirical research reconfirms my theory that the Universe is unpredictable. Determinism is only an illusion, humans unrealistic wish to limit our world so as to deem it controlled. I maintain that events, whatever the development of science will be, will never be deterministically predictable, in a best case scenario we will be able to assess their probability. For Leibniz who was a determinist, there was no past and no future. Einstein made time relative, too. But the universe develops, like the humankind develops through evolution. The past differs essentially from the future, appearance and disappearance are the basic laws of nature.« Quoted after Le Point in Delo, Ljubljana, 28 January, 2002, p. 24.

<sup>197</sup> What can and shall be done about the climate change in Siberia, may perhaps not work in New York City. Etc.

The five statements (4.3.4.1-4.3.4.5) say clearly *what is needed* without saying *how* can this be done. The next five guidelines provide the answers on *how*.

#### 4.3.4.6 INTERACTION AND FLEXIBILITY BASED ON INTERDEPENDENCE

Ensuring of employment of materialistic dialectics instead of medieval metaphysics and idealistic dialectics: We discussed their difference earlier (Fig. 3.5 and 3.6): materialistic dialectics has proven to be the closest to the modern reality, among all three of them, which are still around (and usable and useful in some situations, too). The medieval metaphysics is still good enough when no co-operation is needed and full isolation and disregarding of changing have to be assured, e.g. in checking of blood in medical labs. But as quickly as these labs' results are to be employed in treatment of patients, they have to be **linked** with other partially gained insights. The transition to **materialistic dialectics** takes place by consideration of *interdependencies and reality*. As quickly as one does not simply speculate about e.g. the possible disease and (a /dialectical/ system of) its causes in the case of the patient under consideration, but checks the patient's **real situation**, one employs materialistic dialectics, no idealistic dialectics. In the case of this book chapters are written on the basis of field research and experience; we also tend to detect their interdependencies, the resulting interplays and the resulting changes.

This is stressed here again, because in the implementation of single tasks we have to work with a more *specialized and narrow* concentration than in the case of the general / big picture from the initial formation of starting points. Knowledge, talents, values, and emotions that *we need each other* (ethics of interdependence<sup>198</sup>) open the door.

Many individuals and organizations obviously miss this capability. And the climate change comes to be a dangerous outcome of the lack of the dialectical thinking.

#### 4.3.4.7 DELIMITATION OF ROLES, JOBS, VIEWPOINTS, SYSTEMS

Ensuring of employment of the typology of systems and models in order to clearly delimit the considered characteristics / attributes and objects from the others: The problem with dialectics is its permanent tendency to consider interdependencies and changing. This may cause a lack of **transparency** of the object/s under consideration. **Mathematically precise delimitation** is hence equally needed as linking, even as a precondition for linking. This is assured by clear definition of the *viewpoint/s selected* because it/they say/s what is **taken in account**, what is left aside, what is found relevant, what is not, what is put in the environment, what in the system, etc. Typology of systems delineates what is considered, if e.g. one chooses the open, or the closed, or the relatively closed system, the dynamic or the static one, the natural or the functional one, the deterministic or the probable one, etc. The same holds of **models**. They are, in terms of the mathematical formal definition, systems. In terms of their contents, models

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<sup>198</sup> A short while ago we quoted a part of what Ilya Prigogine said, and now we will use the second part: »Awareness of time is critical for the humankind to avoid chatastrophy. Eistein said that a scientist must step away from the society to be able to create freely. Today this is no longer true. Science has an ambivalent role in society: it discovers drugs against cancer and produces nuclear bombs. When I was young, I was sure that they will be forbidden, but it did not happen – one of the reasons being that scientists are not sufficiently aware of the past and the future. They are creating now and do not think of consequences. I think that the science of future is ethics, which is the only one able to provide an answer to problems like poverty and pollution. The model of a static universe, Einstein's theory that time is only an »illusion«, does not encourage scientist to think about future. In spite of this, I am convinced that the social and natural scientist will slowly find a shared ground. The nature has its story and we physicists are slowly beginning to understand it – and thus our role in it, too.«

describe systems rather than objects<sup>199</sup>. Every book is a model, too. It expresses the author/s' view/s of an object from his or her or their selected (dialectical system of) viewpoint/s, i.e. as a system, in a way in which finding/s can be **expressed**, e.g. by text, picture, drawing and/or metaphors of other technical kinds. So is this book, too. Delimitation is done in the form of chapters and groups of chapters.

It is hard to co-operate, if it is not clear what a team member does and what he or she does not do. *Roles and jobs define viewpoints*. In theoretical terms: every different viewpoint introduces a *different system* to picture the same reality by taking another part of its attributes in its focus. E.g., the president of USA refuses to sign the Kyoto Protocol on climate issues, and he presents the view that this would cause trouble to the USA economy and workers. Lack of healthy air, huge medical care cost, etc. do not seem to be considered in his expressed view. Some other heads of countries speak from different viewpoints, and the situation in their respective countries and governments seems to be perceived differently than in USA.

#### 4.3.4.8 REALISM IN GENERALIZATION OF OUTCOMES

Ensuring of a realistic generalization of findings: A book, especially the one with many co-authors, is in danger of becoming a set, not a system. It is also in danger of becoming too huge for a real reading or even deep studying. Both would cause the book to be useless, even if it was very rich in findings and thoughts conveyed. Therefore, a *quick reader summary* has become a habit. But the problem surfacing now is: the **short version may lose the essence by becoming an empty phrase with no real contents**. That is why it is important to have short generalizations of findings, but to do one's best in order not to lose realism. In the case of some books, such as (Dyck, Mulej, 1998, 1999), authors try to provide this by editorial abstracts of every chapter, and per chapters and groups of chapters, and of the entire book.

If such a book contained only successful projects, it might be unrealistic giving the reader grounds for a false generalization. The five "whats" would receive a wrong "how" response that seeking a way out of a blind alley *always* works. This warning applies to literature about climate change, too.

#### 4.3.4.9 USING A DIALECTICAL SYSTEM

Employment of a dialectical system: We defined the dialectical system as the midway between the unattainable full holism and the misleading one-viewpoint-system's fictitious holism. We find the midway by consideration of a **system of the essential / requisite viewpoints and only them (and their essential / requisite relations and only them, both inside and outside this system)**. Thus, one can be much more realistic than with both alternatives mentioned above, again (medieval metaphysics, idealistic dialectics). Thus, before one starts working, and before one starts finishing the work by generalization, one should check, which of the three alternatives is used. In the case of this book worked on the concept for several years, and kept reworking some of its details until the very end of our time before handing the text to the publisher. This is a realistic way toward realism from the foregoing guideline 8 and the first five guidelines.

Not all viewpoints, not one single viewpoint, but a *system of all essential / requisite viewpoints* – this applies to the implementation phase even more than to the phase of the

definition of the starting points. A **narrow specialization** is now even more possible, necessary, and dangerous, too.

In the case of working on the Local Agenda 21, one may take actions, which seem good locally and from some viewpoints, but less so less locally and from a system of all essential viewpoints, selected on a different basis. Of course, the issue of decision, which viewpoints and relations are essential, is essential and subjective.

#### 4.3.4.10 ANALYSIS IS BASED ON ONE SYNTHESIS AND LEADS TO ANOTHER SYNTHESIS

Consideration of interdependence of analysis and synthesis as two phases of work: We have been taught, perhaps all of us, that the first phase of a work is analysis, then synthesis. Two points, at least, are worth consideration:

- I. the **contents** of both words / notions,
- II. the **basis for analysis**, its starting points, if it is the first phase.

*Ad (I):* In the Webster's School and Office Dictionary of 1978, analysis is said to be (a) separation into constituent parts, (b) summary. Synthesis is said to be (a) combination of parts in a whole, (b) such a whole. The definition of analysis under (a) forgets about contents and talks about techniques, so does the one under (b) as well. An obvious consequence is a lack of a holistic insight. This matters, because: what makes analysis make sense, if not **insight**? The real, not merely a one-sided and only technical, definition of *analysis* is *finding the deeper, hidden truth*, partly by separation of the object under consideration into its constituent parts.

Our answer *ad (II)* will provide the second part of our answer *ad (I)* in a short while. If one searches for truth, and separates the object under consideration into constituent parts, with the Dialectical Systems Thinking one puts the question: on the basis of **which starting points** is this done? The response is obvious: *before analysis, a making or synthesis of the subjective starting points occurs*. One does some thinking before it, of course, but one decides for it beforehand, too. Both synthesis and analysis **are interdependent phases**, which only switch their roles of the more or the less stressed one from time to time in the same process. In the case of this book we went the same path by drafting our decision, conceptualizing and frequent re-conceptualizing of the draft, analyzing every draft for quite a while, making a new one, etc. So did, we believe, our co-authors too. All results of their analyses are based on their syntheses of their starting point, even if they have not called it that way or did all the process subconsciously.

Analysis covers finding the *hidden truth*. It takes place inside the *framework* established by synthesis of the selected (systems of) viewpoint/s. In this book we are discovering the same reality. The analysis, which leads the president of USA to his denial of signature on the Kyoto treaty on climate change, is based on an essentially different synthesis of the subjective starting points, than, let us say, his opponents' ones. Due to the selected kind of the subjective starting points, one *sees* even the given / same objective starting points, the really existing *reality, differently*, because nobody is either able or willing to be fully holistic and include everything.

Thus, the guideline ten brings us back to the guideline one.

The consequences are:

- (1) consideration of the laws of requisite holism, of entropy, and of hierarchy of succession and interdependence, and
- (2) completing up the guidelines about making the subjective starting points with guidelines about making the chosen subjective starting points become reality after they have been defined.

What remains to be briefed is the way to attain all these ends without ever speaking of the basic theory, in an applied way.

#### 4.4 THE DST AND ITS APPLICATION

An attempt to follow the DST principles does not necessarily involve knowing all the theory, because the applied methods may be sufficient. That's why they follow now. Toward this end, we produced USOMID and applied it for beyond two decades.<sup>200</sup>

#### 4.5 USOMID: AN APPLIED METHODOLOGY OF THE DIALECTICAL SYSTEMS THINKING

##### 4.5.0 THE SELECTED PROBLEM AND VIEWPOINT OF DELING WITH IT IN THE CHAPTER 4.5

We discussed all the three laws included in the DST, and both dialectical systems of guidelines so far. What we have not discussed yet is the 3<sup>rd</sup> component of DST, its **applied** methodology. The experience with application of the DST in non-academic settings soon demonstrated the need for those rather philosophically broad concepts to be expressed in an organizational technology, i.e. **methodology**. This is why USOMID came about; the acronym (in Slovenian) reads: Creative Co-operation of Many for an Innovative Work (Mulej et al., 1986, etc., also: Mulej, Zenko, 2002). Here, we will try to see whether or not USOMID can support the efforts of solving the problems of the climate change.

##### 4.5.1 THE USOMID CONCEPT: A REFLECTION OF THE 7 COMPONENTS OF THE STARTING POINTS

Creative co-operation can hardly take place, if e.g. only *hard systems methods* are used, since they are aimed at finding and exposing mechanical, deterministic, linear kind of relations. They are a very important achievement, if a *routinized* behavior is good enough. It is so, when e.g. one deals with very *technical details* of production for all products to be fully equal. It is different when **creativity** is needed. Then, *soft systems methods* become the right choice exposing probabilistic, nonlinear, relations / features / characteristics. Both types of thinking methods are normally needed, of course.

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<sup>200</sup> Dr. Ben Graham, Jr. and many others have learned from the same basic source, from Allan Mogensen. Back in 1926, as an industrial engineer he was in charge of a "motion study" of a worker in Kodak, Rochester, New York. This means that the engineer was supposed to think *instead* of the experienced worker, not with him together, and to find out and prescribe the best way for the worker to do his job. Mogensen produced a film about the worker's procedures. In spite of the habit and intention, the worker saw the film about himself and asked the engineer: "Please, do not use this film, I can do it better." This was a turning point for Allan Mogensen: he realised that he had been educated wrongly and hence did not expect any creativity, skill, knowledge and experience from the worker. On the basis of this experience, Mogensen developed his method of innovating on the basis of cooperation of the experienced performers of the jobs under consideration and consultants, he called it **Work Simplification**. This source and several more were the basis for us to develop USOMID, and for Ben Graham Jr. to develop "Paper Work Simplification". His method is very good at innovation of the administrative routine jobs by nontechnological innovation. USOMID is good at innovation of the creative work processes that can be supported by *framework routine-based procedures* collected in the *programoteque*. See Ch. 4.5.2 about programoteque.

For the soft systems methods' support to a work process to be attainable, the DST has developed (and frequently applied) its USOMID methodology. In DST the **human work process** is modeled: it starts from the starting points - a system of seven elements (see Fig.4.1):

- The *objective starting points* are the objective 'needs' and 'possibilities'.
- The *subjective starting points* are 'talents', 'values and emotions', 'knowledge (on contents)', and 'knowledge on methods' (skills).

All further process depends on them<sup>201, 202</sup>. In USOMID every element among them is *reflected*:

- *Objective needs* reflect the law of entropy, which causes the need for the law of requisite holism and the law of hierarchy of succession and interdependence to be considered as well as both dialectical systems of ten guidelines. Their practical framework response to the objective needs is made possible in the modern innovative society<sup>203</sup>, innovative business<sup>204</sup>, and its culture, policy, strategies, tactics, innovation objectives, awards more easily and normally than in a routinized society and business, or at least in different ways. They can and must be created as *objective possibilities*. Subjectively, the objective needs are in turn reflected in *values and emotions*, e.g. by motivation.<sup>205, 206, 207</sup>
- *Values and emotions* are impacted by the objective needs of a modern society in the form of the motivation for a deliberate search for many possible changes aimed at creation of inventions, potential innovations and innovations; the motivation for it is created by a well grounded feeling of *appreciation for creative co-workers*.<sup>208, 209</sup>
- *Knowledge (on contents – what?)* is developed, mined out, and activated for both purposes said. Since e.g. more than two thirds of innovations are the incremental ones and have to do with the work processes, and since they can best be produced by the work performers with a realistic insight, and since a written insight into processes is usually lacking, especially the one into the rather creative part of processes - making this insight in the form of

<sup>201</sup> The starting points are not only influential over the later phases / steps of e.g. the work process, the later phases also influence the starting points. There are at least two ways for this influence of the future over the present to take place: (1) forecasting and adaptation of the current action to the foreseen future, (2) changing of the starting points in the next cycle of the process in Fig. 4.1, which is a permanent process anyway.

<sup>202</sup> In the case of the climate change issues, politicians are supposed to make decisions, like in other affairs. And they want to be elected again. Thus, when working on the decisions of today, they forecast the reaction of their potential voters to their decisions in the next election process.

<sup>203</sup> We will come back to it. See Ch. 4.7.

<sup>204</sup> We will come back to it. See Ch. 4.6.

<sup>205</sup> In the case of the climate change problems, the objective needs include a healthy natural environment for humans of today and in future to live in happily.

<sup>206</sup> The objective possibilities include measures changing the current state of the natural and social environment toward a healthier one, science, R&D, politics, strategies, tactics, operation and monitoring measures supportive a such changes, first of all the ones with innovative impacts.

<sup>207</sup> There is again a case of interdependence of the subjective and objective starting points, of course, such as the difference of thinking, decision making, and action between the Clinton and Bush Jr. administrations concerning the climate and sustainable development in general. In his draft budget of US for the fiscal year 2002/3, president Bush Jr. cuts government funds for environment protection by 12% (public media, Feb., 2002). Their values differ, partly under the impact of the 11 Sept., 2001 attack over World Trade Center and Pentagon, partly under earlier impacts.

<sup>208</sup> See Ch. 6.5 for some details about values.

<sup>209</sup> In the case of the climate change issues, values and emotions differ a lot, the world wide conferences on these issues are demonstrating, as well as the attitudes concerning the importance of the Local Agenda and the Local Agenda 21. The ones in favor of profit at the detriment of the natural environment, including the damage to human health, may hardly support new ideas about solving / prevention of these problems. Their opponents are their opponents, because their values and emotions let them read the same objective data with different evaluations, what its the most crucial part of the story.

'programoteque'<sup>210</sup> is the visible informational outcome of employment of USOMID. **Programoteque** is made on a framework level first and then proceeds toward more and more detailed levels, all way to a computer support; it is first a description of the given facts, then comes their 'causes tree' analysis, later on perhaps also innovating.<sup>211</sup>

- *Knowledge on methods (skills)* has a general and a specific part; the specific part is problem / topic dependent. Its general part is made of the USOMID/SREDIM procedure of creative work and co-operation.<sup>212, 213</sup>
- The *organizational objective possibilities* for a creative work and co-operation to take place are made of the USOMID Circles, a version of the Quality Control Circles, with some additions.<sup>214</sup>

The *relation* between all the elements quoted is double:

- *learning* by an initial course, and learning by doing;
- working out and employment of the *programoteque* by a creative co-operation process of the studied job performers and their consultants.<sup>215</sup>

Then, the **innovating** process can follow (many cases since 1969).<sup>216, 217</sup>

Hence, in practice the application of DST via USOMID starts with working out the **insight** into the processes under consideration. This is usual, of course; in this case it takes place in the form of working out the programoteque.

#### 4.5.2 PROGRAMOTEQUE

There are hardly any organizations, be they enterprises or others, with a *holistic insight into their entire work process*, i.e. their **basic, information and management** aspects / viewpoints, as well as their links, especially **interdependencies**. The *basic process* of, e.g., a factory covers supply, manufacturing and sales, and it transforms the in-coming material and energy into the out-going products (and waste etc.). The *information process* links the basic and the management processes as well as environment by transformation of data in

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<sup>210</sup> See Ch. 4.5.2. for basic details.

<sup>211</sup> In the case of the climate change issues and their problem solving, making a programoteque would collect experience about the processes of dealing with the climate change of so far in a framework model. Then this process-related experience could be studied for new solutions of an innovative type to be discovered, developed, and implemented, later on.

<sup>212</sup> See Ch. 4.5.3. about this procedure. Its application is of course specific in the case of dealing with the climate change issues, but not so on the general level of the way of proceeding.

<sup>213</sup> Talents are the in-born natural basis for a specific education to result in a specific knowledge of both kinds mentioned. Hence, we do not deal with talents specifically, here, they make a part of the background.

<sup>214</sup> See Ch. 4.5.4. Their application can in the case of dealing with the climate change issues be specific in contents, but not so in the framework procedure.

<sup>215</sup> In practice, all the components and relations mentioned are elaborated on the level of the requisite holism of the authors' choice. All the work processes reflect the law of hierarchy of succession and interdependence. All this is supposed to work against one's entropy.

<sup>216</sup> In the case of the climate change, the innovating process would have to do with a rather concrete finding out the causes and processes and outcomes of measures and behaviors, which have had either good or bad or, most probably, both affects over the climate. The ones that would be found beneficial, would be supported, the others would be subject to attempts of changing. In the new measures, synergies and other attributes of systems thinking would be seriously considered, of course. For innovation to be the right word, implementation and benefit would be unavoidable, of course.

<sup>217</sup> See Fig. 4.6. about the innovating process as a business process. The steps application is hardly specific in the case of dealing with the climate change issues, except in contents.

information. The *management process* transforms the in-coming information into decisions, instructions etc. for the basic and information processes and other out-going information.<sup>218</sup>

It is quite hard to control or even innovate the entire business, or its production subsystem at least, without a requisitely holistic **insight** into the entire process. It is equally hard to innovate or optimally control the entire business or any of its subsystems without the *motivation* of the employees to be creative toward innovation rather than toward abuse; the same is true of their knowledge and experience. USOMID is a method to meet both needs. How?

1. Programoteque provides for a **felt respect and appreciation** for knowledge and creativity of the job performers, and **involves** them. It cannot be produced otherwise. And it motivates by this respect and appreciation.

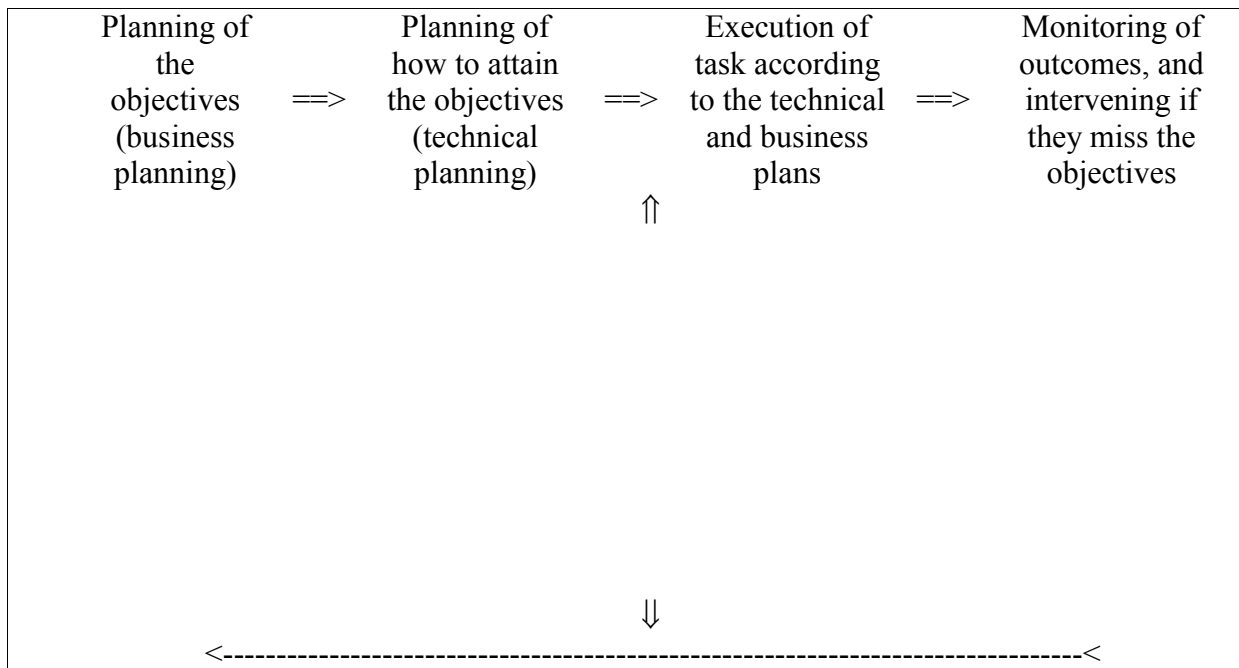
2. Programoteque provides for a **framework** level of structuring, without causing a rigid structure of the process information. Hence, it **supports creativity** rather than replaces it (such a replacement is – on the other hand – needed inside a mass production of equal products except in its engineering and other preparation!). Thus, programoteque supports *optimization of the rather creative parts of the work process*, which cannot be optimized by hard systems methods, and hence tend to be neglected causing lots of otherwise avoidable costs (several cases in Mulej, ed., 1997; Cevc, 2002; etc).

Programoteque is produced step by step. It continuously keeps care for insight into **work processes rather than subordination**, because it is work processes, which create the outcome, and the structure of subordination is only one tool of running the processes. Therefore, one starts – as a consultant (and every good manager, especially an innovation manager, is rather a consultant than a commander!) – with the application of the simplest and most general possible model of the process, see *Fig. 4.2*.

*Fig. 4.2: The interlinking, general program of the programoteque, the shortest version*

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<sup>218</sup> In the search for solutions to issues of the climate change the same procedure may apply.



If you compare Figures 4.2 and 4.1, you see that the model in Fig. 4.2 is a simplified version of the model in Fig. 4.1 (as well as in Fig. 4.6). They could all be related with the usual triangle form of the *structural model of subordination*:

- The *top management* does the planning of objectives.
- The *middle management* does the planning of how to implement them.
- The *low/operational management* and their teams execute the tasks.
- The *monitoring and checking* personnel provides the insight how outcomes match plans, so that interventions can take place where ever and when ever needed.

Once the interlinking program is done, consultants no longer talk to the top management, details are supposed to be better known by their more narrowly specialized coworkers. Each of the four steps in Fig. 4.2 can be further elaborated in all details chosen as suitable, needed and sufficient (law of requisite holism!). There are only two preconditions:

1. One goes from the very rough and short description toward detailed ones, but one may neither switch from insight in **processes** to structures of subordination nor lose the **whole** out of one's sight.
2. One never goes as far in details as to lose the **framework description** in order not to replace the **support to creativity** with replacement of creativity of the process performers (e.g. by a deterministic prescription which, on the other hand, is crucial in a routine job such as one at the conveyor belt).

In order to meet the above two criteria, the principle is that every job performer has **information requirements** that the foregoing job performer in the same process must fulfill. The technique for making a *partial process framework program* includes the following steps to meet this principle:

*The 1st step:* consultant talks to the performers of the job under consideration to collectively find out and write *facts*, how this job is done step by step from its beginning toward its end (the questions put: what, who, when, where, how; *no: why!*).

*The 2nd step:* the same group talks and writes, on the basis of the notes produced in the 1st step, but now the topic is an *analysis* of the process under consideration from its end toward its start (the causes tree):

- Is the insight complete enough?
- Can any activities, which used to be usual so far, be eliminated as avoidable?
- Is the foregoing step really a precondition for the step under consideration?

*The 3rd step:* the same group talks and writes, on the basis of the notes produced in the 1st and 2nd steps, but the topic is now the *influencing* environment of the process under consideration:

- On which other partial processes does the partial process under consideration depend?
- By which documents and information contained in them does the impact of these processes on the process under consideration take place?
- In which way/s and in which step/s of the partial process under consideration is the information received and accepted?

*The 4th step:* the same group talks and writes, on the basis of the notes produced in the 1st, 2nd and 3rd steps, but the topic is now the *influenced* environment of the process under consideration:

- To which other partial process/es is the partial process under consideration providing their inputs?
- By which documents and information contained in them does the impact on these processes by the process under consideration take place?
- In which way/s and in which step/s of the influenced partial process under consideration is the information received and accepted?

Findings can be written in the form modeled in the Fig. 4.3. It can also be computer supported.

Obviously, the 1st step of this procedure deals with the **line 4** in the Fig. 4.3, and so does the 2nd step. The 3rd step covers lines 1-3, the 4th step the lines 5-7. Thus, the *requisite holism of the insight* is enabled. Again, the level of detail is a matter of a free decision.

Fig. 4.3: Form for description of partial processes under consideration

|                                                                                             |                                                                              |
|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 1. Entry connections (where are influences coming from) to the process under consideration  | <i>Preconditions for the process under consideration</i>                     |
| 2. Entry documents and information in them                                                  | <i>Data/Message/Information carrier</i>                                      |
| 3. Entry information activity                                                               | <i>Oral, written etc. reception of information</i>                           |
| 4. The partial process under consideration - the most interesting one in this moment        | <i>Steps and links of the partial process under consideration</i>            |
| 5. Outgoing information activity                                                            | <i>Oral, written etc. emission of info.</i>                                  |
| 6. Outgoing documents and inform. in them                                                   | <i>Data/Message/Information carrier</i>                                      |
| 7. Outgoing connection (where are influences going to) from the process under consideration | <i>Consequences of the partial process under consideration in other ones</i> |

From the viewpoint of **quality** of the outcome, **motivation** is equally important as professionalism. It's the job performers who *are* the professionals of the *job* under consideration, not the consultant, he or she is the professional of the *method* supporting the professionals of the job in their screening and innovating of their job processes. This fact must be **acknowledged**, and the job performers must be **respected and appreciated** for their creative capacity. In other words: the consultant never gives orders or makes decisions, he only takes notes and helps in terms of the method. He or she can never know more about the process under consideration than the experienced and trained job performers do, his or her specialty is another one. He knows best the procedure of co-operation.

#### 4.5.3 THE PROCEDURE USOMID/SREDIM AS THE GENERAL METHOD OF THE CREATIVE WORK AND COOPERATION

The SREDIM label is an acronym for a procedure of a quite holistic work (see Fig. 4.4, vertical steps). Once we had found in working with it, that it did not contain cooperation, we added cooperation steps (see Fig. 4.4, horizontal steps) to make the procedure closer to the law of requisite holism.

The 6 steps of the SREDIM procedure concentrate on the following issues:

1. The step S (= select a problem) is the step in which the present team members (applying all four steps written horizontally in the Fig. 4.4) collect their opinions **what is the topic** for them to work on, what is the broader problematique<sup>219</sup>, and *what is the problem* they select for their work right now (other problems will wait for somebody else or for another opportunity).<sup>220</sup>

<sup>219</sup> The insight into the broad picture of the reality is equally important as the insight into the details on which we are concentrating right now. Having both pictures at the same time, is a crucial part of the dialectically systemic thinking.

<sup>220</sup> It makes sense, in our experience, not to limit the collection of the list of topics, problematiques and problems to the team members alone. An *organized criticism and criticizing* is a helpful tactique. It helps to collect many topics etc. worth working on, potentially. The list of topics etc. collected in this way can be publicly exposed as a poster

*Fig. 4.4: The procedure USOMID/SREDIM as the general method of creative work and cooperation<sup>221</sup>*

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listing them all in one column, and having room in another column in which individuals interested in working on the problem in an invention-innovation process (individually or in a team) can sign up. If nobody signs up, the problem is going to sit and wait. If they sign up, a team can be made of them to work on the problem as volunteers, but on the company time. Mostly, the team is assigned one hour a week in a period, which makes no serious harm to the daily job obligations. They are rewarded for inventions and for innovations, but not for spending time.

<sup>221</sup> X = connection point for the process to be a permanent one.

| THE 6 STEPS OF SRE-DIM                                    | THE 4 STEPS INSIDE THEM | 1. Individual thinking in a written form (brain writing) | 2. Circulation of notes, reading and additional individual brain writing | 3. Discussion on the basis of notes aimed at shared findings and conclusions | 4. The final minutes on solution agreed upon by the team |
|-----------------------------------------------------------|-------------------------|----------------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------|
| 1. Select (the problem to be solved)                      |                         | X==> * ==>                                               | ==> * ==>                                                                | ==> * ==>                                                                    | ==> * ==>                                                |
|                                                           |                         | <=====                                                   | <=====                                                                   | <=====                                                                       | <=====                                                   |
| 2. Record (data on the problem)                           | ↓                       | ==> * ==>                                                | ==> * ==>                                                                | ==> * ==>                                                                    | ==> * ==>                                                |
|                                                           |                         | <=====                                                   | <=====                                                                   | <=====                                                                       | <=====                                                   |
| 3. Evaluate (data collected)                              | ↓                       | ==> * ==>                                                | ==> * ==>                                                                | ==> * ==>                                                                    | ==> * ==>                                                |
|                                                           |                         | <=====                                                   | <=====                                                                   | <=====                                                                       | <=====                                                   |
| 4. Determine + develop (solution of the problem selected) | ↓                       | ==> * ==>                                                | ==> * ==>                                                                | ==> * ==>                                                                    | ==> * ==>                                                |
|                                                           |                         | <=====                                                   | <=====                                                                   | <=====                                                                       | <=====                                                   |
| 5. Implement (solution)                                   | ↓                       | ==> * ==>                                                | ==> * ==>                                                                | ==> * ==>                                                                    | ==> * ==>                                                |
|                                                           |                         | <=====                                                   | <=====                                                                   | <=====                                                                       | <=====                                                   |
| 6. Maintain (solution in practice)                        | ↓                       | ==> * ==>                                                | ==> * ==>                                                                | ==> * ==>                                                                    | ==> * ==>X                                               |

2. The step R (= record data) is the step in which the present team members (again applying all four steps written horizontally in the Fig. 4.4) **collect data** about the problem selected earlier, and present them to each other. The question *why* is *not* asked now, it will have its turn in the next step. On the basis of experience concerning the way of doing this step, a framework programoteque can be produced and applied when topics are comparable enough.<sup>222</sup>

3. The step E (= evaluate data) is the step in which the present team members (again applying all four steps written horizontally in the Fig. 4.4) *analyze the problem* with the collected data and present their findings to each other. The question **Why – is central** now, one tries to find out the roots of the problem and the reasons for it to surface<sup>223</sup>. On the basis of experience concerning the way of doing this step, a framework programoteque can be produced and applied when topics are comparable enough.

<sup>222</sup> This means, that the programoteque is a dialectically systemic stock of framework programs to be applied when appropriate, i.e. when the situation is comparable enough for the old experience to be useful as a framework reminder on how to deal with the situation. The difference from habits of many well experienced and successful persons is that their reminder remains in their head (as long as it does), and programoteque contains written and trasferable data, able to become information.

<sup>223</sup> Frequently, the mistake occurs that the team members want to prove their possible solution here. This is too early, if one does not know the backgrounds of data collected. Data tend to be superficial (E.g. a medical case: a higher body temperature is no disease, but its symptom, actually a symptom of a number of them. With no knowledge of the roots and backgrounds one can hardly select the right medicines. Similar is it in the case of economic, business and other topics. In the case of the climate change, this is very crucial, because there is usually a long list of impacts to be taken in account, including their synergies.)

4. The step D (= determine a solution) is the step in which the present team members (again applying all four steps written horizontally in the Fig. 4.4) **judge the potential solutions and select one** on a comparative basis. The question of *realism of potential solutions* is central, now. Hence one may tend to evaluate the methods applied earlier as a source of a better or poorer realism.<sup>224</sup> On the basis of experience concerning the way of doing this step, a framework programoteque can be produced and applied when topics are comparable enough.

5. The step I (= implement solution chosen at the end of the step D) is the step in which the present team members (again applying all four steps written horizontally in the Fig. 4.4) **plan** the way of how to *change the given reality* by application of the invention they have attained (and they **use, implement** the plan, of course). The process of its **realization**, the structure supporting it, the knowledge base required, the potential obstacles etc., are to be taken in account. On the basis of experience concerning the way of doing this step, a framework programoteque can be produced and applied when topics, which are comparable enough, surface again.

6. The step M (= maintain solution in the real world) is the step in which the present team members (again applying all four steps written horizontally in the Fig. 4.4) plan the way how to **fight the opposition** against their innovation, how to persuade their partners, sponsors, champions, apply methods, etc. in order to *make the new solution survive*. In this step they may also find out what new or unsolved troubles are around and worth starting the entire SREDIM/USOMID procedure again concerning the new issue. On the basis of experience concerning the way of doing this step, a framework programoteque can be produced and applied when topics are comparable enough.

The four steps, which make the SREDIM/USOMID procedure different from the SREDIM procedure, take care of **co-operation** in the team. They also make this procedure different from the brain storming methods by several important small inventions, such as:

- Team members are invited to think about the **selection** of the problem, too, not only of its solution. Thus, they own the problem rather than feel that the problem is imposed over them.
- Team members do *not go directly* to their **oral** discussion, because this would make them spend lots of time without actual creativity. Time is used more economically and creatively if the brain writing and the brain storming discussion steps are combined.<sup>225</sup>

#### 4.5.4 THE USOMID CIRCLE - AN ORGANIZATIONAL POSSIBILITY SUPPORTIVE OF CREATIVE CO-OPERATION

The most usual organizational possibility of creative co-operation is a **meeting, session**. But most of us have not experienced them as a time freeing a lot of creativity<sup>226</sup>. One reason for this unfortunate experience is that in most meetings they do not apply a method such as the one described here in Ch. 4.5.3, but they rather follow the logic of *one-way communication* (the boss speaks, but the others ...?). Most meetings also tend to consist of too many individuals for anything else to be possible, too frequently. Therefore, it makes sense to consider the finding of the psychology of small groups that creativity is best in **groups of 5-12**

<sup>224</sup> E.g. if one has chosen the medieval metaphysics instead of the modern materialistic dialectics, essentially different findings may come out. Different kinds of systems theories may have a similar effect. So may different statistical and other quantitative methods, different market research methods, etc. The methods chosen and applied make the framework inside of which findings are achieved, the rest may be out of sight partially or even completely.

<sup>225</sup> Literature about creativity techniques lets us see that this is an unusual combination. (See: Pecjak, 2001) But the experience lets us see that it is a very fruitful one.

<sup>226</sup> In Slovene, a game of word can make the essence of a meeting clearer: it is called *sestaneč*, hence it is linked to *sestati se*, i.e. *come together*, and to *sestaviti*, i.e. *put together, make a whole from parts*.

members. In a bigger group, the number of mutual impacts tends to outgrow the possibility of a real co-operation and creation. In a smaller group, one may lack information.

The word USOMID circle is based on international experience (Quality Circles, Quality Control Circles etc.). Such a circle is an efficient work group on the following basis:

- Members receive training (on methods to be applied).
  - Organizational roles are assigned to everybody, so that the burden of organizational tasks is shared rather than completely put on the shoulders of the chairperson alone, making this person overburdened and the others irresponsible.
  - Everybody tries to
    - Achieve the common objective with the results of the shared effort.
    - Understand the work method.
    - Receive and accept the suitable knowledge, skill and tools.
    - Make a contribution toward an encouraging climate in the group.
- Accept responsibility for his or her work, and share acknowledgment for it.  
Give and accept professional help and support when needed.

USOMID Circle applies the procedure SREDIM/USOMID already in the phase of its informal, interim and mental working, as well as later on, when the team / circle works regularly and **deliberately tries to make possible changes, and make them innovations**. It follows the same procedure whether working in its normal, usual, composition or in an *extended* one (= with additional professionals and experts invited).

The USOMID circle is a group of workers and/or other volunteers who all participate actively in discovering, selecting and solving of the problems that have to do with their **own daily jobs** in terms of their basic, informational and managerial sub-processes. They all **volunteer** for joining the circle, but work on company time, usually one hour a week. They are entitled to be rewarded when successful.

The basic form of motivation for the team members of an USOMID circle is **the consideration and appreciation of their creativity** on the part of their peers and superiors.<sup>227</sup> Financial rewards are one form of it, there are several more, such as public prizing, advancement, research funds, additional training and education paid for and enabled, etc.

#### 4.5.5 CONCLUSIONS ABOUT THE USOMID METHODOLOGY OF INVENTIVE AND INNOVATIVE THINKING AND ITS APPLICABILITY TO THE PROBLEMS OF CLIMATE CHANGE

The problems of the climate change are *far from simple* and far from tackling a *single* profession or scientific discipline / science. They demand requisitely holistic solutions, and hence a **methodology of holistic creative interdisciplinary co-operation**. These requirements need support from **personal traits** of the persons involved, because their personal traits have the role of their subjective starting points. Their co-operation can be well supported by **teamwork** methods with which they study processes in which either the climate change surfaces, or they can be mastered requisitely holistically. Recent cases, again, let us see that the USOMID methodology allows for **more holistic** consideration, elaboration and implementation of solutions than other methods, which are in principle comparable, such as the very useful project management (Slevc, 2002).

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<sup>227</sup> The appreciation of creativity belongs to main drivers of success in making and using the programoteque for the invention and innovation processes, according to our experience.

The application of such a methodology seriously depends on the style of management and on its change in terms of an **innovation of management**, which will in its turn lead to innovation management. We were able to see, that the application of USOMID requires democracy at work for co-workers involved to be trusted enough, and to feel trusted as creative individuals / groups. Then, they tend to submit ideas and elaborate them to innovations.

Once invention-innovation efforts and results become a wide spread and normal practice, the transition from a random innovating to an “innovative business” can have its turn. There are other methods enhancing creativity and innovations, such as reengineering, 20 keys, ISO 9000; 2000, EGS 2000. They are more known internationally than USOMID. But have a hardly better history of success. Hence, we will not address them here.

#### 4.6 INNOVATIVE BUSINESS

The oldest *innovation of management* may well have been the **hierarchical subordination** of the less qualified members of an organization to the more qualified and experienced ones (Schmidt, 1993). This was several thousand years ago, when they were building pyramids in the ancient Egypt. It made and makes sense as long as:

- (1) The superiors do not abuse their position.
- (2) The subordinates would not be able to perform well enough in their jobs with no supervision and instruction, due to their lack of expertise and interest.

In the course of the 20th century, the equipment has been more and more introduced that has increasingly required more skills, education and training, and thus has made the traditional hierarchical subordination less and less useful and needed.

The next *innovation of management* may hence have been the

- (1) *human relations concept*, between the two world wars, and
- (2) *human resources concept*, in recent decades.

Their main difference from the old tradition is the supposition that **subordinates are capable of creativity and responsibility**.<sup>228</sup> This finding has had a lot to do with the practical experience as well as with the growing need that the companies and other organizations both develop and activate as much of their personnel’s creativity, inventiveness and innovativeness as possible.

Gradually, a next *innovation of management* entered the scene, which we may call **innovative business**. It can be simply defined by the following five sentences:

1. In principle, every cost is unnecessary. In reality it is so, if we **work smarter**, not harder, and produce innovations.
2. Today, every product and process becomes **obsolete**, sooner or later. That’s why we must know their life cycles, do research, do development (connecting research results with the daily needs and practices), create other inventions and make them innovations as a new, useful / beneficial basis of survival, on a continuous basis.
3. Survival, and therefore both good and poor work is **everybody’s business**. Nobody, neither the superiors nor the subordinates, are entitled by their own life reality to be irresponsible and oppose or disregard innovation.
4. Therefore let us **continuously**, all the time and everywhere, search for possible novelties! Only a small portion of them may become *inventions*<sup>229</sup>. From some of them, by research

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<sup>228</sup> Therefore, the employed people are no cost to be reduced as much as possible, but precious resources to be invested in and activated.

<sup>229</sup> By definition, inventions are the new, perhaps making sense and potentially useful ideas. (EU 1995; EU 2000)

and development, sometimes something both usable and new might be created, *a potential innovation*<sup>230</sup>. Customers will accept only a fragment of them as useful and worth paying for, hence making a benefit to both customers and suppliers, therefore deserving the name of *innovation*.

5. The entire business policy and practice is innovation oriented, not just a fragment of it. Results pay, not efforts (Rebernik, Repovz, 2000). Hence, let us **work like the clever ones**, not like fools.

A further part of the essence of the innovative business is that the five sentences of its definition no longer apply to the producing part of the organizations only, but to **all activities and all parts** of life in **all organizations**. The effort must be broadly disseminated and permanent, because the pressure of competitors is permanent, and for competitiveness the **quality must be systemic**<sup>231</sup>, which is impossible without continuous innovation.

See *Fig. 4.5* for definition and typology of innovation.

The process of (innovative, hopefully) management can be modeled, in a simplified picture, as in *Fig. 4.6*.

Once the innovative business comes to prevail in a society, it may acquire the label of an innovative society.<sup>232</sup>

*Fig. 4.5: The internationally accepted modern definition of innovation and of innovation management, and our typology of innovation*

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<sup>230</sup> A potential innovation is, in our own definition, a new, technically elaborated, but not yet beneficially applied novelty. It is quite close, perhaps, to becoming an innovation, but the marketing / beneficial practical application is still missing. (See: Mulej 1994; Rafolt 1997; Afuah 1998; Celan et al. 2002)

<sup>231</sup> Recall Ch. 2 of this part of this book about the systemic quality, please!

<sup>232</sup> When we are discussing the climate change, we may see its close relation to making of innovative societies of today, but with a lot of lack of holistic thinking. The market, the legislation and the culture behind them, as discussed in the Ch. 2 of this book, have not known holism and were taught to consider only the internal economics and cost, and to forget about the external ones. One of the dangerous effects, called side-effects, of this process, is the climate change of today. On the other hand, it is the innovative society which may best be able, in principle, to cope with the problems of the climate change, in terms of knowledge, talents, and resources / possibilities available – once their values and emotions change toward more holism, in order to survive. – In the last days of January, 2002, public media reported about the Northern Italy's problems of climate change very simply: they had no rain for four months in which they would usually have also a lot of snow, not only rain, and therefore the smog is so bad that going out or opening the window does not provide a fresh, but a dangerous air. New measures are looked for. Hopefully, they will be conceived and implemented requisitely holistically to solve the problem better than fictitious solutions of so far.

Innovation, as a **process**, is producing innovation as an outcome.

Innovation, as an **outcome**, is every novelty that is accepted as useful/beneficial by buyers and customers. Innovation = invention + commercialization / application with benefit for both customers and suppliers.

**Innovation management** is a process aimed at efficient and effective control of innovation, both as a process and an outcome.

**Innovative business** is controlled by a requisitely holistic synergy of both the routine and innovation management, taking place as either routinized or innovative management, depending on the phase of process and type of issues to be dealt with.

**Twenty types of innovation** can be differentiated by combinations of three criteria:

1. *Contents:*

1.1. Program (new successful business programs)

1.2. Technology (new successful attributes of products and production procedures)

1.3. Organization (new successful attributes of organizational procedures and relations)

1.4. Management (new successful attributes of management, such as democracy at work aimed to activate creative capacities of co-workers for innovation)

1.5. Method (new successful methods of management and organization)

2. *Consequences:*

2.1. Radical innovation (causing successful crucial changes, replacing the given skills, equipment, maybe markets, etc.)

2.2. Incremental innovation (causing successful smaller changes, enhancing the given skills, equipment, maybe markets, etc.)

3. *Duty to innovate:*

3.1. Professional duty to innovate (in the job description, reducing the employee's right to receive reward for invention, but allowing one for innovation)

3.2. No professional duty to innovate (e.g. suggestion system)

#### 4.7 INNOVATIVE SOCIETY

Gradually, in the advanced countries, the innovative business has become the prevailing culture of the entire countries:

- The market ratio of supply and demand passed the transition from
  - (1) the *random market* in which farmers etc. produce for themselves and sell only random surpluses (“self-sufficient economy” prevails), via
  - (2) the *producers market* in which farmers, factories etc. no longer produce for themselves, but the supply is still smaller than demand (“queuing, guild economy”, buyers cannot find everything they want), to
  - (3) the *buyers market* in which supplies exceed demand (“market economy”, suppliers cannot find buyers for all they offer, **innovation is necessary**), and further on to
  - (4) the *state supported buyers market* in which supplies exceed demand a lot (“advanced market economy”, **innovation is very necessary**).
- The continuous need for innovation encourages **creativity** of everybody, and therefore causes the evolution of **democracy** as a societal mechanism making room for *creativity and holism*, not only as *democracy in politics* (with many parties, civil society etc.), but also in *economics* (with free entrepreneurship, choice of job, profession etc.), *on shop floor* (with invention and innovation circles, quality circles, leadership instead of

*Fig. 4.6: The cybernetic circle of the preparation and implementation of*

*the management process (a simple model)<sup>233, 234</sup>*

| MANAGEMENT PHASES        |    | PREPARATION PHASES                                                |
|--------------------------|----|-------------------------------------------------------------------|
| Definition of vision     | ⇐  | Drafting of vision, mission, policy, strategy, tactics, operation |
| ↓                        |    | ↑                                                                 |
| Definition of mission    |    | Definition of starting points for drafts and                      |
| ↓                        |    | Consideration of experiences & theory                             |
| Definition of policy/ies |    | ↑                                                                 |
| ↓                        | ⇐= | Intervening when and where needed in all management phases        |
| Definition of strategies |    | ↑                                                                 |
| ↓                        |    |                                                                   |
| Definition of tactics    |    |                                                                   |
| ↓                        |    |                                                                   |
| Running the operations   | ⇒  | Checking the results of operation                                 |

managership, i.e. a co-operative instead of a commanding management etc.), *in family, education, local community life, etc.*

**The innovative society** differs from the (foregoing, historically) routinized society:

- It applies all achievements of development of the worldwide civilization.
- It accepts and applies its own and foreign inventions and innovations rather quickly.
- It applies foreign knowledge to upgrade its own knowledge in order to effectively develop and use all the technologies of production, organization, education etc.
- It, on this basis, attains both a high international competitiveness and quality of life.
- Its inventiveness and innovativeness, both as attributes and activities, reach (at least) the West European level, so do their preconditions.
- The creative co/workers, scientific and other inventors and innovators are well appreciated because they are the most useful co/citizens and co/workers.
- The uncreative individuals are in trouble, especially the ones under-using their natural and learned capabilities.

**The dialectical system of attributes of an innovative society** includes:

1. A contemporary, creativity-based *democracy* both in the entire society and all / most organizations.
2. A contemporary, creativity enhancing *market* in which, as well as in the democracy, innovative persons and organizations prevail and reign.
3. A contemporary perception of *ownership*, which tells clearly the responsibility and includes creative and innovative ambitions rather than seeking rent (as an income based on owning without creating) only.
4. A contemporary perception of *innovation*, which says that innovation is every useful novelty accepted as such by customers and granting the suppliers a suitable profit / benefit, too.

<sup>233</sup> Consideration of the environment - business, political, natural, etc. - is not visible directly in Fig. 4.6., but it is part of consideration of experiences and every other information entering the process in Fig. 4.6, as well as information going out of this process.

<sup>234</sup> All phases in the model are linked by information and information requirement: the foregoing phase produces, in a best case scenario, all information required by the next following phase and only that information. In the case of innovation management this precondition is even harder to meet than in the case of a routinized management, because the decision must be made while all information cannot be available: the future market's / customers' reaction to the supply offered will determine what is a **failure** and what is an **innovation**. (See: Peters 1998)

5. A contemporary way of running the business, the *innovative business*, which continuously strives on innovation of any kind discussed here earlier.
6. A contemporary perception of entrepreneurship, i.e. *innovative entrepreneurship*, which means that not every owner of an enterprise is an entrepreneur, but only the one who combines his or her business factors in an innovative way in order to produce innovation and live on it.<sup>235</sup>
7. Education and other societal subsystems which are not economy and business, but rather create human resources, circumstances and preconditions for them to flourish, and therefore also *support innovation rather than routine*.

#### 4.8 COMPLEXITY, INNOVATIVE SOCIETY, SYSTEMS THINKING, AND CLIMATE CHANGE – CONCLUSION ABOUT APPLICABILITY OF THE DST TO SOLVING THE CLIMATE CHANGE ISSUES

The process of surfacing of the innovative society, which is still limited to 20% of humankind right now (Dyck, Mulej 1998, 1999), is obviously also a process of a growing complexity. Therefore, it is also a process creating a growing need for systems thinking. The climate change is one of the serious **symptoms** of the rather hidden background of these problems – of the practical lack of holistic / systems thinking, which is still too far away from the LvB's ideal, which in its turn is coming to be more and more a precondition of survival of humankind.

DST is usable and useful for discovering and solving the problems of the climate change. One starts with finding out that there is an entropy process demanding a requisitely holistic and innovative problems solving. The process runs for natural reasons according to the law of the hierarchy of succession and interdependence. This law requires the framework process to be foreseen, and therefore the subjective and objective starting points of the decision makers to be defined. Hence, the guidelines concerning the definition of the starting points apply. Once the work has been planned, which the decision makers and their advisers have done, the work must also be executed. In this phase narrow specialists enter the scene, and therefore their managers, as coordinators, must apply the further guidelines from DST, namely the ones concerning the realization of the defined objectives, goals, and procedures. – The main difference, in the case of climate change, is not the approach, but details of the contents. It is the finding out the facts concerning the environmental care, the sustainable development, and their resulting / emerging impacts over the climate change; what follows all this, is taking the measures aimed to more / requisitely holistically control the cause of the dangerous climate change by innovative measures.

#### 4.9 CONCLUSIONS FROM THE CHAPTER 4

In human history, there have always been **innovations**, which solved some current human problems. Mostly, they have **not** been **holistic enough**, and caused new problems along with solving the earlier ones. Thus, over millennia, humankind came to the 20th century as the **century of living on innovation**. The 21<sup>st</sup> century is not promising to be any easier to handle. Both the speed and style of life are dictated by the **innovative societies** and their economies under the name of **market and competition and democracy, globalization** being added. Crises are permanent, and they demonstrate that **entropy** is a permanent tendency, which continuously requires both innovation and holism. Systemic thinking helps us better than one-sided thinking, co-operation helps better than isolation, and creativity helps us better than

<sup>235</sup> Ownership on legal terms is not equal to ownership on economic terms. (Mulej et al. 2000)

routinism. **Innovative business** is supported in **innovative societies**, USOMID and similar method support effectiveness and efficiency of efforts aimed at **excellent systemic quality** in order for the suppliers to satisfy their customers (better than their competitors do<sup>236</sup>). **Innovation management** needs to take care of all these preconditions in all details. They are not discussed here, but in other books, which on the other hand do not include these background materials.

Let us finish with four **quotes** about systems thinking from distinguished authors:

»It is in the nature of systemic thinking to yield many different views of the same thing and the same view of many different things.« (Ackoff, 1999; a comment on: Flood, 1999)

»In the present global market, systemic thinking has risen to a position of prominence never before attained. Globalization, networking and coalition building are examples of systemic behaviour that stress the need to view and deal with issues holistically, rather than in isolation.« (Sulaiman, 1999; a comment on: Flood, 1999)

»[In this book] you will see and hear, again and again, that:

- We will not struggle to manage over things – we will manage within the unmanageable.
- We will not battle to organise the totality – we will organise within the unorganisable.
- We will not amply know things – but we will know of the unknowable.« (Flood, 1999, 192)

»Systemic awareness begins with a spiritual appreciation of wholeness. Wholeness may be appreciated in terms of

- interrelatedness of events, and
- spontaneous self-organization leading to emergence and new order.« (Flood, 1999, 192)

Thus, we are living between mystery and mastery. (Flood, 1999) Requisite holism is also somewhere there between these two extremes of knowledge/information about reality.

Innovation management is an extremely good case of the permanent need for systems thinking, these quotes tell us. Including the dealing with the issues of the climate change.

So far, we were able to see that the **DST** as a methodology of building bridges of co-operation of an interdisciplinary and creative kind is **applicable** to solving the climate change issues. DST tries to make an *impact* over the *human personality* and then to use this – new and more holistic personality – as subjective starting points in a process of making inventions and innovations. But we also stated that the DST is neither the only systems theory around nor the only one to be potentially applicable to solving the climate change issues well enough.

Therefore, let us take a brief look at a selection of other systems theories. We will do so in Ch. 5, after we take a look of the interdependence of the climate change and our civilization.

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<sup>236</sup> Let us finish with the following anecdote. Two friends were out there in the nature. They were taking some rest. All of a sudden, they were attacked by a wild animal. When they saw it, one person started running barefoot, the other took his time to put his shoes on. “Do you intend to run more quickly than the animal, if you put your shoes on?” “No, but more quickly than you, this is enough for me to survive in this competition.”

## **4.TR THE CLIMATE CHANGE SYSTEM AND OUR CIVILISATION SYSTEM**

### **4.TR.0 THE SELECTED PROBLEMS AND VIEWPOINT OF DEALING WITH THEM IN THE CHAPTER 4 TR**

The climate change system as an integral part of the Earth biosphere, has a bigger influence on our civilization as we humans of our civilization think and believe. In absolute terms the climate change is making our life possible. But we humans are mostly trying to do our best in our modern relations to nature and each other not to appreciate this fact, but to harm the climate change system as much as we can, yet fortunately not as much as we think we may.

### **4.TR.1 THE CLIMATE CHANGE SYSTEM AND OUR CIVILISATION**

There is a theory of the anthropocentric interference with the climate change system, which is trying to explain reasons for the climate change caused by our civilization over the last 200 years, 1800 – 2000, and we would like to discuss it and to assess feasibility of such a theory.

The philosophy about this issue was written many centuries ago when the story of David and Goliath appeared. But by our standards we humans are not viewing our David-like abilities and impacts as a general practice, and we do not know what we are, what is our natural system, which systems we are interacting/interrelating and co-operating with, and where do we belong. What we do understand is how to make money out of our civilization and how to use the nature's richness for it. What are our impacts and what could be their consequences, most of us humans do not care. What about the living of our civilization on the Earth, we have to recognize the biosphere's capacities for our, human, species to be successful rather than harm ourselves. It is not only competition but also and mostly co-operation, which is making our species live. As long as we shall live on the present paradigm, which could be seen as "the ostrich head", rather than take the long-term responsibilities for our civilization's impact on our own biosphere, so long we shall be increasing the difference/distance between our civilization and our nature/our biosphere.

It is *not the planet Earth* that is the home of our civilization, but *the biosphere*, which is a tiny part of the planet Earth. Vulnerability of the two are two, not even comparable issues.

What is the present status of our civilization like, do we see our civilization requisitely holistically – as a system, and what are interdependences/interactions and co-operation needed for a sustainable future of our civilization, are the issues of "to be or not to be" and important only for our civilization's well being.

### **4.TR.2 OUR CIVILISATION – FROM WHERE ARE WE?**

If we accept that the origin of our ancestor, the Homo Sapiens, has been dated some 100.000 years ago and her first settlements some 12.000 years ago (the first settlements in Eurasia), and great cultures (China, India, Mesopotamia, Egypt, Persia) 7.000 – 3.000 years ago, we may discuss *from where* we are. But *what* we are, from point of view of the natural sciences – biology of the biosphere and planet Earth, this issue is not included into any old script or our predecessors' philosophy. Religions – the permanent supporters of our civilization are our predecessors' innovations, but they have never discussed the origin of the civilization. Their focus has always been on human being and how to get from people as much as possible.

Existence, economics, and ideology have always been interdependent. Warriors, kings, rulers, democrats from the past (such as the ancient Greeks some 2.500 years ago) and present, religious / spiritual leaders, politicians and many others, who have been self-appointed, elected or appointed, were products of their time and ruled as they ruled. The tribe stories – on and by people, chiefs, and spiritual leaders – describe what we are, but do not discuss what are we doing for our living, and what is our civilization's impact on the biosphere.

#### **4.TR.3 WHERE DO WE BELONG?**

If we accept that we humans are an integral part of the planet Earth biosphere – nature, and the peak of the life tree on the planet Earth, from the natural sciences point of view, and take system theory as our thinking tool, we may say that we belong to the planet Earth biosphere.

Thus, our civilization is *one of the many life systems* inside the planet Earth biosphere and we may say that we are one of the planet Earth civilizations. And which are other civilizations? From our research we may point to many living creatures and large civilization, which are outnumbering Homo sapiens by the number of their members many times. Among the largest populations are microbial species, etc. It is known that survival is based upon availability of food, water, air, and space, but what has never been considered, is the impact of the species on the food/water/air/space availability. In the nature many species are known, which have a short lifetime, as individuals / individual representatives of their species, but as species they have been within the biosphere for very long time. The classical case are microbial cultures – parasites, which destroy their host and themselves, but not as species, but as a present culture invading the host. This is a life story, one among many others. And the nature has taken care of matter transition within the kingdom of life. It is a permanent system of matter transition from “ashes to ashes”, not used for ruling the humans but symbolizing the cycling of matter within the biology of the biosphere.

Let us see ourselves in this context. First scattered settlements were where the food, water, air, and space were abundant, and settlements flourished. When settlements had come together, the cultures/nations were established. And as long as the food, water, air, and space were abundant the culture was in good shape, but when food, water, air or space became restricted, the culture went down. So finally our civilization became our and global rulers of the planet Earth. After a few millennia, food has still been abundant (in 1960's), and water was abundant (in 1960's), and air is abundant (at the beginning of third millennium), and space looks like being abundant. But at the end of second millennium the food was no more abundant, the water was no more abundant, the air was no more abundant, and only space still looked like abundant, which in fact is neither so any more. Is the end of our civilization approaching us?

From the natural sciences point of view: yes, it is. But, any culture in the biology of the biosphere has its time of birth, childhood, adulthood, old ages, and history, anyway.

#### **4.TR.4 CONCLUSIONS FROM THE CHAPTER 4 TR**

The novelty to be attained – and to be made innovation – could be the ability of the current Homo Sapiens to think, understand, and learn, how to *requisitely holistically* manage our own civilization affairs, e.g. to all humans food, water, air, and space for living. This task can be done better, if the systems thinking is used. Several systems theories can help us, and can be differently applicable in different problem situations. Let us take a look at some of them.

## 5. SOME OTHER (SOFT) SYSTEMS THEORIES AND THEIR APPLICABILITY TO THE ISSUES OF CLIMATE CHANGE – A BRIEF OVERVIEW<sup>237</sup>

### 5.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 5<sup>238</sup>

Systems theory has developed as a methodology, too, not only as a worldview. Experience says, that the extremely broad thinking, which LvB has required from humans, reaches *beyond limits* of capabilities, values, ethics and interest/s of nearly all men and women on the planet Earth today (see Ch. 1). Humans need what *they* find a requisitely realistic approach, less limited to the general part of attributes only (and hence less oversimplifying, too reductionistic), except in the case of the aim to find out the most frequently repeated attributes (which is good enough in *a phase* of the scientific work, but less so in other phases of it and in the »real world«). This fact might belong to reasons that the GST is not much supported, in practice. New theories of a very similar orientation, which is toward general isomorphism and common policies / rules have shown up over the last years. The most recent two are called the *chaos and complexity theories*.

### 5.1 THE CHAOS THEORY AND CLIMATE CHANGE

The Chaos Theory first emerged in physics and was considered a mathematical discipline, but it tends to be widely used in other areas (= i.e. from other viewpoints of dealing with life), too. In this book you may find that this is so, because its authors tend to (informally and independently!) apply the (dialectical) systems thinking, although such a purpose is not explicitly formulated<sup>239</sup>. Of course, newer attempts bring new capabilities of insight, and one can say that in some respects, the Chaos Theory is renewing the systems thinking (see: Mulej et al. 2000; Mulej and Kajzer 1994; Huang, in Vezjak, Stuhler, Mulej, eds. 1997; Shirhall, in Dyck, Mulej and coauthors 1998, 1999; etc.). This is clearly visible from the quotation:

Chaos theory is dealing with »real units or entities,  
which cannot be foreseen and are not linear,  
and were excluded by the Newtonian science<sup>240</sup>«

(see: Kiel and Elliot, eds., 1997).

In other words, *the processes are chaotic, if their behavior is partly deterministic and partly indeterministic, hence **partly foreseeable***. In the language of dialectics, one would say that both types of behavior are a consequence of interdependence, which is always visible as the

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<sup>237</sup> Matjaz Mulej

<sup>238</sup> We will present the following systems theories rather briefly because they are much easier to find in English references than the DST that has so far had mostly conference and article presentation, internationally, or as a chapter in e.g. Dyck, Mulej, and coauthors (1998, 1999).

<sup>239</sup> This fact is possible because both Dialectics, Systems Thinking/Theory, and Chaos Theory tend to try to find out the plain natural backgrounds of reality and of thinking about it. There is no mystery about Systems Theory, it only fills in the leak produced because humans were stressing the *complicatedness* aspect for centuries so much that they lost the *complexity* aspect. The latter now must be discovered and found crucial again.

<sup>240</sup> As we suppose our readers to know, the Newtonian science calls only the deterministic processes and events scientific. If an event was only probabilistic or even possibilistic, it could not be considered scientific. – This attitude has obviously changed, over the last decades: practically all disciplines apply statistics, i.e. deal with probabilities and possibilities, not only the totally foreseeable processes/attributes. (See footnote featuring Prigogine above.)

*unity and fight of adverses*<sup>241, 242</sup>. On this basis, unforeseeable processes may have foreseeable consequences, and foreseeable processes may have unforeseeable ones<sup>243</sup>. This is why complex processes cannot be watched and managed totally realistically in a linear manner, especially not if the observer / manager limits himself or herself to a single viewpoint. Consequences of complex processes are normally caused by *interactions* and come to be *emerging synergies* of interactions of life components which are partly interdependent, partly independent, and partly dependent, at least in a given moment / period of time, rarely for ever. Besides, these units tend to include in the process different parts of their own attributes on different occasions<sup>244</sup>.

The same finding can be found about human attempts to master a process or a situation (and even to do it once for ever). There is usually a certain level of *self-organization*, especially in nature, but also in enterprises and other human-created organizations. Research, even a lab-based research can provide for insights which are usable on a *framework / model basis* rather than directly and/or linearly. This experience reflects the fact that **life is nonlinear**, and so is everything else, which is worth human consideration today (Kiel and Elliot, eds., 1997)<sup>245</sup>. Nonlinear processes are »sensitive to the starting conditions«<sup>246</sup> and to the mutual interactions between the processes under consideration and their environment/s that may show up later on.

In other words, both predictability and its lack exist at the same time and in a networked style<sup>247</sup>. On the level of individual attributes, the processes are unforeseeable, on the more general level statistics can show averages and deviation from them, thus more attributes of the entity as a whole can be foreseen more easily (if conditions do not change too much). In the language of the Newtonian science the entity as a whole would be called *a disorder*. But

<sup>241</sup> In business, this attribute is usual. Businesses are organised in specialized subunits, such as marketing, sales, supplies, finances, accountancy, production, etc. They belong to the same enterprise (which is their unity), they have also mutually different attributes (which are their adverses), and they are interacting (which is their way of what philosophers have called fight). The outcome of their common project work, e.g. professional preparation of a new investment, can neither be fully predicted nor fully unexpected; it may depend on a business function which may prevail over the others (even too much, sometimes), or on another, or on their synergy/ies.

<sup>242</sup> Climate is chaotic, on the said terms, too. It is under influence of both human interventions and natural processes with no human interventions, as well as their emerging synergies.

<sup>243</sup> This finding is true of weather, including climate and its changing, economy, societal processes, nature, too. In general, e.g. we know what is the result of the interplay of supply and demand and price in a market, but we cannot be totally sure what may happen in every case. A potential buyer may or may not become a real buyer, if the offer seems favorable (as estimated by the supplier). In nature, a medicine can help cure a disease with one person, and not so with another; circumstances may be different from case to case, although a generalisation does not include differences. (See Fig. 3.2 again!) Etc.

<sup>244</sup> Your own dog or other domestic animal is not always equally friendly. A coffeeshop etc. may be »in« for a while and then abandoned, the reason not being clearly visible. The same may be true of different sports. – Whenever there is a choice of different decisions and actions, the conditions are chaotic. Hence, chaos is very natural, not a problematic situation, which can and should be dismissed, but it is a hard one to live with on a routinized basis.

<sup>245</sup> Linearity would mean that the future events / attributes / processes could be foreseen on the basis of extrapolation on the basis of the past ones; in such a case conditions and circumstances would not change, deviations from the old general trend would be blocked off by the *negative feed-back loops*. In practice, this can sometimes be attained, but there are also *the positive feed-back loops*, which reinforce the deviation. Then, a new event / attribute / process shows up, such as a new plant, an organizational or technological innovation, a new government, a new country etc.

<sup>246</sup> Compare with the Law of hierarchy of succession and interdependence in the Dialectical Systems Theory!

<sup>247</sup> In the language of dialectics we can see a delimitation of all attributes of a given entity in three interdependent subgroups / subsystems / partial systems (recall Fig. 3.2 again). The *general* subsystem contains the attributes which are shared by all members of the entity, e.g. to all in the same enterprise. The *group-specific* subsystems contain attributes, which are common to some groups, but not to all members of the given entity, e.g. shared by both marketing and the finance department etc. The *individual* attributes do not show up again with other members of the same entity, e.g. the very individual data of a person, such as the number in the identity card, finger print, etc.

statistics shows the level of possibility and probability that an *order* shows up anyway<sup>248</sup>. Actually, as we can see, both order and disorder exist at the same time, are interdependent and interactive, which causes and enables, at least, the *complicatedness and complexity* as well as the existence of the real life and its parts. This is also the basis that – in terms of the Newtonian, hard-systemic, thinking – the Chaos Theory makes an **unusual framework of theory** (Richards, in Kiel and Elliot, 1997).<sup>249</sup> It requires its users to think *systemically* rather than traditionally, and thus to give up research per parts and the summing up of partial findings with no emerging synergies. In reality, the entire object cannot be cut to parts, which no longer influence each other, and still be what it used to be<sup>250</sup>.

If we had time for details, we could see that the chaos theory presents an interesting further step of those kinds of the systems theory/ies, which have not evolved into tools of single rather narrowly specialized disciplines, but have kept a more **general validity**. Let us hope that its development is not over yet: humankind of today lacks methodologies, which would be able to combine exactness and usefulness in one, which most topics could use quite well (e.g. Geyer, 1997).

If compared with DST, the chaos theory does **not** explicitly deal with the formation of human **personality** – the subjective starting points, but with the natural phenomena and their general attributes. This makes it useful for understanding some aspects of climate change, but less for providing to humans of today a clear orientation what to do about it and how to approach it.

Another modern version of systems thinking, which also deals with complex problems and fights the traditional thinking style, is called the Complexity Theory.

## 5.2 THE COMPLEXITY THEORY AND THE CLIMATE CHANGE

Recently, a good summary of the basic attributes of the **Complexity Science** was published (Dent, 1999). The purpose of his article is said to be “to offer a simple definition for Complexity Science and to demonstrate the shift in worldview necessary for Complexity Science to become second nature to people as traditional science is now. – Simply put,

*Complexity Science is an approach to research, study, and perspective  
that makes the philosophical assumptions of  
the emerging worldview (EVW) - these include  
**holism, perspectival observation, mutual causation,  
relationship as unit of analysis, and others;***

**see Table 1**” (exposure ours, to stress that systems theory / thinking is receiving another endeavor / support, after many had forgotten about it<sup>251</sup>). “Classical science, as practiced in the

<sup>248</sup> A single individual reaction of a potential customer to the offer of a (new) product or service or procedure cannot be a good basis for the conclusion about the entire selling. A big enough sample, put together according to statistical rules, can provide for a quite good basis, although with a certain risk. The same is true of election forecasts, measurement of public opinion, estimation of potential business decisions etc., practically of every unlinear process. The old supposition that processes are linear, is now found an oversimplification, a case of reductionist thinking. (Richards, Brown, McBurnett, Rosser, Jr., etc. in Kiel and Elliot, eds., 1997). The foregoing footnote provides for an explanation from another angle, the one of philosophical generalisation.

<sup>249</sup> Does not this statement sound like the ones about LvB and the DST? Very much so. Humans tend to forget, make oversights, and invent anew, therefore, rather than apply the given sources. Nobody can read everything available.

<sup>250</sup> Extreme cases: a broken mirror can not again be a mirror, neither can a broken egg. Research by disciplines finds out physical, chemical, economic etc. laws in mutual isolation, and tends to forget about their mutual impacts.

<sup>251</sup> Let us make a short comment to the said notions:

20th century, for the most part makes the philosophical assumptions that will be labelled here the traditional worldview (TWV) – which include underlying assumptions of **reductionism, objective observation, linear causation, entity as unit of analysis, and others**” (exposure ours again, as above). “This TWV, which has allowed people to make significant achievements in many fields, is no longer serving as a reliable guide.” (Dent, 1999, pp. 5-6) - His entire Table 1 demonstrates the contrasting differences.

An additional quote may make sense (Dent, 1999, p. 7): “It is important to note that theorists are not suggesting that the traditional underlying assumptions are wrong. In fact, many of them seem to be useful in localized settings. For example, Prigogine and Stengers (1984: xxiii)<sup>252</sup> see **determinism and indeterminism** not as irreconcilable opposites but “each playing its role as a partner in destiny” (exposure ours, as above). Between bifurcation points<sup>253</sup>, determinism is operative. At a bifurcation point, however, indeterminism takes over. Consequently, indeterminism (which does not dismiss localized determinism) and other emerging assumptions seem to be more useful abstract concepts. They reflect reality more accurately in a large number of instances.” Etc.

Experiences, which we have made with two conferences applying Complexity Theory to management, in 1999 and 2000, and a long discussion by internet ever since, demonstrate that complexity is reviving the good principles of systems thinking very well and with good promises (NESCI, 1999; NESCI, 2000). But, in terms of **applied method(ologie)s** supportive of complexity as a worldview, at the moment we still better turn to the DST and some other contemporary Systems Theories. Alternatives have yet to show up.

In terms of the climate change, the above wording “localized settings” does not apply a whole lot. The nature, and climate as its part, is not limited to any local setting, although it differs from locality to locality, in the individual part of its attributes. It is rather full of complex problems of mutual impacts and enhancements by a broad-minded / narrow-minded co/operation of many agents in nature incl. humankind of today, such as different enterprises of the same area or different industries from the simple old-fashioned farming and trading to the most modern high-tech ones, local and other authorities of several administrative levels, non-governmental organizations, population (as individuals, families, interest groups etc.). Complexity Science, as an EWV, on the other hand, does apply. But it may need a methodological support to be useful and beneficial.

Hence, let us turn to some other contemporary soft Systems Theories.

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- **holism** is the basic attribute of systems thinking and Systems Theory;
  - **perspectival observation** is based on the selected viewpoint in them;
  - **mutual causation** is expressed by interaction in them, and
  - **relationships** as unit of analysis are expressed by interdependence in them, as their background of interactions.

The point is therefore somewhere else: forgetting about the important impact of the **selected viewpoint** (which is stressed explicitly and specifically in Mulej's DTS most of all), and forgetting about the need for **interdisciplinarity** as the basis of holism and transdisciplinarity, prevent the GST from a valid explanation of the complexity of reality. This is the hole in the whole, which the complexity theory is filling in.

<sup>252</sup> These two authors are cherished by systems community very highly. This is another demonstration of the close link between the Complexity Theory and the Systems Theory; they both represent “EWV” in terms of Dent (1999), we see.

<sup>253</sup> A bifurcation point is a step in the process in which several options are possible, and it is hardly possible to foresee all the consequences of each option. Thus, judgement and decision with a poor information basis are needed rather than routinized behavior, if one likes it or not.

### 5.3 A SELECTION OF CONTEMPORARY SOFT SYSTEMS THEORIES – A COMPARATIVE VIEW CONCERNING THEIR USEFULNESS TO THE ISSUES OF CLIMATE CHANGE

#### 5.3.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 5.3

In its first decades, until 1970s, the traditional (i.e. linear and descriptive) Systems Theories prevailed or even were the only ones around (Jackson, 1991). Later on, several authors found that this was leading to an over-generalization, which tends to be poorly realistic. One interesting distinction, among many, showing differences between the existing systems theories (Mulej, Kajzer 1998), is the delimitation between soft and hard systems theories.

The **soft** systems theories, according to Checkland (1981), include the ones, which presuppose that the

*output depends on input probabilistically  
rather than deterministically.*

In machines and similar technical products, a hard-systems behavior is needed, expected, and aimed at; this is why mechanics, technical cybernetics, including automation and computerization, etc. are supposed to produce very reliable outcomes as responses to the foreseen impacts (such as switching on the electrical lightening at home, starting a car etc.). The notion of soft systems resulted from the experience of prof. Checkland (while he still was a TR&D researcher in a high-tech company in UK) that a manager cannot expect his team members to respond to his or her initiatives in a hard-systems style. He expressed the difference also by denoting the **topic** of the soft-system approach as *action* and *action research* (rather than discovering natural facts and/or designing tools on their basis). **Human action** differs from the processes, which are *not* running on *conscious self-organization or organization*, but on laws, which reflect / are natural facts and are studied from the viewpoints in which the natural and engineering sciences are specialized. The previous concept of the General Systems Theory and Cybernetics that there are generally valid isomorphisms, came to be found limited to smaller groups of features, events and processes rather than general. *Humans*, as individuals and as groups, are the part of nature, which is *not designed, but acting*. They act along the lines of their circumstances and conditions, and their own ethics, interests, knowledge, skills, perceptions of real circumstances, of laws of physical and other reality, their own selection/s of preferences in terms of both needs and possibilities.<sup>254</sup>

Recent decades produced *more differences* inside the systems movement, not only the limitation of the General Systems Theory to a small portion of the attributes considered as the general ones, and not only the differentiation into the hard and soft systems theories. We, the authors of this summary are not feeling qualified to discuss any details of the *hard systems theories*, they are mostly worked on by engineers aiming to design and produce reliable and

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<sup>254</sup> We hope that this brief comparison of concepts of soft and hard systems does not make an impression that we think that either soft systems or hard systems are more important than the other group, or even exclusively important. Far away from such a one-sided, biased notion. We try to say that it is up to the viewpoint of consideration, managing, working in production or elsewhere, which *part* (subsystem or partial system) of the really existing attributes of the object (i.e. feature or event or process) under consideration belongs to the group / system / dialectical system of the *essential* attributes, viewpoints of dealing with them, their environments, their mutual interdependencies and other relations. The others come to be neglected, with all the potential consequences mentioned earlier in this contribution, in the requisite holism is defined too narrowly or too broadly.

helpful tools such as machines etc. Our education and experience limit us to the *soft* systems theories, because they help us deal with *social aspects* of the real life and the human action in it. Inside this set of systems theories there are a number of them, which we want to brief in this contribution, in order to help the readers to make their choices of their (mental) tools, when they will be dealing with the problems and other topics of the modern life of the 21st century, including the climate change. Another contribution should support a similar selection among the hard-systems theories.

We will brief a few soft systems theories, which we find promising in terms of the modern life of the 21st century. We will have no room for details, of course. Our choice includes:

- The Viable Systems Theory, because it sheds a new light on hierarchy of subordination in organizations as organizational systems. It requires co-operation and communication rather than commanding.<sup>255</sup>
- The Soft Systems Methodology, because it offers concepts and a framework method of working on solving problems tackled by action research.<sup>256</sup>
- The Dialectical Systems Theory, because it offers concepts and ways of influencing the human beings, who are supposed to work and cooperate in organizations as organizational and business systems. In modern circumstances, they are supposed to attain as much holism and innovation as possible.<sup>257</sup>
- The Critical Systems Thinking, because it tackles management, especially conflict management, and offers a matrix-type combination of a »system of systems methodologies« and »a matrix of conditions and problem situation«. It enables selecting of a proper methodology when one works on solving a given situation / process / event.<sup>258</sup>
- Cybernetics, because it does not concentrate on description, but rather on solving the problems tackled. The evolution of cybernetics makes it more and more usable and useful in organizations as organizational and business systems.<sup>259</sup>

The role of information is essential in both cybernetics and all kinds of systems theories. Sometimes it is conceived too narrowly. Hence, we are adding some comments on it.<sup>260</sup>

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<sup>255</sup> In the case of dealing with the climate change, the Viable Systems Theory matters, because it allows for a democratically organized co-operation, which might activate more creativity and holism than a commanding hierarchy with a boss to whom no subordinate individual / group may say a word of disagreement or suggestion.

<sup>256</sup> In the case of dealing with climate change, the Soft Systems Methodology matters, because it makes possible a well arranged process of thinking, which combines insight in reality, working on models in a R&D lab style, and returning to reality including adapting of the models to reality before using them.

<sup>257</sup> We dealt with the Dialectical Systems Theory (DST) earlier (see Ch. 4), hence we will only mention it here, to classify it as a part of a larger subgroup of Systems Theories. As we saw, the DST matters in the case of dealing with the climate change, because it points to the starting points of the processes (and guides them), as their background. DST also provides for attitudes and methods making the interdisciplinary creative co-operation possible. This leads toward (a requisite) holism of action and solution.

<sup>258</sup> In the case of dealing with the climate change, the Critical Systems Thinking is important because it refuses the uncritical tackling of any fact, speaks for consideration of interdependence under the label of complementarism, for holism, especially with its applied methodology called Total Systems Intervention, and for creativity under the label of emancipation of participants.

<sup>259</sup> There are several versions of Cybernetics, called Cybernetics of the 1st order, of the 2nd order, of the 3rd order, and of the conceptual systems (see: Umpleby and Valsee, in: Mulej et al., 2000). The first one covers observation of events and processes only, the second one includes human involvement in the observed process, the 3rd one specifies it in observation, decision making, and impacting, the one of conceptual systems includes impact over human concepts / thinking and feeling. In the case of dealing with the climate change, the last two are more realistic and may serve us better than the first two.

<sup>260</sup> In the case of the climate change, information matters a lot, because it is the basis of a more or less holistic insight and of the action based on it.

Complexity is real, but also stressed a lot by systems theory. It can be hard to handle. We are hence also adding some ideas about some tools usable for *simplification of management* in / of complex processes and situations.<sup>261</sup>

### 5.3.1 THE VIABLE SYSTEMS THEORY (VST)<sup>262</sup>

Stafford Beer, the author of the VST, defines viability as the

**capability** of an entity such as an individual or an organization  
**to survive** in a rather demanding environment

(Espejo, in: Mulej et al. 2000).<sup>263</sup> His viewpoint of research and application is *management of complexity* which arises from inside and outside the organization / individual under consideration. Relations expressed in impacts over the organization require this organization to behave according to the *law of requisite variety*. It means adaptability, which requires a response to be prepared and used against every potentially dangerous impact from the environment<sup>264, 265</sup>.

Toward this end, the organizational principles must free creative capabilities of organization's members by enhancing their *autonomy* along with caring for *cohesion* of the entire organization. This is made possible by stressing mutual *communication / information flows* enabling working and co-operation rather than hierarchical subordination limited to subordination without creativity and decentralization. Complexity namely shows up both in environment and inside the organization. If the lower levels, in terms of the traditional hierarchy of subordination, receive enough autonomy and information to be able to do their jobs efficiently and effectively, the *remaining variety* does not burden the central top management too much<sup>266</sup>. Knowledge of the *information requirement* and good information channels, along with *diminishing disturbances* from the environment, and *strengthening its impacts* over its environment, are the bases for the person / organization to act as a viable system.

A to-be-useful work along the lines of both research and practical solving of the problems of climate change should well consider these experiences.

- Hierarchy should not be too much of commanding, but rather *supply of information* top down and bottom up, as well as from one's environment and into to.

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<sup>261</sup> In the case of the climate change, simplification (of thinking and models) matters, because climate is a very complex feature on its own, and the climate change is a synergetic result of very many human actions and natural processes. See chapters having TR in their titles in this book.

<sup>262</sup> Dusko Ursic and Matjaz Mulej

<sup>263</sup> S. Beer, at the end of the World War II, was a psychologist trying to help soldiers to return to a normal life, i.e. to become viable on their own, after years of total subordination and stress as soldiers, in a very different setting, and to free themselves from the mental problems caused by war experience. Later on he helped many organizations and countries find their place and control their destiny more holistically.

<sup>264</sup> The law of requisite variety differs from the law of requisite holism. It is older, but more narrowly oriented into a requisite holism in relation of an entity to its environment from the viewpoints of keeping the entity's identity and having material means to fight the bad impacts from environment.

<sup>265</sup> In a recent discussion by e-mail with prof. Mulej, prof. Umpleby put the difference between the two laws very well as follows: The law of requisite variety addresses the completeness of material resources available in dealing with one's environment. The law of requisite holism addresses the comprehensiveness of the mental model to be applied in research, action, etc. (Umpleby, 14 January, 2002)

<sup>266</sup> In other words, if the top management or any other manager is democratic enough and behaves as trainer and information supplier to his subordinates rather than as their commander, they can do a lot of work instead of him or her. He or she has to take care of the jobs, which they cannot cover, and this is called *the remaining variety*.

- Research should provide for knowledge, operation management should use it on the basis of “now and here”, top management on the basis “there and then”, i.e. from broader and long-term viewpoints.
- Communication channels should help members use the “requisite variety” in both blocking off the impacts from environment and strengthening the impacts over the environment.<sup>267</sup>

### 5.3.2 THE SOFT SYSTEM METHODOLOGY (SSM)<sup>268</sup>

P. Checkland, whom we mentioned above as the author of the distinction between hard and soft systems, developed also a **framework methodology of dealing with soft systems** called SSM. It consists of seven steps, which are delimited into a group of five steps (1, 2, 5, 6, 7) concerned with the real-life situations in a *hands-on style*, and a group of two steps (3, 4) concerned with them in a *lab-style*. (Mingers, Ursic in: Mulej, 2000, and earlier).

SSM, as a procedure,

- allows for *permanent learning*,
- includes interdependence by both the notions of *cultural diversity* and *wish to co-operate*,
- helps us care for holism by its aim to explain the *problem situation* (including its context!), not the concrete problem only.

**Objectives** are hard to define and require us to work on their definition first. This work includes finding out the initial state of the situation under consideration, its components, structure, processes, clear description of the given state and possible options, contents and influential circumstances of the intervention, contents of the problem and of its solving.<sup>269</sup>

This is the basis for one’s transitions to the lab-style (called **systemic thinking** by Checkland). One should attain a *broad and deep enough understanding* of both the situation and trends, of all essential viewpoints of the action under research such as customers, doers, transformation, aspects, owners, and environment.<sup>270</sup> These findings and ideas should make possible the *modeling* of activities for a transformation to follow. In the next phase (no 4) the ideal model (called formal system) and conceptual model (about the way of solving the problem situation under consideration) are composed from the viewpoints of what and how should be done<sup>271</sup>.

Models may have to be changed in the lab-style, but they are after that also *confronted* with the hands-on **real situation**, in phase 5. In phase 6 one finds out, which *changes of the model* are desired and able to happen, before *action* takes place, in phase 7.

In terms of dealing with climate change, the MMS model provides for *learning and action* to be interdependent and thought about quite holistically. Perception, argumentation, comparison, decision-making and action – they all may be covered in a quite holistic style<sup>272</sup>. The result is not simply a solution to a problem, but a *change in the broader situation*,

<sup>267</sup> On the basis of ideas of S. Beer, his followers have developed an interesting applied methodology called Syntegration (Espejo et al., 1999).

<sup>268</sup> Dusko Ursic and Matjaz Mulej

<sup>269</sup> The phases 1 and 2 can be supported by five reminders for thinking. (Mingers, in Mulej et al, 2000).

<sup>270</sup> The phase 3 is supported by six reminders for thinking. (Mingers, in Mulej et al, 2000).

<sup>271</sup> The phase 4 is supported by a system of 9 + 8 reminders for thinking. (Mingers, in Mulej et al, 2000).

<sup>272</sup> The real level of holism depends on persons defining answers encouraged by SSM, of course. This human attribute is not a specific topic of SSM, like it is in the DST.

followed by a new learning. Of course, the **subjective judgment** of observers / actors / decision makers is unavoidable, prevailing of a culture (i.e. prevailing habits, views, ways of life and working, incl. the legal and political documents and practices, etc.) is important. These prevailings of human attributes are important in both VST and SSM. This notion brings us to Mulej's Dialectical Systems Theory, which is concentrating on the human personality and work process a lot (See Ch. 4; Mulej and coauthors 2000 and earlier, since 1974).

An especially important feature in such a process covers the conflicts<sup>273</sup> of the parties involved. Here, the Critical Systems Thinking may be helpful.

### 5.3.3 THE CRITICAL SYSTEMS THINKING (CST)

CST is the youngest among the well-known soft systems theories. Its authors M. Jackson and R. Flood were students of P. Checkland. They specialized in application of systems thinking to management, especially to management of conflicts. They accept his criticism about the over-generalization of the hard systems theory and extend it to his Soft System Methodology, because it avoids working on conflicts (Jackson, in: Mulej et al., 2000, and earlier). They require five attributes to be included in a system / methodology of thinking:

1. **critical awareness** (rather than satisfaction with the given situation, i.e. routinism);
2. **social awareness** (to include the broader rather only direct consequences into thinking);
3. **complementarity in theory** (to allow all different kinds of knowledge available to be included);
4. **complementarity in practice** (to allow the same for all different methods available);
5. **human emancipation** (to allow for creativity to flourish rather than subordination to reign).

The tools they produced and use make a *system of systems methodologies* for the problem solvers to select the proper one/s from, according to the attributes demonstrated by the *matrix of conditions and problems*.<sup>274</sup>

In terms of dealing with the climate change, CST can also be quite useful. All available knowledge can be listed for an **overview to replace oversights**, so can all attributes of the real situation, which one is able to detect. One is supposed to *criticize* and to *accept criticism*, to feel *interdependent* (under the notion of complementarism, both in terms of theory and in terms of applied methods), to employ *all capacities* available, and to think of the *broader consequences* able to show up, usually as sideeffects. These consequences are very much what the modern life of the 21st century is going to be all about (see: Wood, 2000; Affuah, 1998; Prigogine, 2002, quoted earlier in two footnotes; etc.).

Dealing with management of our lives, not only organizations, brings us closer to cybernetics.

### 5.3.4 CYBERNETICS OF THE 1ST ORDER, 2ND ORDER, AND 3RD ORDER

In mid 1940s the idea showed up, that it might be worthwhile to transfer the concept of the nervous system of the living bodies into the machines; this might make machines able to transfer information and make decisions. From this effort automatic machines, including

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<sup>273</sup> Checkland speaks of the wish rather than of the need to co-operate, which means that he avoids conflicts. But they are an unavoidable part of reality, including the issues of climate change: there are one-sided interests around, usually, with humans and their organizations.

<sup>274</sup> On the basis of ideas of CST, its authors developed an interesting applied methodology called Total Systems Intervention.

computers have emerged. The **thinking machines** were very much based on the feedback mechanism, which is a special case of (a hard systemic and rather routinised) interdependence between parts of the same entity.<sup>275</sup>

This concept was later on called **the first order cybernetics**. This label was found out, when **the second order cybernetics** was discovered. This was a new revolution in science (Umpleby, in Mulej et al., 2000):

- One was no longer dealing with the natural attributes as *given facts* only.
- One stopped observing *passively* the natural processes and leaving the observing persons outside the scope.
- One found that the *observers* are actually a part of the process. This means that the laws of nature are not objective on a holistic level, but only inside the selected viewpoint and (pre)conditions.
- Hence, there are *no objective* scientific findings, because they depend on the *human* approach and selection of viewpoints and interpretation of findings.

This was a revolution in science – from the expectation of a total objectivity to admitting the role of humans. The next step of evolution of cybernetics came to be **cybernetics of conceptual systems**. It is not important only to introduce *cybernetics of cybernetics*, as the second order cybernetics has done by including the observer into observation. It is also important to consider and influence the *ideas of observers*. The relation between the individual ideas and society around them is one of interdependence and interaction. Therefore it is too rough and shallow to consider the ideas on the general terms only. It is *individuals* from whom the impacts start.

A quite natural next step is the finding that it is not realistic enough to talk about human beings as observers only. They actually combine *observing, decision making, and impacting*. This finding resulted in **third order cybernetics**. (For some details see: Vallee, in Mulej et al., 2000). This is a new revolution in science:

- Science is no longer limited to finding out facts and general laws about them, neither to a passive description of them.
- Science combines finding out facts and technology of using them for an influence.

**Cybernetics**, due to such an evolution, may no longer be seen as a science and practice of using feedback as its only attribute. There are at least five attributes making its dialectical system: (1) *management* (in terms of any kind of impacting) of (2) *complex*, (3) *dynamic*, and (4) *stochastic, probabilistic* and even *possibilistic*, features (as systems), (5) by using *information*, including *fee-back* as one of its types.

In the case of dealing with the climate change, we see that this process is partly outside the human impact and partly under the human impact. Hence, several kinds of cybernetics may serve investigators and practical actors, be they individuals, businesses, other organizations, or governments, as usable tools of consideration, decision-making, and action. They all use information, the above definition says.<sup>276</sup>

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<sup>275</sup> This transfer of insights belongs to the rather fruitful examples of isomorphisms.

<sup>276</sup> There are at least two crucial types of information: (1) the feed-forward information, such as provided by forecasting, planning, designing a machine etc., and (2) the feedback information, which provides for (2.1) either the decision-maker and actor to see the consequences of their impacts, or (2.2) the blocking off the tendencies for a deviation from the equilibrium to take place. (See: Kralj, 1998, and earlier)

This finding brings us closer to the notion of information and to the need for a few thoughts about it.<sup>277</sup>

### 5.3.5 THE ROLE OF INFORMATION IN SYSTEMS THINKING

In the daily life, the word *information* tends to be used in many different contexts and contents with a lack of a clear definition (see: Rosicky, in Mulej et al., 2000). We were able to see the same reality concerning the word *system*. This is far from being the only attribute they may have in common.

Information has, first of all, to be delimited from the notions of data and message:

- **Data** exists when signs are ordered into a *syntactic* entity, such as a word, an organ of a body, a leaf of a tree, etc.
- **Message** shows up when data is ascribed a meaning, thus receiving its *semantic* dimension.<sup>278</sup>
- **Information** shows up when a message makes an impact by coming to be understood, accepted and causing an action: this is called the *pragmatic dimension* of information.

From such a definition, one can see that it is problematic to call the making and application of computers – informatics, even less so to let it monopolize the notion.<sup>279</sup> The same would apply to ordering data in book keeping, in libraries, etc. One can find something, which all of them have in common, and so do all other features meeting the mathematical definition of a system:

- Information is an **influential relation**.
- There is no **system**, hence, without information.
- There is no **entity**, hence, without information.
- There is no **order**, hence, without information.
- Information is a **natural phenomenon**, which is not limited to humans and their relations and organizations.
- Information is, potentially, but not unavoidably, supportive of **holism**.<sup>280</sup>
- Information is an expression of **interdependence** in general.<sup>281</sup>
- Information can be a **physical** (e.g. in a stone, in a machine), **biological** (in a living cell, organ, organism), and/or **human** (in a group, organization, society, humankind) **relation**.
- Information can be linked with **evolution** (e.g. of a cell of an embryo, developing into lever, of another cell of the same embryo becoming the eye, etc.) and with **development** (of e.g. a society from a nomadic one to an postindustrial one over many steps in the process).

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<sup>277</sup> Actually, all systems theories and cybernetics use and produce information, or try to do so, at least. So do, maybe subconsciously or unexplicitly, the traditional sciences, too. Dealing with climate change tends to attain the same: to define, understand, and solve the problematique by solving a dialectical system of problems with a dialectical system of solutions, which are conceived and undertaken requisitely holistically. All the briefly summarized systems theories can together make a kind of a »system of systems methodologies«, which serves as a toolkit, when the insight into the »matrix of problems and situations« lets us see what must and can be done.

<sup>278</sup> The role of the selected viewpoint already is entering the scene, which has not necessarily been the case with data. This is even more true in the case of information. Different viewpoints make different messages and informations, even from the same data.

<sup>279</sup> On these terms it is wrong / superficial to speak of »information society« and include the modern communication facilities and tools, only, more or less, such as computers, telephones, internet, etc. They make only a fraction of the innovative business and innovative society. See Ch. 4.6 and 4.7.

<sup>280</sup> An impact is possible by making people think, decide, and act on a biased basis, e.g. by political propaganda, etc., too.

<sup>281</sup> Impact is normally a both-way relation: one must adapt to one's listener to attain influence over him or her. Etc.

- Information can be a tool **against entropy**, a tool of negentropy, because (and if) it induces order, evolution, development, holism, interdependence, relations etc., keeping or transforming an identity of an entity.
- Information can (also, but not only!) be a **product of consciousness** in terms of *knowledge, data interpretation, learning and other experiencing, indeterminism and determinism*.
- Information can be **lacking** and/or **exceeding** in terms of the *information requirement*.
- Information can be subject to **individual subjective understanding** of given data and messages.

The viewpoint in which the traditional sciences were specializing, was not the one of information – it was rather the one of *energy and matter* and their flows. The issue, e.g., was **how much** energy, food, etc. an embryo may need to become able to be born and survive. The issue from the viewpoint of cybernetics and systems theory results from a different viewpoint: **why** will an embryo become a dog or an elephant rather than a tiger. The answer is: **information**.<sup>282</sup>

In dealing with climate change, humankind of today may still have to come across a similar change of questions put from different viewpoints. As long as only the traditional question was asked, only (!) the **basic process** (the one of production of products and/or services, its supplies and their sales) was found worth consideration. Cybernetics found the **information** and **management** processes to be (interdependent and interactive) preconditions of the basic process (and impacted by it, too, of course). Hence,

consequences in the form of climate change do not come from the basic processes only,  
even less from them alone and/or in isolation from anything else,  
but they also/rather come from the information and management processes.

These two processes govern the basic process – in a way of the choice made by the owners of the management process. Its owners, of course, must consider the basic process very carefully in order to place the right instructions into it, but this is their choice anyway.<sup>283</sup>

This set of findings lets us see the **growing complexity of managing an organization** (of any size), of impacts over it and of its consequences, including the climate change. Let us, hence, take a look at possibilities to simplify management processes, which may let us have more time to deal with the crucial open issues of the dialectical system of all three processes.<sup>284</sup>

### 5.3.6 SOME TOOLS USABLE FOR SIMPLIFICATION OF MANAGEMENT IN COMPLEX PROCESSES AND SITUATIONS

<sup>282</sup> In this case information is found in the *structure of the system* of genes, as humankind has learned, not in genes, which are something of matter with little energy, but a lot of impact, as a system (in the mathematically based sense of its definition).

<sup>283</sup> Which instructions are the right ones? This decision depends on the selected (dialectical system of) viewpoint/s and hence on the subjective (and objective) starting points of the decision makers.

<sup>284</sup> Mulej and Kajzer (in: Mulej et al., 1994) published (a dialectical system of) four sets of guidelines aimed at making the basic, information, management processes and the process of their co-ordination creative and innovation friendly. We do not feel we have room here to elaborate on them.

First of all, we should never forget the sentence by Albert Einstein, the great scientist in physics who has never developed his exceptional findings by experiments, but rather by mathematics (which is the biggest level of abstraction and reduction).<sup>285</sup> He said:

**Let us simplify as much as we can,  
but no more.**

What can be simplified?

Reality is as it is, and it cannot be simplified, because this would reach beyond the human scope<sup>286, 287</sup>. The human image of reality can be simplified, and this generates dialectical systems, systems, and models. They are used as the bases of the human action, not insight only, of course. If the basis is too simplified, the action will tend to have a too unrealistic background. Hence, this simplification may be helpful and dangerous, both at the same time, even.<sup>288</sup> See Fig. 5.1.

If simplification is unavoidable, reduction from the object level to the model level is so, too. The reductionism, which LvB was fighting rightly, is back, for natural reasons. The issue, which shows up reads:

***In which ways can one simplify / reduce  
the total amount of attributes to the requisite one,  
and no more than that,  
in order not to exaggerate, but to rather  
comply with the law of the requisite holism?***

*Fig. 5.1: Relations between the existing object under consideration  
and the levels of holism of the human consideration of it<sup>289, 290</sup>*

<sup>285</sup> This high level of abstraction may have been the main reason for – as Prigogine said, according to a quote in a footnote above – Einstein to lack the appreciation how very important the time and change are.

<sup>287</sup> E.g.: Over millennia of development of humankind, many humans came to live in towns rather than in forests. In old times, in forests, it was good enough to bend down and pick up a berry in order to eat it. In the modern, developed / advanced times and societies, the process has many more steps, which is called progress and productivity growth (!?), anyway. One produces roads, car, refrigerators, grocery stores, water and energy pipe lines etc., to cover activities that have not been necessary in the »primitive old times and life styles«.

<sup>288</sup> Of course, new and new tools are invented and (in a small percentage) transformed to innovations, too. From the viewpoint selected by their authors, they may simplify the human dealing with reality. They may diminish the remaining variety, the VST would tend to say. But reality is as it is, from other viewpoints. If chemicals are used a lot in agriculture etc., it is easier to produce larger quantities of food. But: what about their impact over health, nature, etc.? What about the longer-term usability of the same arable land, after it has been poisoned with millions of ton of chemicals a year for long decades? Cars make our life easier – in some respects, such as moving around. What about parks changed to parking lots, about breathing clear air, being in physical shape etc.? Etc.

<sup>289</sup> In the case of climate change, the *object* under consideration is the entire nature, including the humankind of today and in future. The *dialectical system* is selected by the person / team in charge of consideration / management, and in the case of the UNO declaration of sustainable development (in Rio, 1992) it covered the survival of humankind of today and in future and its dependence on the care of the same humankind for its natural environment and its interdependence and interaction with its economy and way of life. The *system* was selected on a much narrower basis, i.e. by selection of a single viewpoint, e.g. the one of the USA economy, the one of the climate change, the one of the agricultural production, etc. The *model* explains / pictures a system mentioned right now in a more or less clear way, such as statistical data, books, films, pictures, legal documents, etc., which all simplify to make the essence understandable to the audience of the author of the system. A number of systems, when related to each other, can make a dialectical system, which in its turn is presented by a dialectical system of models about these systems. – But they are never equal to the object as a whole, because it is too complex and complicated for humans to be able to attain its *total holism*. (Recall previous chapters of this book, if necessary, please.)

<sup>290</sup> The point of the Fig. 5.1 in terms of the real life and the human dealing with it reads: it is hardly possible to deal with anything complex without cooperation of several persons, and hence without communication between them. For communication to be possible, one comes – as an individual – rather unavoidably to the model, while one tries to deal with the object. In other words, all the steps of simplification in Fig. 5.1 are normal in the humans daily practice of thinking, decision-making, and action. The basis for co-operation, thinking, decision making, and action, is therefore

| <i>Difference in level of realism in consideration of the object dealt with</i> | <i>Level of simplification in description of the object dealt with</i> | <i>Aspects taken in account in dealing with the object dealt with</i> | <i>Components taken in account in the object dealt with</i> | <i>Relations taken in account in the object dealt with</i> |
|---------------------------------------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------|
| <b>Object</b> <sup>291</sup>                                                    | <i>None</i>                                                            | <i>All existing</i>                                                   | <i>All existing</i>                                         | <i>All existing</i>                                        |

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quite far away from a totally realistic one. Thus, returning to the level of the dialectical system (of models) is so crucial for success, which is unavoidably based on the requisite holism (according to experience we have watched). That's why we said frequently that *simplification may be helpful and dangerous, both at the same time*.

<sup>291</sup> The object (feature, process, event, ...) exists and therefore has *all* attributes. Once one starts to deal with it, one selects among those attributes the interesting / important / essential ones. In the case of this book: it is Universe that exists as the object, we chose the climate change as the interesting part of its attributes.

|                                          |                 |                                                                             |                                                                              |                                                                                             |
|------------------------------------------|-----------------|-----------------------------------------------------------------------------|------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| <b>Dialectical system</b> <sup>292</sup> | <i>Small</i>    | <i>All requisite / crucial viewpoints and relations / interdependencies</i> | <i>All requisite / crucial viewpoints and resulting components (= r. c.)</i> | <i>All requisite / crucial relations between crucial / requisite viewpoints &amp; r. c.</i> |
| <b>System</b> <sup>293</sup>             | <i>Big</i>      | <i>One, selected by viewpoint selected</i>                                  | <i>According to the selected viewpoint</i>                                   | <i>According to the selected viewpoint</i>                                                  |
| <b>Model</b> <sup>294</sup>              | <i>Very big</i> | <i>The same as in system, partial / simplified</i>                          | <i>The same as in system, partial / simplified</i>                           | <i>The same as in system, partial / simplified</i>                                          |

It was discovered that it is better to face the topic of complexity and its simplification by a **process approach** than by a structure approach to an organization, production etc. (Schiemenz, in Mulej et al., 2000, and earlier; Kajzer, 1982; etc.). Oversights tend to include less many important attributes in this way.<sup>295</sup>

**Hierarchy**, if it is not limited to a commanding hierarchy of subordination with no / lack of creative co-operation between bosses and their co/workers, is a useful tool of simplification of management. It allows for mutually different parts of the same process to be considered as relatively independent entities and to be worked on by specialists. The interdependencies and interactions among members of such a sub-entity (e.g. finance department in an organization, LA21 in a part of a local community) are *more frequent and important* than the ones among different sub-entities. Acknowledging the differences between parts of the process is the basis for *division / distribution of labor* and even more for *co-ordination of work processes into one entity*.<sup>296</sup>

**Recursion** is a different way of simplification, although quite closely linked with hierarchy in a number of cases. The point of this simplification of management is not in the differences, but rather in the *similarities*, which show up again and again. Specialization to a specific profession is such a case: it is easier to become a good boss inside the same specialized department and industry than in a different one. *Repetition* of the same features (= recursion) allows for routine and requires creativity to be employed to the remaining, non-repetitive, not re-occurring, non-recursive features<sup>297, 298</sup>.

<sup>292</sup> In the case of this book: the viewpoints of description of the nature, of the climate circumstances, of the climate change, of the systems thinking as a thinking tool, etc., and their relations – this is what makes our dialectical system about the climate change.

<sup>293</sup> In the case of this book: Our thoughts in the framework of our single viewpoints make our single systems (which emerge to the synergy called the dialectical system when we link them to each other) per individual chapters, e.g.

<sup>294</sup> In the case of this book: Every chapter is a model of single-viewpoint system, so is every paragraph, sentence, figure. They all emerge to the synergy called the dialectical system of models and make the book, which is our final model for us to convey our findings to our readers.

<sup>295</sup> In the case of dealing with the climate change, both the process of its making and the one of solving problems related to it matter more than the issue of who is whose boss. The latter issues shows up as well, of course, but it is the *process* that makes the *structure* needed and appropriate rather than vice versa.

<sup>296</sup> This is how a process-based structure comes in. Neighboring local communities pass their LA21 plans, but they co-ordinate them, too, hopefully, in order not to make more damage to each other than benefit to themselves. If they did not do so, the tragedy of the commons might tackle of us with terrible consequences.

<sup>297</sup> This would be the case of the remaining variety in the Law of the Requisite Variety and its application in the Viable Systems Theory/Model. See about it in Ch. 5.3.1.

**Black-box** can also help *simplify the management*. A car driver does not have to know the *functioning*, it is enough if he / she knows only the *behavior* of his / her car, so does a TV-viewer, a user of a kitchen appliance, a person cooking his or her own tea, coffee etc., who is no profound professional. Frequently it is not necessary to know the inside, the »hidden processes«, to manage, these cases say. Sometimes these processes are impossible to know but on the level of behavior, i.e. on a (more superficial) black-box level, such as processes in a brain. In business, a democratic boss may have much less work to do, because he is able to trust and hence to consider his subordinates as black-boxes and concentrate on the remaining variety.<sup>299</sup>

**Feedback** may help such a boss to control the process well enough. But feedback is not only a type of input-output relation between human beings. It is a basic attribute of products based on the first order cybernetics, as discussed above. All automata are self-regulating due to feedback, but the level of temperature of a water-heater etc. is predetermined by **feed-forward** information installed. This is called **regulation** rather than self-regulation, for this reason.<sup>300</sup>

In nature, there is a lot of **self-regulation**, if the humans do not intervene too much. Harmony arises from interdependence and interaction of mutually different parts of the same ecosystem, and it is a process of a dynamic stability.<sup>301</sup>

**Autonomy** can be found in nature and in organization. It can be called a way of using the black-box approach, hierarchy and recursion combined, as well as regulation and self-regulation combined, or even all of them combined.<sup>302</sup>

**Standardization** is another way of simplification of management. Standardized parts of machines are easier to replace. Standardized rules of conduct are easier to follow. Programoteque is such a case (on a framework level!), as mentioned above. Standardization of decision making is also possible, but it is easier to attain in terms of methods than in terms of contents (Potocan, 1999).<sup>303 304</sup>

**Trustworthiness** and **reliability** of partners in business, private life, working together allows for granting much more autonomy than the opposite attributes do. It can develop to substantial

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<sup>298</sup> In the case of dealing with the climate change, it may make sense to invite the ones who have already collected knowledge by education and experience (as well as suitable values, emotions, and talents, of course), to work on a new plan concerned with dealing with the climate change, e.g. in another local community.

<sup>299</sup> In the case of dealing with the climate change, the coordinators among a number of neighboring local communities / countries / activities of LA 21 etc., should better trust their coworkers and concentrate on what they do not cover.

<sup>300</sup> In the case of dealing with the climate change, reports to coordinators are a case of feedback loops, mutual impacts of parts of nature are another case, measurement with instruments can let us help see them better / more easily.

<sup>301</sup> The issues of climate change emerge from both the self-regulation of nature and the many human interventions, which are (more or less unavoidably) one-sided in their character, and from their emerging synergies.

<sup>302</sup> If the selected viewpoint makes somebody concentrate on such an autonomous unit, the impression can result that this is an independent unit. This shows up as a wrong conclusion, once another – broader – viewpoint is selected.

<sup>303</sup> In dealing with the climate change, standardization may be seen in the typified framework models how to approach the problematique, such as LA and LA21, in measurement, in adoption of somebody else's experience, etc. In a creative work, the standardization remains on a framework level based on successful experience, of course. It serves as a reminder / check list, etc. Guidelines in DST are such a case (see Ch. 4.3.3, 4.3.4, 4.5). Creativity concerning the details is required, but also supported by the framework. In a routinized work, rules of conduct replace the user's creativity. Every step must be fully covered. (In the modern daily life, e.g. users of computers face rules all the time, so do users of most other machines.)

<sup>304</sup> Application of quantitative methods that are quite close to a hardsystemic approach, requires some standardization of data and procedures, too. See Ch. 6.4, 6.7. and 6.10.

savings, too, and is therefore investigated a lot under the term of **creditworthiness** (Knez-Riedl, 2000, and earlier).<sup>305</sup>

In all given and similar cases of attempts to simplify management, there is one more link to systems thinking, at least: a **requisitely systemic preparation** and **action** are prerequisites for such attempts to work rather than to disappoint.<sup>306</sup>

### 5.3.7 SOME COMPARATIVE CONCLUSIONS ABOUT THE SELECTED SOFT SYSTEMS THEORIES

It is possible to conclude that the briefed soft system theories can all be *useful* in dealing with the modern life of the 21st century. They can all build *bridges* between the interested parties involved, they can all support their co-operation without destroying their actual *differences*. They, though, **differ** from each other in the **viewpoints** / specific topics selected. Thus, it is up to the users to make their choice – from this system of systems methodologies.

Since the parties involved may, before accepting the dialectical systems thinking as their culture, feel opposed rather than complementary to each other, and may have different habits concerning ways of proceeding in their work, we may want to make them aware of three facts regarding their *subjective starting points*:

- In terms of knowledge on contents (the issue: What and why?) they are *different* and need to remain so in order to be complementary / interdependent / needing and benefiting each other.
- In terms of knowledge on methods (the issue: How and why?) they have a chance to *standardize their methods* of work on a frame-work level, which does not replace, but rather supports their creativity and transforming of it into a common good, e.g. innovation.
- In terms of values (the issue: Why to care for working on this?) and emotions they have their interdependence as their background resulting in their *ethics of interdependence*; on this basis, they may co-operate better and more easily once they develop their mutual *ethics of interdependence* (Mulej, Kajzer, in Mulej et al., 2000, and earlier).
- In terms of their natural talents (the issue: Is this activity for me, am I for it, by my nature?) they have their natural capacities of different orientations and can develop them into better or worse knowledge, values, emotions, activities, and outcomes. But they have to work on it, and it may be a hard work. Alternatives may be even harder to take.

## 5.4 SOME CONCLUSIONS ABOUT SYSTEMS THINKING ABOUT THE CLIMATE CHANGE

The problems of business, living and natural environment, which are intersecting<sup>307</sup> each other, are not only expressed

**globally, but also locally.**

On this level, they are no longer a far-away theory or political declaration, but a hands-on system / (partial, but complex and complicated) entity of life. It can hardly be resolved by declaration rather than by concrete actions undertaken by concrete persons in charge of

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<sup>305</sup> See Ch. 6.3.

<sup>306</sup> See Ch. 6.8 for a world wide case.

<sup>307</sup> Due to this fact, the Fuzzy Systems Theory may also apply to the climate change of the 21st century. We do not include it here as it is somewhere between the hard and soft systems theories, and as we lack room anyway.

managing their daily life conditions and results. As long as these persons stick to biased, narrow views, their chance of success is quite poor rather than easily attainable. Once they include into their environ/**mental** views

- their **interdependence**,
- their impact over their **starting points** and, later on in the same process,
- the impact of their starting points over their **perceptions, preferences, objectives, tasks, processes, technologies and results**,

they have much more of a chance to survive as business organizations, individual parts of nature, and local authorities in charge of quality of life and working life. Their **transition from the biased thinking to a rather / requisitely holistic thinking** may be eased, if they accept into their values and knowledge the concept of systems thinking (see also: (Zenko, 1999; Zenko et al, 2002; IDIMT 1998, IDIMIT 1999; Mulej et al. 2002) for an *informal systems thinking*). The modern businesses of the 21st century addresses complex problems, which need to be managed by human beings who are unavoidably narrow **specialists** and (hopefully) mutually **co-operating** at the same time, to be requisitely holistic. A common methodology can support them in this effort, while trustworthiness (Knez-Riedl, 2000; Ch. 6.3. here) and ethics of interdependence can open doors for their co-operation better than mistrust and their obsolete ethic, e.g. preferring independence and dependence, in their values and emotions.

Their **alternative**, if they find this suggestion too demanding,  
is even more demanding: **end of chance of survival,**  
**but realization of entropy by ruining their**  
**conditions of life and working,**  
**i.e. their own tragedy of the commons.**  
The choice is up to them.<sup>308</sup>

Some people, especially the ones who **exaggerate** in trusting their own way of life (only), and quite many also in the **less advanced** areas / societies tend to think that their economic and social environment still allows them to remain *one-sided and superficial*. They tend to remain so. It is, or seems to be, simpler. Hopefully, the simple current processes will not cause to them too complex and tough *consequences*, as it frequently happens. The same fear is possible in the case of **too narrow** specialists who are not willing to enter interdisciplinary cooperation. These experiences apply to climate change, as well.

**Prevention of such unpleasant and unhelpful consequences may be called a major aim of the (dialectical) systems thinking.** In many cases DST has worked, over its about 30 years of development and application, but not until it was accepted by the decision-making persons into their consciousness or even sub-consciousness<sup>309</sup> as the basis for subjective starting points, e.g. in the form of the individual and organizational *culture*. Hence:

- The (dialectical) systems thinking can help the humankind of today and in future to come closer to the LvB's rightfully required **worldview** – be citizens of the entire world, care for the entire biosphere, see it as an organization with many interdependencies, fight exaggerated specialization – by interdisciplinary creative cooperation with transdisciplinary values of the mono / single-disciplinary specialists completing each other up.

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<sup>308</sup> Because we love our and your children and grandchildren, we beg you not to choose the one-sided alternative.

<sup>309</sup> We might better use the word: preconsciousness, than the word: subconsciousness. Psychologists found that subconsciousness is able to be too full of data to really help consciousness, if there is no selection. It is the role of preconsciousness to act as the door-keeper between the two (Kline, 2000).

- This is why the suggestion made by Molander and Sisavic (1994) that systems thinking needs to become a **mass movement**, like TQM is doing, is so important.<sup>310</sup>
- This in turn is why the *quality movement* is so important, if its notion is conceived in a (dialectically) systemic style (see: Peters 1995), **not** in a **bureaucratic** one (see: Ursic et al. 2000; Pivka, Ursic 2001).
- Systemic thinking needs to be made more **popular and generally applied**, including the chaos and complexity theories (see: Ch. 5.1, 5.2).
- And this is what demands more of a **modern learning** (Lessem 1991; Parsloe 1995; Coghlan 1994; Flood, 1999; etc.).
- This is what the consideration of complexity (e.g. of globalization of economy, climate change) supports, but does so better, more effectively and efficiently, if conceived in a **(dialectically) systemic style, rather than e.g. in a bureaucratic**, biased, one-sided one.
- The bureaucratic one tends to show up if more short-term, one-sided and superficial business etc. criteria tend to prevail over more long-term, holistic and deep ones, i.e. over the systemic ones.

What could and should be done for sufficiently many (influential) individuals (and organizations) to accept the (dialectically) systemic style of thinking, decision-making, and action, so that the humankind could solve our issues concerning the climate change? How can we make it all happen / accepted? See Ch. 6 for some thoughts about implementation.

Before it, let us remind you of some natural facts, again, in the Ch. 5.TR.

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<sup>310</sup> As we wrote in Ch. 2, the modern notions of TQM methodologies, are able to support informal systems thinking much better than the ones used to that were usual before 2000.

## **5.TR THE CLIMATE CHANGE SYSTEM AND THE BIOSPHERE<sup>311</sup>**

### **5.TR.0 THE SELECTED PROBLEMS AND VIEWPOINT OF DEALING WITH THEM IN THE CHAPTER 5.TR**

The climate change system is an integral part of the Earth's biosphere and it has a multi-complex purpose of putting together, provide, and guard basic conditions of the life: temperature, water cycle, air-sea-ocean movements, protection, management and regulation / control of the biology of the biosphere.

The climate change system is one of sub-systems of the biosphere. Which parts of the biosphere system could be affected by impact of our civilization is a question, which we shall try to indicate an answer to, now.

### **5.TR.1 THE PRESENT STATUS**

Biology of the biosphere has many successful systems, which are in different stages of life. The most successful and the best evolved is the rain forest. Of course the geography, i.e. longitude, latitude and altitude of the environment and space impact the conditions and possibilities for evolvement and management of life. Second to these conditions is availability of water, which in many cases is closely connected with evolvement of the biological system. In many cases the biology of bordering regions between two different environments land/see, fresh water/land etc., include very successful systems like mangroves, corals, coastal sea and ocean waters etc. But the bigger portion of the biosphere the oceans and seas (around 70 % of the earth surface are oceans/seas and 97.3 % of all water on the Earth is in the oceans and seas) are less researched and more difficult to know in details.

A general biology knowledge may indicate that the best biological systems on terrestrial surface are the forests, the second are grasslands, and than come the biotopes specialized according to local conditions – swamps, bush lands, makia/gariga (Mediterranean), mountains, the Sub-artic, Artic and Antarctic regions, rivers and lakes, deserts, etc. In coastal waters of oceans and seas there are corals, mangroves, and many more as biological systems belonging to successful stories.

All natural systems are composed of physical, geographical and biological characteristics, which make a basis for their composition, while the climate change system provides the conditions (water, air, temperature) to provide/guard their evolvements. We may explore the past and see the present of these systems, but we cannot see future evolvements, due to many possibilities and influences to come.

### **5.TR.2 FOOD PRODUCTION**

Water and food are very interdependent, when we discuss the food production of our civilization. Water is a basic precondition for food production. Due to changes in the biosphere our civilization was replacing water available for food production naturally with water from other sources – rivers, lakes, artificial accumulations, etc. Actually, by doing so, the food producing environments have become very similar to the artificial systems, and have been moving fast out of the biosphere patterns.

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<sup>311</sup> Timi Ecimovic and Rashmi Mayur

Due to increased demand for food, new areas have been put into exploitation, which have not been used before. The artificial food producing systems entered a long-term use (reactions in the biosphere are taking time as long as they need, since nature always has enough time, or nature does not care for time, etc). The reaction was very much limiting the production ability, and our civilization was forced to innovate technologies for food production and protection (not to forget the profit / money gaining reasons) of the food production systems. Many pesticides were invented and then innovated. One-sidedness of the purpose of innovation has been resulting in damages within the biosphere that have gone far beyond our ability to understand them, when we commenced to use pesticides. Today the synthetic chemical compounds should better not enter the natural systems, because of their long-term damaging effect on the different parts of nature systems such as water pollution, desertification and loss of productivity of agricultural lands, etc.

At present we face a large intoxication of the biosphere with pesticides. It is a consequence of lack of consideration of both complexity and complicatedness of our (only!) biosphere.

### **5.TR.3 WATER AVAILABILITY**

Due to an exaggerated growth of the needs of our civilization (drinking water, industrial consumption of water, etc.), and demand for agriculture and food production, the water sources in the nature are becoming insufficient. Many innovations were used for solving this problem, of which many have had an impact on the biosphere systems. Let us mention here the exaggerated use of fresh river/lakes waters, resulting in the destruction of underground deposits and lakes of water, and combined with a lack of understanding the physics of the underground water deposits systems, etc.

At present we face large deficit of fresh water sources, and quality of present sources is questionable, due to pollution by synthetic chemical compounds and their long-term effect. Recently, also the influence of hormones, and hormone-like substances are becoming more and more important. From water supply viewpoint our future does not look nice.

### **5.TR.4 POLLUTION**

Our civilization's settlements of near past and present (over-concentration of people and self-creation of the fragile environment – mega cities etc.) has caused the pollution of all waters in such regions, including areas as far as such polluted waters travel. Actually, the pollution has been a combined effect of pollution from city life (countless toxic substances – natural and synthetic chemical products, etc.) ending in the waters from individual kitchen outflows and sinks, toilets and sewage systems, and from the “natural” rivers flows. Secondly, the usual agriculture intoxicates lands and underground waters and further waters connected with intoxicated lands and underground waters. Finally all this is ending into coastal sea and ocean waters, which are in different stages of pollution/intoxication.

### **5.TR.5 RIVERS**

Our civilization has used rivers as sewage transport system. To achieve the combined effects of the protection of human settlements, citizen's properties, and civilization's achievements against the natural river waters floods huge hydro constructions were introduced. Actually, by our civilization's standards, we have straightened the natural river flows, and by doing this, we destroyed the natural/biological river waters “filtering” systems. We achieved a fast take off of the river waters, and only this, because we did not protect civilization settlements and

achievements against floods. In the long-term the floods are still there, but with a much more damaging effect. A majority of the rivers need eco remediation of their natural abilities for hosting life and other qualities destroyed by our civilization.

### **5.TR.6 COASTAL WATERS**

A further topic with a comparable destiny tackles estuaries and coastal waters, which in many cases were reconstructed into businesses, settlements, and tourist resorts with no / poor natural/biosphere characteristics. They are opening new frontiers for pollution of coastal waters and as a consequence the oceans/seas waters.

Today a larger share of human population of our civilization than ever lives on litoral coastal lands. The pollution of coastal waters is taking place, and soon we shall be able to read results of our continuous action damaging the quality of sea and ocean waters.

### **5.TR.7 CONCLUSION FROM THE CHAPTER 5.TR**

The data briefed here make us conclude that many individuals and organizations need to learn and apply system/holistic thinking. Both the past and present experiences of our civilization's impact on a large number of natural systems are calling for more effective nature, space, and environment protection.

In reality, we need diffusion of holistic thinking for a broader impact towards better and more suitable way of thinking, decision-making and action, in order to attain our civilization's long-term responsibility and preserve our nature of our Earth rather than to suffer a global tragedy of the commons.

## 6. IMPLEMENTATION OF HOLISTIC THINKING ABOUT THE CLIMATE CHANGE SYSTEM<sup>312</sup> - PART 1, A POTENTIAL DIALECTICAL SYSTEM OF METHODS

### 6.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 6

A new concept about solving the problem of the climate change must not remain a novelty, but become a *beneficial novelty*, i.e. **innovation**, *not only an invention*. This important process is far from easy, because both its preconditions, its working, and its consequences are complex and complicated. Authors, politicians, businesspersons, other influential persons, as well as others take many decisions. Customers, mostly, come across to-be innovations in their **diffusion** process and decide which invention will be innovation (for themselves); the same is true not only of new products and processes, but also of new concepts. **Before** diffusion, there is another complicated and complex process in which preconditions are met for invention to be created and to become a potential innovation, too. It is diffusion, which makes from a potential innovation a real innovation. All these phases and activities require systems thinking. The **process** briefed here (on a rough framework level of the requisite holism) can help authors know and handle their potential success better.

### 6.1 THE NEED FOR HOLISTIC THINKING ABOUT THE CLIMATE CHANGE TO BECOME A GENERAL CULTURE, OF THE INFLUENTIAL HUMANS, AT LEAST

Professionals with specialization in issues of climate change discovered how very complicated and complex this issue is. They also discovered that practically every person influences climate in practically every action, although every individual contribution to the problem seems to be very small and hence its causes / sources might be left alone / uncared for<sup>313</sup>. It is the **market**, anyway, which is supposed to take care of the **general interests**, they used to say, and still tend to say. Only recently, like a decade ago, not directly in reactions to the first attempts by the Club of Rome of earlier times, it has started coming to be more generally accepted that the

**market** teaches us *about prices, not about cost*,  
and especially not about the external cost,  
i.e. the cost burdening the general public rather than  
its actual causes / sources, such as societies / companies,  
which care for profit more than for cost of environment  
and cost caused to themselves<sup>314</sup>, <sup>315</sup> by their own

<sup>312</sup> Matjaz Mulej and coauthors, named where appropriate

<sup>313</sup> This is a very clear case of a lack of dialectical / systemic thinking, which can be nicely commented with an old proverb: »Stone upon stone – a palace, grain upon grain – bread.« The point is the emergence of a new synergy, pollution in this case, making the natural environment more and more unlivable and costly to recover and live in.

<sup>314</sup> Perhaps indirectly rather than directly and therefore harder to see and understand. E.g. pollution causes diseases, which in turn cause medical cost, which in turn causes higher taxes, which in turn are paid by the polluting organization and individuals. The amounts of cost may be higher than amounts of cost for preventing the pollution. (See: Hawken, 1994; UNESCO Courier, Dec. 2001; etc.)

<sup>315</sup> In November, 2002, international press is unfortunately having to report about a huge tanker sinking on the western Spanish coast, ruining many hundreds of kilometers of the coastal and maritime life. How terribly one-sided has the human thinking about such ships been so far, is visible from the statement that the influential (and responsible? Or only accountable?) persons and bodies of international organizations in charge are discussing to change the rule that such tankers must have a double-layer body (rather than a single-layer one) from 2015 on, and possibly require the rule to apply earlier. – This is another case of profit killing profit and causing a big tragedy of commons.

## one-sided dealing with the natural environment

(see: Hawken, 1994). Hawken (1994) also makes a suggestion how to use the **taxation system** to change the (unavoidably) rather one-sided selection of viewpoints of the businesses:

- *not by additional taxation* of those who cause waste causing damage to natural environment and hence cost to humankind,
- but by *transfer of taxation burdens* from the one supportive of maltreatment of the natural environment to the one punishing such a maltreatment, and supportive of a more holistic care for our natural environment, including ourselves.

Hawken (1994) warns: companies cannot go to jail, only persons, including general managers, but they will then be replaced for the company to go on in the role of a tool of the **depersonalized capital and profit**. But: experience is clear:

no warnings, no nice words about  
the need for ethics of interdependence,  
it is only *taxation and market regulation*,  
which changes company behavior

(Hawken, 1994).

But such a new taxation takes time to prepare and introduce. It also takes time and lot of **public pressure** to have new taxation passed in parliaments, which are controlled by the big profit-makers (and employers, both at the same time) rather than by the holistic environmentalists and general public, population, whom the negligence of the natural environment makes suffer from illnesses etc., and who anyway accept the majority of (hardly visible) trouble in order to avoid another (very visible) trouble – lack of jobs and income causing poverty.

To make the story short, let us quote from an article provided by prof. Elohim in a WACRA 2001 Newsletter GSW4 on 29 August, 2001, and written by Ignacio Ramonet<sup>316</sup> in 1997 before the Kyoto conference about global warming and combating it and its crucial visible (!) source – the increasing world emissions of greenhouse gases:

»It seems appropriate that this conference is being held in the Far East, given that Asia is currently being shaken by a series of disasters both financial and ecological. These disasters are linked. For, when it comes to environment, we are witnessing reckless policies that are leaving the planet dangerously depleted.

»Up until very recently, major world economic institutions such as the World Bank, the IMF and the OECD, in tandem with devotees of ultra-liberalism, have been parading the »tigers«, old (Hong Kong, Singapore, Taiwan and South Korea) and new (Malaysia, Indonesia, Thailand, and the Philippines) as the answer to the »failure of the third world«, and as models worthy of emulation. Now, these countries have been afflicted by a series of major stock exchange upsets. After the turmoil on the Hong Kong stock exchange, the financial markets of the five continents plunged into a maelstrom, with Wall Street in the lead, unleashing onto the world the spectre of an international monetary crash...

»The model of economic growth founded on cheap labor, over-valued currencies, cut-throat export policies, and high interest rates designed to attract international investor-speculators, all within the framework of authoritarian political regimes, suddenly appears as less than exemplary – in fact as downright dangerous.

»Some of the countries most affected by these stock exchange storms – Indonesia and Malesia, for instance – have also been hit by ecological disasters on an unprecedented

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<sup>316</sup> Ignacio Ramonet, LEADER Taking care of Planet. Le monde diplomatique, November, 1997

scale. Major fires, raging out of control, have ravaged forests on the islands of Sumatra, Borneo, Java, and Sulawesi, affecting an area of more than 8.000 sq km. Huge clouds of toxic smoke, the size of half a continent<sup>317</sup>, have brought with them a pall of soot and have plunged cities such as Kuala Lumpur into semidarkness, as well as contributing to a series of accidents (the crash of an Airbus, which killed 234 people; a collision at sea in which 29 died).

»The two catastrophes – financial and environmental – are plainly linked. In part, of course, the fires can be explained by the drought caused by the cyclical climatic phenomenon known as »el nino«, but the real reason for this ecological disaster is the policy of massive deforestation that has been pursued over decades. This has been based on a speculative and suicidal model of hyper-productivity geared solely to exports. Calculatedly ignoring the difference between economic growth and real development, the nations of both North and South have been engaged in the systematic destruction of natural environments. Every kind of plunder has been inflicted on the planet, affecting earth, waters, and atmosphere alike. Headlong urbanization, deforestation of tropical forests, pollution of aquifers, seas, and rivers, global warming, depletion of the ozone layer, and acid rain: a massive program of polluting activity, which is threatening the very future of humanity.

»Sixty thousand sq km<sup>318</sup> of arable land disappear every year as a result of desertification. All over the world, soil erosion and over-exploitation of the soil are eating away more and more of the world's cultivable land. The stability of ecological systems is threatened by industrial pollution caused by the countries of the North and by the poverty of the South (deforestation and the disappearance of fallow land). The deathly logic of absurd economic and political systems results in human beings still dying of hunger. And 800 million people in today's world suffer from malnutrition<sup>319</sup>.

»By 2010, the world's total forest cover will have decreased by more than 40% compared with 1990. In 2040, the accumulation of greenhouse gases could result in an overall rise of one to two degrees in the world's average temperature, and a rise in the level of oceans of between 0,2 and 1,5 meters. Admittedly, we are not certain that this will happen but, if we wait until all scientific data is available, it will be too late to act. Rising sea level will already have caused irreparable damage.

»Between 100.000 and 170.000 sq km [of forest] disappear every year. That is four times the size of Switzerland. Deforestation is destroying a unique bio-inheritance: the tropical forests provide a habitat for 70% of the world's species. Each year something like 6.000 species are wiped off the face of the earth. According to the International Union for the Conservation of Nature (IUCN), 20% of all existing species will have disappeared within the next ten years.

»The forests most affected are the tropical forests. In Indonesia, for instance, almost 80% of the rain forests on the island of Sumatra have disappeared since the 1970s. And on Borneo, the number of trees felled has risen almost five-fold in sixteen years. Part of the explanation for this destruction has been rapid population growth, with people using the

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<sup>317</sup> The Asian continent is 44,1 million sq km, which is 4,5 times the European one, close to 2 times the North American one (incl. Greenland), 2,5 the South American one, 1,5 times the African one, 6 times the Australian one (Enciklopedija, 1959). Thus, the toxic smoke was covering an area close to the one of North America, or the double area of Europe. To us, the data quoted are clearer with these comparisons. (N.B., M. Mulej)

<sup>318</sup> This is about the size of the states of Virginia, or Tennessee, or Pennsylvania, or Ohio, or New York, or Mississippi, or Louisiana, or Kentucky, in USA (Data about size from Webster's School Dictionary, 1978). In less than a year such a process covers Switzerland, in two years Greece, in six years Japan or Germany, in seven years Sweden, in eight years Spain, in nine years entire France, etc. (Data about size of countries from Enciklopedija, 1959. N.B. by M. Mulej)

<sup>319</sup> Dumont, R. (1997), *Famines, le Retour*. Politis-Arlea, Paris

woods as fuel and the land for agriculture, but it is also explained by the exploitation of forest products destined for the rich countries.

»The Berlin conference on climate change in April 1995 endorsed the point of view that the market was not capable of responding adequately to the global risks threatening the environment. The protection of bio-diversity and the variety of life by means of a durable (= sustainable, from French, N.B. by M. Mulej) development has become imperative: development is defined as »durable«, if future generations inherit an environment at least equal in quality to that handed down by preceding generations.

»The Western countries – and notably the United States [of America], which is responsible for half the industrialised countries' carbon gas emissions – ought to be sticking to the commitment signed at the Earth Summit in Rio in 1992. But they are not. While the European Union was calling for a 15% reduction in greenhouse gases by the year 2010, the Clinton administration has just proposed to return to 1990 levels by 2012,<sup>320</sup> and to set up a system of tradable »pollution permits« as from 2008. For their part, various governments from the South have refused to accept that the degradation of ecosystems is going to incur tragic consequences for the whole of humanity.

»Without a collective effort, we will not manage to take care of the planet. It is time for both the North and the South to call a halt to the model of development that has been pursued for centuries, to the very great detriment of our planet.<sup>321</sup>«

A collective effort requires **many to co-operate**. Let us use another article to briefly let you see why is co-operation so hard to attain, e.g. among businesspersons<sup>322, 323</sup>:

»For 60 years, Russel Ackoff has taught business classes and counseled corporations. The professor emeritus of management science at the University of Pennsylvania's Wharton School of Business is an internationally recognized expert on systems – on how the parts relate to the whole. At a recent Institute for Management Studies seminar in Kansas City, Ackoff rued the »silo thinking« and the specialty training that has shaped American organizations.

»Business schools, he contended, spend too much time teaching separate disciplines, such as marketing and finance and human resources, and not enough time teaching about the necessary communication among those departments. That compartmentalized thinking carries over into the business operation. Thus, he said, finance managers tend to see everything as a financial problem, marketing managers tend to see everything as marketing issue, and so forth.

»Sometimes, only an outsider can come into an organization and see solutions that should have been obvious, had department leaders been thinking about interaction rather than turf protection. That's the big-vision thinking that may seem out of individual reach, but Ackoff had a message for business leaders at any level:

»Remember: Having the best parts isn't  
the key to having a successful business,« he said.

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<sup>320</sup> Public media report, that the Bush administration in 2001 refused to sign the Kyoto document at all. (N.B. by M. Mulej)

<sup>321</sup> Translated by Ed Emery, quotes Elohim.

<sup>322</sup> They make the very crucial impact in the modern so called democracy. After the first phase of democracy had included slave owners of the ancient Greek town-states only, and the second phase brought feudals and clergy to parliaments in order to control kings and emperors to some extent, at least, the third phase, after the French, British, and American revolutions and later on in the 19 century brought entrepreneurs to power. They were the innovative part of the contemporary society and still are, that's why.

<sup>323</sup> The article reached us by e-mail on 04 September, 2001. It is John Donges [jdonges@seas.upenn.edu](mailto:jdonges@seas.upenn.edu) who sent it, and it is Diane Staffors, columnist, who published it in the Kansas City Star on 30 July, 2001, titled »Interaction among departments is crucial«.

»The key is having the best parts that fit together.  
The best management is over the interaction  
of parts – not managing the parts themselves.«<sup>324</sup>

Ackoff said too many managers spend too much time micromanaging their subordinates – who don't need their close supervision anyway. He related a human resource study that found that the percentage of what employees know about their jobs that they're actually allowed to use on the job is 23 percent. »If we used any other corporate resource as poorly as that, everybody would be out of business,« he said.

»Ackoff also criticized business-improvement programs such as process re-engineering and benchmarking on the grounds that they focus on improving parts of the system rather than the organization as a whole. »You can't take a collection of the best parts and expect it works best,« he said. »You have to have a collection of the best parts that work together. There's a big difference.«

»Ackoff said the Japanese and Scandinavians have been better »systems thinkers« in designing organizations. Meanwhile, most U.S. organizations dissemble their systems into parts. The blame, he said, may lie with the ancient Greeks. The Greeks, he said, analyzed life into four separate aspects: work, play, learning, and inspiration. The Western world has designed organizations to address those aspects separately. Yet, Ackoff said, they can't be separated. »They're intertwined like four horses pulling a cart. The speed of the cart depends on the slowest horse.«

But the problem does not originate from business schools and businesspersons only. It is a general problem of the way education is organized, especially in countries, which are latecomers to the most advanced styles of living, working, learning, and playing. Karl Jezernik, professor of electronics, University of Maribor, Slovenia, finds:

»All new scientific areas are going to share more general and interdisciplinary skills, but our (= Slovenian, N.B. by M. Mulej) universities and their programs are still organized on the basis of the guild divisions. This organizational style originates in the technology development from times of the end of the 19th and beginning of the 20th century.«<sup>325</sup>

Other investigations demonstrate that the **problem of narrow rather systemic thinking and feeling** has even broader roots than the ones quoted / mentioned / discussed so far. In a reaction to the terrible event of 11 September, 2001, in New York and Washington, D.C., another article in the same daily reveals the roots of different fundamentalisms, terrorism, and the taliban's Afghanistan, and quotes:

»The renown thesis by Samuel Huntington [about the struggle of civilizations, cultures] is wrong in this case. We are facing a fight between the fundamentalistic minorities and the democratic majority, between an open society and small, closed-in communities. In U.S., there are talibans, too, for instance some rednecks in Florida swamps. Or you may think of rightist extremists in Europe.

»The reason for me to criticize the American communitarism is as follows: it honors a closed-in culture of a community. And it is true: the more a community is closed, the better it functions – as a community. Ku-Klux-Klan is perfect, as a community – a shared history, a shared tradition, all what communitarians require. But this is no alternative for a modern society. ...

<sup>324</sup> Exposure is ours. M. Mulej

<sup>325</sup> Smaka, M. (2002): Razvoju novih tehnologij namenjajo v razvitem svetu izjemno veliko pozornost (The development of new technologies is paid an extremely big attention in the advanced world. In Slovene). This is part 8 of an interview-based journalistic contribution, 26 January, 2002, Vecer, Maribor, p. 17.

»The only choice we have today, is the choice between a perverse dependence in which the terrorists almost completely decide about our life, or a healthy dependence in which we become partners<sup>326</sup> and create a democratic world, which will control and subdue terrorists.«<sup>327</sup>

In other words and applied to the topic of this book:

The roots of the problem of climate change  
lie in the historic experience of an  
**acceptable efficiency of closed-in communities,**  
which used to be manageable and able to manage their lives.  
But they are no more so, because specialization emerged, step by step,  
over millennia, and especially in the last centuries and decades.  
This process made parts of humankind and other nature  
**critically interdependent and hence interactive.**  
The climate change is a consequence of the  
**massive oversight of this interdependence and interaction,**  
which made the entire planet Earth one closed-in community.  
Obviously, many people do not know this yet.  
The new situations need new solutions,  
and they as a novelty need diffusion  
to become innovation, i.e. beneficial novelty,  
for its consumers and, as a consequence, for its authors,  
all humankind – in the case of climate.

## **6.2 THE DIFFUSION OF NOVELTIES – A REMINDER ABOUT THE DALECTICAL SYSTEM OF VIEWPOINTS TO BE CONSIDERED AND ACTIONS TO BE UNDERTAKEN<sup>328</sup>**

### **6.2.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 6.2**

This chapter is trying to produce a brief checklist on making an innovation from an invention. The STIQE conferences (Rebernik, Mulej, since 1992 biannually) etc. have clearly demonstrated that innovations, both technological and non-technological, result in (a more or less) excellent / good enough quality, and they result from systems (i.e. holistic) thinking in their turn.

These findings apply to a new concept, too.

It must meet criteria of »systemic quality« better than others do. Its authors must therefore be requisitely holistic, creative and successful. Complexity and complicatedness, i.e. entanglement is a given, we have only the option to take it in account to a higher or lower degree, sooner or later in the process: oversimplification of thinking, decision making and acting causes oversights causing complex and complicated consequences rather than simple ones, quite often.

### **6.2.1 NEW SOLUTIONS TO THE ISSUE OF CLIMATE CHANGE, (INFORMAL) SYSTEMS THINKING, AND INNOVATING**

<sup>326</sup> In the language of this book and systems theory, we would call this kind of dependence – interdependence.

<sup>327</sup> Cundric, J. (2002): Res »Bog tako hocē?« (Does »God want it this way« indeed? In Slovene.) This is part 49 of an resource- and interview-based journalistic contribution, 26 January, 2002, Vecer, Maribor, p. 25.

<sup>328</sup> Zdenka Zenko, Matjaz Mulej, Nastja Mulej

From empirical discussions about the climate change, we collect the following brief conclusions:

- There are many (more or less partial) solutions to the problem of climate change available, but there are also many criteria for a (potential) customer of them to choose one or more of them. Thus the points we are going to mention in the text to come are important for *success of a solution*.
- Solution developers concerned with the climate change may be concerned about the technological attributes only of their potential solution/s, or **conceive** it/them more / requisitely *holistically* (aimed at /unknown/ customers satisfaction).
- To meet customer criteria of the good enough / total quality, any product must be good on a (requisitely) holistic basis; thinking about (*requisite*) *holism* must include technology, production, business planning and doing, marketing including selling, human resources, property rights, and several more aspects, as a (dialectical) system, which means with consideration of *all its essential subsystems, partial systems, sub-processes and partial processes as well as their synergies*, limited to covering everything essential and nothing else nor less (see Ch. 4). A *total* holism is impossible, since there are too many viewpoints and synergies around in reality for *all* attributes to be covered completely.
- Solution developing and selling should hence better be a very **interdisciplinary** endeavor, which links at least business, technology/ies, human resources, organization, management, nature, into one whole, leaving no essential holes / blanks – if it should produce an innovation.

If we add a **comment** about the above summary in theoretical terms of the systems and innovation theory, it would briefly include the following:

- A solution concerned with the climate change is a *new synergy* in terms of its contents, on formal terms a new system with a *complex* structure and the role of a subsystem in bigger, broader complex systems mentioned above (and many others, if other *viewpoints* were selected for its consideration).
- A product idea, incl. a solution concerned with the climate change, is an *invention*, which *sometimes* (in about 7-8%) becomes an innovation, in general.
- *Creativity* is essential in producing the product idea and also in *every* later *phase* of its way toward becoming an innovation.
- Many aspects requiring creativity include **detecting**:
  - the impacting *factors* for the idea to have potential to become innovation;
  - the impacting *professions* to be included in making the idea and in helping it become an innovation;
  - the impacting *emotions / values / ethics*, which along with the professional capacities have an important role in making the idea and in helping it become an innovation;
  - the impacting *circumstances* and *conditions* in which the impacting persons are acting.
- They also include **selecting** the concrete factors, professions, emotions, circumstances in three basic groups:
  - the ones to be considered *critical* in the given case;
  - the ones to be considered less critical, but though an *important* environment in the given case;
  - the ones to be considered *negligible* and left aside in the given case.
- They also include **connecting and networking** of the above selections into a synergy, system; in this case this would be a successful, innovative product idea – a new solution saving human lives from consequences of the climate change, in other cases this could be a piece of music, a sports game, a scientific finding and/or discovery, an innovative

service, way of management, family, friendship, war, peace, a new enterprise or another organization, a new person/ality / group / society, piece of nature, any other complex feature / event / process,

- Further on, they include making / summarizing invention or innovation in terms of the above factors, which includes the *process* from **making** the invention, **developing** it into a potential innovation and further on into innovation, involving also consideration of and making impact over environment and circumstances.

This means that creativity and holism in the phase of *development* of a potential problem-solving idea (without all the later phases of the process) are not enough, although essential. Holism may be based on using the systems theory (of a selected kind) explicitly or implicitly, informally<sup>329</sup> (IDIMT; Mulej et al., 2000; Zenko, 1999; Zenko et al., 2002).

One element of the process which is hard to know is how might **potential customers** respond to offers from different authors / sellers of a novelty. They can be put into the following three main groups (*Fig. 6.2.1*).

The *Fig. 6.2.1* may apply to solutions concerned with climate change, too:

- Solutions concerning climate change are novelties, *inventions*.
- They are facing *opposition* and are prevented from becoming innovation.
- UN (in Rio, 1992) started the *diffusion* process of the concept of sustainable development and may have not gone far enough down the road so far to make their ideas an innovation.
- Therefore, *more work* needs to be done for the climate change to stop threatening the humankind's survival. This work includes the diffusion of potential solutions.

Hence, the first step of an idea / solution seller's process is to try to find out in which group / class in *Fig. 6.2.1* one can classify oneself and one's potential customers. Then the next steps of the dialectical system of processes apply, finishing with a long-term customer acceptance.

## 6.2.2 CUSTOMER ACCEPTANCE – MARKET SUCCESS BY EXCELLENCE BASED ON CONTINUOUS INNOVATING

Research on diffusion of novelties (Rogers, 1995) demonstrates on the basis of several thousand cases that it is very difficult for an author and his or her change agent to make an **invention accepted** by the potential customers. What they find *good enough*, is called *excellent / perfect* and depends on five pillars of total quality which are interdependent and each of them must be excellent (Creech, 1994). They are: The *product*, *processes*, *organization* which all must be perfect, *management* which must be leadership, not managership, i.e. cooperative rather than commanding, *commitment* of co-workers.<sup>330</sup>

<sup>329</sup> Informal systems thinking takes place when the concepts of holism, interdependence, emergence, synergy, complexity, depth of investigation, thinking, decision making, and action, networking, interdisciplinarity, transdisciplinarity by interdisciplinary cooperation, openness, hierarchy of complexity, etc., rather than single-disciplinary, one-sided reductionism etc. are used, but no formal language of systems theory shows up. Holism inside a single discipline helps, too, but is rarely sufficient for unpleasant surprises (caused by the so called strange attractors, i.e. unforeseen factors and synergies) to be avoided. – The concept is important because there is a lack of education in systems thinking / systems theory, there is a lot of unavoidable narrow specializations, and hence a lack of consideration of holism. Even more: holism is frequently considered fictiously, limits of consideration being reduced a lot and reviving the out-of-date reductionism under the name of systems thinking / systems theory. See: Ch. 3.2.

<sup>330</sup> See: Ch. 2.2 again.

Fig. 6.2.1: Typical markets for differently finalized novelties

| Level of finalization of a (potential) novelty                                               | Plausible sellers / suppliers                                                                                                                      | Plausible customers / buyers                                                                                                                    |
|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Invention</b><br>(= <i>new and potentially promising idea, not yet usable or useful</i> ) | Authors and research organizations lacking feeling and knowledge concerning the (technical & technological) development, production, and marketing | Entrepreneurs prepared to risk a lot and to pay a small remuneration to the author / research organization, which own/s and sells the invention |

|                                                                                                             |                                                                                                                                                          |                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Potential innovation</b><br>(= <i>new, already usable idea, but not yet proven useful by customers</i> ) | Authors and research organizations having knowledge about technical & technological development, and lacking it concerning production and marketing etc. | Entrepreneurs prepared to take risk in production and marketing etc., but less so in the technical & technological development, hence they buy its outcome/s |
| <b>Innovation</b><br>(= <i>new idea, already proven useful by customers</i> )                               | Authors and organizations aiming at royalties and/or broadening their market after penetration in the market                                             | Entrepreneurs and managers preferring the risks of obsolescence and dependence to the risks of new production, marketing etc.                                |

A product is perfect if meeting criteria of **systemic quality** made of the system *price, (technical and commercial) quality, range, and uniqueness* (see: Bolwijn, Kumpe, 1990) as they are both defined and accepted by *customers* (and without harm to the natural environment, hopefully).<sup>331</sup> None may be missing; they are interdependent. If we take a closer look at »systemic quality«, we can expose (here) two attributes, at least:

- Attainment of systemic quality depends on **innovation** in virtually **all** business functions and by all co-workers throughout the entire process from making / finding the very first idea to the final product development and business success.
- A given level of systemic quality can be **continuously improved** all the way to the top world standards of excellence – by continuous technological and non-technological innovation.<sup>332 333</sup>

In the West, therefore, continuous innovation is the *contemporary culture*. With the other 80% of mankind, this culture is not yet well developed (as cases in /Dyck, Mulej, and coauthors, 1998, 1999/ prove).<sup>334</sup>

If innovation is the precondition of excellence, which is a precondition of market (and life) success, let us brief the preconditions of innovation.<sup>335</sup>

### 6.2.3 PRECONDITIONS OF MAKING INNOVATION FROM AN INVENTION ON THE AUTHORS' PART

<sup>331</sup> On the basis of UNO Declaration on Sustainable Development the care for environment must be added, including the climate change is the visible top of the eisberg, that we called in the subtitle of this book the big tragedy of the commons. Hence, efficiency, quality, flexibility, uniqueness, and social responsibility, including nature (including ourselves), are making the modern system of five attributes required from an optimal company.

<sup>332</sup> Which invention is brought on the OK level of systemic quality by innovation – this decision is made by customers, not authors.

<sup>333</sup> Most probably, every activity - managerial, informational, organizational, or technological - can be (1) made cheaper; (2) improved in terms of reliability etc. of products and services supplied to internal and external customers; (3) adapted to their requirements; (4) done in a way making the supply unique for the customer, and (5) sustainable in terms of the care for nature and thus for ourselves, including solving the problem of our shared big tragedy of the commons.

<sup>334</sup> In the case of climate change, this difference between the rich and innovative 20% and the poor and routinized 80% of humankind is crucial, as we saw in Ch. 6.1. The so called advanced / developed world (measuring development on their / our own criteria) is of course not willing to give up their / our paradigm of life and development. The so called backward / underdeveloped world (many parts of it, at least) is/are trying to catch up with the other 20% in order to escape their poverty and neocolonial subordination and abuse. The nature belongs to the biggest victims of this processes, and as a consequence, all the humankind of today and in future does so, too: the big tragedy of the commons.

<sup>335</sup> We should, of course, use no linear thinking in this context; many unmentioned factors of complexity and complicatedness may have their impacts, directly or indirectly.

Authors and/or their representatives dealing with potential customers and with their potential product, aim at making innovation from their invention. Innovation is *both a complicated and complex outcome and process*, which depends in a concerted (= systemic) way on the system of the following (interdependent) preconditions (where interdependence is denoted with X) (Dyck, Mulej, and coauthors, 1998, 1999):

Innovation = (invention X entrepreneurship X holism X management X coworkers X culture X customers X suppliers X external (socioeconomic) conditions X natural environment X random factors).

- *Invention* includes all new ideas, which might become innovations.
- *Entrepreneurship* is a human characteristic of persons, who work continuously on conversion of inventions into innovations, and take the risk and pride of the new success.
- *Holism* is a precondition based on consideration of all essential / requisite viewpoints, elements and relations as well as resulting synergies in the process of making inventions and transforming them in innovations.
- *Management* is different from entrepreneurship. It involves efforts at a total and profitable exploitation of all resources, which have earlier been created by entrepreneurship.
- *Co-workers* matter because neither entrepreneurs nor managers can know nor time-wise and physically do it all alone.
- *Culture* is embodied in the sub-consciousness and tells us right from wrong. It hopefully supports invention and innovation processes and outcomes.
- *Customers* make invention accepted in the market as an innovation or not, and contribute inventions.
- *Suppliers* can support innovation as sources of ideas, quality, choice, and cost (reduction).
- *External preconditions* (from the viewpoint of an organization) include what traditional economic theory used to consider most or even exclusively, such as market, government, regulations, etc.
- *The natural environment*, especially in terms of sustainable development, is to be considered equally important.
- *Unforeseeable, random features* might be considered a part of objective preconditions, but not necessarily. They cause probability rather than determinism.

Innovation is obviously a topic, which belongs to *no single science* or profession or person, but requires all of them to share the effort of inventing and innovating and its yield, after a success with customers. Therefore invention, innovating and innovation must be integrated in the *entire business process* as well as in the support provided by the (supra/inter)-national economic system and policy. In the case of climate change, the international policy must be important, and has been found so, but rather on paper than in reality.

Which component/s among the above ones **may be missing**, if a new idea, including a solution concerned with climate change, is supposed to become an innovation? **None**, we see, after experience collected. – This is one more proof that systems thinking is essential, be it formal or informal. But it is not the last proof.

#### 6.2.4 FRAMEWORK MODEL OF IMPLEMENTATION OF CONTINUOUS INNOVATION ON THE AUTHORS' PART

The *model* always includes vision, mission, policy, strategies, and tactics (Belak, 2000). We need also to consider that *implementation* of a strategy is at least as complex as its making; it

is here that we confront the established old habits (Feucht, 1995), be it in the authoring organization or with its potential customers.

The **phases** are presented in a logical sequential order, but in reality the process is not linear at all, but dialectical, i.e. full of interdependencies and interactions (See: Belak, 2000), as follows<sup>336</sup>:

- *Vision* may be summarized as »survival on the basis of competitiveness by holistic creative work and cooperation aimed at a systemic quality in accord with customers' requirement.«
- *Mission* (e.g.): »delight customers with an excellent systemic quality and attract them as sustainable customers.«
- *Policy* (e.g.): »implement innovative business as a source of a continuous systemic quality in all parts of the business process and all units.«
- *Strategy* towards implementation of such a policy may employ continuous self-assessment of one's own quality in terms of the European Quality Award or Baldrige Award, or Deming Award, or (as a first phase) attainment and re-attainment of International Standards Organization's rule ISO 9000 certificate or something similar.<sup>337</sup> In the case of climate change, ISO 14000 applies too, of course.
- *Tactics* for implementation of such an innovation strategy is e.g. an »organized critique, followed by teams and task forces that work on solving the selected problems« (on a voluntary basis and on company time, one hour a week) with awards for inventions (symbolic in value, but with no delay) and for innovations. Innovation reward is foreseen for all of the innovative team, all members of their own organizational units, every organizational member including managers, while a half of the value created by innovation enters the company business funds, but is specifically reserved to support invention-innovation activities (See: Kejzar et al., eds, 1995).

Once *inventions and potential innovations* result from the summarized process, the *diffusion process* comes in to change ideas and products into innovation (Rogers, 1995).<sup>338</sup>

## 6.2.5 THE DIFFUSION VIEWPOINT OF MAKING AN INNOVATION AND MARKET SUCCESS

In a competitive market<sup>339</sup>, a supplier can hardly let customers wait for a new product or other invention, they are also hard to discover: **demand** must often, but not always, be **created**. This is done by **persuasion and diffusion** making both the authors and the potential customer

<sup>336</sup> The UN Declaration on Sustainable Development, Local Agenda and Local Agenda 21 etc., may deserve, as a requisitely holistic entity / action plan, i.e. a dialectical system, a thorough rethinking in terms of this process.

<sup>337</sup> EQA and ISO 9000 explicitly relate excellent quality with all preconditions of the market success and with learning, innovation and systems thinking, in their versions of 2000, no longer only the production process and the insight in it.

<sup>338</sup> In the case of potential solutions concerning the climate change, too, its producers and representatives are in the role of change agents and have to do their best to make the future (!) new idea accepted by its potential users. This means that they need a lot of capacity in communication, persuasion, listening, gaining opinion leaders and their informal aides as facilitators of the persuasion process, etc.

<sup>339</sup> Sometimes it may happen, even today, that customers ask or even urge developers of solution/s related to climate change to develop a solution. We are aware of such a situation. But we will not consider it in any detail for a number of reasons: (1) this is an exception to the rule of the modern market, (2) it applies to the best, most regarded solution developers only, not the majority of them, (3) the urging customers tend to belong to the *customers-innovators* mostly who make only 2,5% of the entire market, perhaps to the *early adopters*, but much less to the *early majority*, *late majority*, and *laggards*, who make 80% of the market, together. In addition, it frequently happens that a supplier, who is no longer under the pressure of competitors, tends to become rather lazy, investing less than earlier in the novelties and into the capacity to invent and develop and market them. The consequence, of course, is most frequently, that customers no longer find such a supplier good enough, not to talk of an over-average excellence.

know each other better. What should e.g. author of a potential solution related to the climate change think about to achieve success? When is a new solution's quality good enough?

The author/supplier *cannot know* this answer  
as long as he cares for his product more  
than for his potential customers.<sup>340</sup>

Hence, the diffusion process addresses the dialectical system made of:

- (1) the *novelty* to be offered,
- (2) the *communication process* between the supplier/s and the potential customer/s,
- (3) *time* for potential customer to decide for the novelty (or against it), in to do so in a big enough number for the supplier to succeed economically, and
- (4) the group of potential customers as a *social system*. (Rogers, 1995)

***Every potential customer may be another story. The framework summarized here may need very particular elaboration for every potential market segment to come to be known well enough, mastered and even attracted on a long-term basis. Why?***

- Whether or not the novelty will become an innovation, is up to its *potential customers*. They may find it suitable, or not. Authors/suppliers may do a more or less informed guessing about their needs, and try to influence them. Therefore change agents are needed.
- The *change agents*, with the support from the *opinion makers* and their *unprofessional aides*, may make the potential customers *aware* of the novelty and even *persuade* them, or not.
- The *social structure, norms and roles* of the change agents and opinion makers in their social system, such as a local community, a company, etc., may support the novelty, or not.
- The *individual properties* and *socio-economic statuses* of customers may make them interested in the novelty a lot or hardly, and may do so *quite early, later on, or never*.

A similar impact over the potential customers may be ascribed to ***communication channels***:

- To some, but rather few, *mass media* may be sufficient.
- Others may need *interpersonal communication* with their peers and friends, who already have acquired the novelty, because they trust them better than the advertisers.
- The more *cosmopolite* or the more *localite* channels may do a better job, from case to case.

The potential customers / adopters of an offered novelty may be as *different* as we mentioned earlier in a footnote (classifying them into customers innovators, etc.). One consequence of this fact is that they are differently easy / hard to **persuade**, take a differently long **time** to make their decisions, need different **approach methods** of change agents, opinion makers and their aides, find different **attributes** of the product / solution offered acceptable / promising / inviting / persuasive, etc.

The suppliers are interested in selling many pieces of their solution, and to do so with the least possible effort and cost. Hence, they are very interested in creation of a *critical mass* of customers adopting their supplies. Once the critical mass is attained, the new market develops a lot on its own, and the change agents may and can concentrate on other potential customers.

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<sup>340</sup> Sometimes the customers are not able to know their own needs, which may rather easily be so in the case of the climate change and measures tending to control / reduce it. The idea must be sold to people, they must be persuaded of their own need for the new solution offered, e.g. a new taxation system, technology diminishing diseases, etc.

Too often the potential customers, who are less open, rich, innovative risk takers, are left aside. This means that the change agents do not **change the habits** of the potential customers who may need the novelty offered most of all, because they are lagging behind the development of others anyway (even if they have good reasons to do so, from their own viewpoint systems)<sup>341</sup>.

That's why **networks** matter so much, be they between *individuals* or between *organizations* (in which the diffusion process is even more complex and complicated, because more persons and relations are involved<sup>342</sup>). It depends on the type of the novelty offered, whether or not a **centralized** or a **decentralized** diffusion system works better.<sup>343</sup>

**Consequences** are the final essence of the story, and they are normally a *synergy of desired and undesired, direct and indirect, foreseen and unforeseen* outcomes. – The more (requisitely) holistically these and similar issues are worked out in the *feasibility study*, *business plan* and *marketing plan*, the bigger may be the chances for the consequences to have less undesired, indirect, and unforeseen consequences (Belak 2000; Celan et al. 2002a, b; Likar 2002; Bucar, ed., 2002).<sup>344</sup> Systemic thinking helps a lot again.

#### 6.2.6 SOCIAL MARKETING AND THE DIFFUSION OF NOVELTIES CONCERNING THE CLIMATE CHANGE

In principle, governments and other authorities may **force** people to adopt novelties, especially innovations. In the case of such a decision and action, society *imposes* its will on individual behavior. But such a *coercive approach* is not very popular with the public and makes many oppose it, even if the ideas are OK. *Social marketing* takes this fact in account and tries to **gain adoption** of e.g. inventions that may improve health, if they become innovations, etc. The point is in application of the commercial marketing strategies and tactics to the diffusion of nonprofit products and services. Hence,

it can apply to diffusion of novelties,  
which should become innovations  
concerning the climate change, too.

According to Rogers (1995), the social marketing approach has been applied, over the last decades, to energy conservation, smoking cessation, safer driving, etc. Often social marketing campaigns seek to **convince people to do something that they may find unpleasant**, but it makes sense (from other viewpoints), and brings benefit to its users. It has proven useful / effective in attempts to cope with social problems and to bring about *useful social changes* in society. When done right, social marketing can make a difference. But

<sup>341</sup> This situation is very frequent (Dyck, Mulej and coauthors, 1998, 1999), covering 80% of humankind, and is called the *law of the innovation paradox* (Rogers, 1995).

<sup>342</sup> Even more: organizational attributes which are helpful in the phase of creation of awareness, interest, positive decision etc. concerning a potential innovation, may be harmful in the later phase of its practical implementation, and vice versa (Rogers, 1995). E.g. it may be easy to persuade a manager, but the consequences may be bad, if he or she is found imposing rather than trustworthy as an opinion leader. Besides, an opinion leader must not be too different from his community. Etc.

<sup>343</sup> In January, 2002, there was a debate whether or not is it correct that Microsoft wants to offer computers in the value of \$1 billion as a gift to public schools. This looks like a nice gesture of a decentralized type, but may cause a unification that would make a centralization effect similar to a government decision about which company supplies spare parts, next generation products, etc.

<sup>344</sup> But we may never be totally sure: information which is used for them is basically a *better or worse guessing*, requisitely holistic or not so, everything can never be known in time, decisions cover future. In addition, economic data cover 50% of economic reality, at best (Grayson, O'Dell, 1988).

- it must be adequately funded, and
- staffed by competent individuals, and
- enough time must be provided for carrying out a social marketing campaign, and
- it should incorporate both formative<sup>345</sup> and summative<sup>346</sup> research in order to design effective messages.

Social marketing is essentially a type of **planned communication process**. But it is not motivated, like a commercial one is, by a desire for profit. It is usually government and other nonprofit organizations that carry it out.

The essentials of a social marketing **campaign** include the following (Rogers, 1995):

1. *Audience segmentation*. This is a communication strategy that consists of identifying certain sub-audiences within a total audience, and then one conveys a special message to each of these groups.
2. *Formative evaluation research*. It is conducted relatively early in a communication campaign in order to create more effective messages in time. Pre-testing of provisional messages with small samples of an intended audience in order to obtain feedback allows the messages to be redesigned and thus made more effective. It provides an audience orientation to social marketing campaigns.
3. *Positioning of the novelty* relative to its meaning from the viewpoint of the intended audience. The name of the potential innovation, the logo symbolizing it, etc. matter a lot. If the potential adopters do not accept / like them, novelties also can be refused, not only names and logos.
4. *Keeping the price of the to-be innovation very low*. The point is to change behavior, not to earn profits, but not to give the novelty away for free, anyway. Further, distribution of the novelty should be convenient for its potential customer / adopter.
5. *Utilization of easily controlled communication channels*. The campaign planners need to make a good choice of time of e.g. broadcasting in radio and TV in order not to miss the intended audience segment (which may happen in a paid advertisement).

The change agents, when using a communication process, must bear in mind that a message in communication channels may be missed. Even in the case that it is not missed by members of the intended audience segment, this means only the *beginning* of a **novelty / innovation decision process**. This process consists of five phases (Rogers, 1995):

1. *Gaining the first knowledge*. This entire process is an information-seeking and information-processing activity in which an individual / organization obtains data / message / information in order to decrease uncertainty about a to-be innovation. At this – knowledge – stage one wants to know what is the novelty all about and how and why it works. There is no decision yet. *Mass media* can effectively transmit such information.
2. *Persuasion stage*. Persuasion occurs when the same individual / organization – before his / her / their decision-making – forms a favorable or unfavorable attitude toward the offered novelty as a to-be innovation. Now he / she / they seek/s information to evaluate the novelty, in order to reduce uncertainty about the consequences to be expected. He / she / they want/s to know the advantages and disadvantages of the novelty in his / her / their own situation. There is no decision yet. *Interpersonal networks with near-peers* are particularly likely to convey such evaluative information about the novelty.
3. *Decision stage*. Decision occurs when the same individual / organization engages in activities that lead to a choice to adopt or reject the novelty offered. On the basis of the foregoing two stages, *subjective evaluations of the new idea* from other individuals are

<sup>345</sup> This is evaluation of the program before the action (Rogers, 1995).

<sup>346</sup> This is evaluation of the program after the action in practice, and before a next one (Rogers, 1995).

especially likely to influence the deciding individual / organization. Such decisions can be reversed in a later stage (see stage 5 of this process) – to *rejection* of an adopted novelty and to *discontinuation* of its use (due to dissatisfaction or due to replacement with another improved novelty). It is also possible to adopt a novelty after a previous decision to reject it.

4. *Implementation stage*. Implementation occurs when the same individual / organization puts the novelty into its use. In this phase experience is collected, which may make the decision-maker unsure of the quality of his / her / their decision. *Re-invention* is likely to occur in this stage (adapting of the novelty on the basis of the new adopter's / user's inventive / innovative ideas, in order to make the novelty more innovative / useful / beneficial to themselves and on their own criteria).

5. *Confirmation stage*. Confirmation occurs when the same individual / organization seeks reinforcement of his / her / their decision about the novelty, which has already been made, but the previous decision may be *reversed*, if one is exposed to conflicting messages about the novelty / innovation. *Subjective* evaluations, like in the decision stage, are especially likely to make their influence in this stage again.<sup>347</sup>

The **lengths of time** needed for the process may differ under the impact of both (1) the novelty, (2) the communication process, and (3) the personal traits of the decision-makers, as well as of (4) the traits of the culture of their social system. It is a synergetic process, of course.

In the case of novelties to be diffused for something to be innovated concerning the climate change, all these attributes need to be taken in account. A very thorough **preparation**, not only in terms of professional issues concerning the *novelty* in question, but also of the professional issues concerning the *communication process*, as well in terms of the *political preparation* for the near-peers and other opinion makers, is essential. Again, systems thinking surfaces as a precondition for success.

## 6.2.7 CONCLUSIONS ABOUT DIFFUSION OF NOVELTIES

The invention-innovation process, including solutions related to climate change, is long, complex and complicated. It runs from freeing, making/enhancing and activating *capabilities* of all available resources all the way to the final *acceptance* of the novelty by the customers and resulting *benefit* for them and the authors and owners of the novelty. *Developing and diffusion* of e.g. a novel idea about solving a climate change issue, are two big parts of the same whole, very interdependent and requiring (informal) *systemic / holistic thinking*. It also means a transition from a routinized to an *innovative management*. The process covering all the way from idea via innovation to excellent quality and good life results (see: Afuah 1998; EU 1995; EU 2000; Reger et al 1999; Schleicher 2001; Treven 2001). The alternative is clear and bad: from the viewpoint of a supplier this may be bankruptcy, from the viewpoint of humankind ruining the preconditions of human life (Hawken 1994; UNESCO 2001, Dec.; Vezjak et al 1997; Strebel 2002; etc.). Developers of solutions related to climate change and their distributors (= political and commercial sellers, their change agents, opinion makers, and

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<sup>347</sup> The five stages usually occur in a time-ordered sequence of knowledge, persuasion, decision, implementation, and confirmation. Sometimes the impact of the incoming information is so strong that the decision stage precedes the persuasion stage.

aides) ought, perhaps, to *rethink* their own practices from this system of viewpoints, too.<sup>348, 349, 350</sup> The potential customers/markets of such solutions may be made less unknown and strange (but never completely!). They may also be able to make a better contribution to humankind, including themselves.

Tools making the diffusion easier, especially in the case of such a complex issue as the measures to master the climate change, include data, messages, and information making one's partner trustworthy.

### 6.3 THE MEASUREMENT OF SUCCESS BY MEASURES OF CREDITWORTHINESS / TRUSTWORTHINESS<sup>351</sup>

#### 6.3.1 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 6.3

Until recently scientific and public attention has been paid mainly to the degradation of natural environment. The lack of other complementary resources (of tangible and intangible nature, like knowledge) makes the problem even more severe. Because of the changing environmental circumstances the need for a better understanding and managing of scarce resources is apparent on both the macro and micro level of both the economy and the society. Firms, being at the same time business as well as living and viable systems, on one hand, and subsystems of the society, on the other hand, are in different stages of environmental awareness and responsibility (Knez-Riedl, Mulej 2001). Both of them depend a lot on values and emotions of the key persons, on their knowledge and capabilities to

act in an environment-friendly way  
and, at the same time,  
successfully from the economic point of view.

In seeking the ways how to *link economic and environmental performance*, firms adopt environmental standards and trying to remain competitive, or to gain competitive edge. For that reason they are interested in the *environmental best practice* and in the environmental creditworthiness of others and of themselves. As a matter of fact, the best practice presents a new standard in the **environmental creditworthiness** assessment. Over recent years the role of creditworthiness of a firm has gained its significance as a selection criterion decisive in

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<sup>348</sup> One normal, but potentially problematic attribute of the authors of a potential solution, including the one concerning the climate change, might be their **pro-innovation bias**. They might trust their own idea so much that this attitude might make them blind for attitudes / viewpoints of others. Especially important is this difference when one communicates with persons / social systems such as villages, countries, companies, etc., whom one tries to persuade to implement the supplied (potential) solution to their problem. (Rogers, 1995)

<sup>349</sup> Another problem in the same relation – between suppliers and potential adopters / customers of an idea as a potential solution – is the unavoidable difference of knowledge and values about the potential solution. If the difference is small, then there is not much new, if anything at all. Rogers (1995) calls such a relation *homophily*. There must be some difference, and Rogers (1995) calls it *heterophily*. But, if heterophily is too big, e.g. the supplier is too innovative in criteria of the social systems, which he is trying to persuade, he / she has a poor chance. That's why *empathy* (= capacity to put yourself in somebody else's shoes) is so important. – This is true of the potential solutions concerning the climate change, too. In addition, there are strong lobbies with vested interests in whose shoes one must put oneself in order to understand them requisitely holistically to succeed.

<sup>350</sup> The process becomes additionally complex and complicated, when the potential adopters of the offered novelty feel that the change agent, who talks to them, actually is a professional representing the organization owning the novelty and trying to make profit for the organization rather than benefit for the potential adopter. - The climate change processes are full of such experiences of mistrust ruining the initial, hopefully benevolent, idea.

<sup>351</sup> Jozica Knez-Riedl

several kinds of the present-day business transactions. By increasing environmental awareness the recognition of both environmental risks and opportunities has emphasized the need for the so-called **eco-rating**.

A nowadays-successful firm should respect the **principles of sustainable development**, which refer to a reasonable use of natural resources and appropriate technologies (see: Knez-Riedl, 1997b; Knez-Riedl, 2000a). The integration of the environmental criteria into the economic practice demands:

- understanding of (individual and organizational) contradictions among environmental and economic principles,
- solving of conflicting interest of economic efficiency and eco-efficiency, and
- distinguishing between the traditional consideration of »successful business« and the so-called »**sustainable organization**« (Knez-Riedl, Mulej 2001).

Along with the changing role of firms a tremendous **change of success paradigm** has influenced a lot the understanding of creditworthiness and of criteria of its assessment. Firms, which are environmentally responsible, are searching for business partners with the same ecological values and with a strong environmental commitment. They are trying to find partners who are not environmentally risky and search for environmental opportunities (e.g. possibilities to build the so-called *eco-partnership*).

### 6.3.2 THE NEW SUCCESS PARADIGM AND THE CONTEMPORARY CONCEPT OF THE FIRM'S CREDITWORTHINESS

The new circumstances, especially the discontinuities in the global environment and the dramatic worsening of natural environment of humankind of today have influenced the concept of the contemporary firm, its success and development. A firm is at the same time a business entity and a social institution contributing to the social welfare. If we view a firm as a market institution, its economic and legal *responsibilities* matter a lot. The attention is put mainly on the strategic position of a firm, on its *competitive advantage*. Along with its increasing social role and *social responsibility* a firm should be aware of the variety of risks, among which the ecological ones have influenced the concept of a successful firm a lot. Orientation towards an environmentally sustainable future requires strategies, goals and actions consistent with the concept of sustainable development. In this context the success is understood as **acting and developing in harmony with natural environment and thus protecting its quality**. But being accepted by the society is equally important. For that purpose a lot of learning and sound *knowledge* about environmental quality is necessary. Besides a range of management capabilities a strong *commitment* and *persistence* are of equal importance.

Over recent years the role of the **creditworthiness** of the firm has gained its significance as a *selection criterion* decisive in a range of present-day business transactions. Even more, new kinds of risks, increased awareness and the need for *early recognition* of both risks and opportunities have even more emphasized the need for creditworthiness assessment. Today's generations of entrepreneurs, firm owners and managers are becoming much more aware of the importance of knowing their business partners, shareholders and other stakeholders (see: Knez-Riedl 2000b; Knez-Riedl 2000c). The attention paid to these relationships is evident in greater care about creditworthiness. It is one of the possible ways of reducing the *information asymmetry* and the risks arising there from. As a *guarantee of reliability* and trustworthiness of business partners and other stakeholders, information about their creditworthiness has been and is indispensable for building and maintaining good relationships (in e.g. strategic

alliances, networks, with both local firms and global corporations). Therefore the information about creditworthiness is vital in making strategic decisions influencing the future of the firm.

The **concepts of the creditworthiness** of a firm vary and so do the approaches to its assessment. Most up-to-date methods deal with both risks and opportunities. In that way they overcome the traditional role of creditworthiness, being a tool for minimizing or avoiding risks (mainly the financial ones). Besides risk awareness the contemporary concept of creditworthiness is oriented towards *conscious search for perspective business partners*. The shift towards future demonstrates care about the *future* development of a firm and of its environment. In such a modern context, it is not enough any more to use only the financial analysis as a predominant analytical method, and the *financial* measures as the main analytical tool. Therefore some approaches, known and used especially in the field of *marketing* and *strategic management* (besides e.g. renewed SWOT analysis, portfolio method, life-cycle approach) are important (see: Knez-Riedl 2000b, 2000c)

Looking at the firm as a socially responsible business system, several relevant (intertwined!) viewpoints of such a system (see: Knez-Riedl 1996; Knez-Riedl, Mulej 2001) should be taken into account in the creditworthiness assessment. This emphasizes its **interdisciplinary** character, which demands different kinds of expert knowledge and co-operation (e.g. in data exchange and explanation).

Being defined as the “capability to survive and develop” (Osmanagic-Bedenik 1992), creditworthiness of a firm has been assessed by taking into account a variety of categories, indicators, as well as their interdependencies. So the **assessment** of creditworthiness is, on one hand, leaned upon a **wider range of quantitative factors** (including the so called non-financial measures) and, on the other hand, on a variety of **qualitative factors**. They are identical with the key or critical success factors depending mainly on business activity of a firm (the industry the firm belongs to). Besides the *conventional* financial and non-financial measures a range of new, *unconventional* measures are created (e.g. customer satisfaction, innovation capability). They are more demanding in terms of different information, depending especially on *information disclosure* and the willingness of several stakeholders to participate in the creditworthiness assessment.

In the evolving of **new characteristics** as well as roles of creditworthiness multi-theoretical foundations have to be used. Theoretical pluralism enables confronting and complementing of very different, but relevant (and interdependent) viewpoints (see: Knez-Riedl 2000c). The concept of sustainable development enters new perspective by **combining** two basic notions, the **economic development and ecological sustainability**. At the micro and business level, the economic and ecological principles are confronted in a specific way, conflicting in a short term, and complementing each other in a long term. Environmental awareness and environmental care are becoming critical for success of a firm.

### 6.3.3 ENVIRONMENTAL CREDITWORTHINESS

It is the orientation towards future, which makes place for the so-called environmental creditworthiness. Different decision makers, stakeholders and interest groups (e.g. consultants, information providers, several experts) demand thorough and timely information about firm's creditworthiness, and hence the **environmental dimension of business activity** is becoming an important part of criteria for creditworthiness assessment.

The increased attention is paid to the »**sustainable business**«, which can be seen from special analytical approaches (»ecological or green portfolio«) and tools like ***environmental indicators and ratios*** (see: Knez-Riedl, Vezjak 1997). Therefore, assessing the firm's creditworthiness takes into account very evidently existing and potential environmental risks. This trend can be seen in banks, other financial institutions, such as the Stock Exchange and, last but not least, among the firms themselves. But besides identifying the firms, which are from the environmental point of view too risky, the attention has been shifting towards the opportunities arising from environmental concerns, as well. For that purpose the characteristics representing ecological advantage or challenge should be identified. They encourage the new kind of partnership, the so-called **eco-partnership**, the collaboration of partners with strong environmental commitment. Conventional measures of success, methods of assessment and tools like ratios do not satisfy such intentions. They demand environmental data and information, transformed into environmental indicators and ratios. They should disclose and explain as soon as possible the events, providing the so-called *early warning signs* about environmental risks and opportunities (not only historical and present, but especially about those possible in the future).

Assessing the ecological profile of a firm needs in addition to *environmental information system* the so-called *environmental disclosure*, which is confronted with an adverse attitude towards it and many other *information barriers* (especially data dispersion, lack of transparency and difficult access to information sources). The environmental creditworthiness can be assessed by additional, deeper insight into firm's activity and into its relationships with the environment. By development of the **environmental accounting** (Rubenstein 1994) and especially of the **environmental management** (Kolk 2000) and its information system the data needed can be obtained (from eco-balance sheet, environmental reports, systems of environmental indicators and ratios and other kinds of environmental information) (see: Knez-Riedl 2001b).

The main difference between a successful organization (in economic terms) and a sustainable organization are the *criteria of success*. In the case of sustainable organization the *cost efficiency* is combined with the *ecological efficiency* (see: Knez-Riedl 2001b). For that purpose both the environmental and cost consciousness are required. Treating costs in a conventional sense should be replaced and complemented with the knowledge of ***environmental economics*** (Kolk 2000, Knez-Riedl 2000a) and ***environmental accounting*** (especially the ex-ante character of the main business categories). Therefore it is important to be aware of the impact the firm's environmental activity and profile have on cost, but equally on revenues and business results, of both direct and indirect, intended and unintended, foreseen and unpredicted impacts. From that correlation stems the necessity to evaluate the creditworthiness in a longer period. Investments in environmental protection, as a rule, cause costs first. Positive gains (not merely in measurable value of profit) can arise much later (see: Knez-Riedl 1997b; Knez-Riedl, Vezjak 1997).

Besides the development of the *environmental ratios* system/s, which present/s the quantitative factors of environmental creditworthiness, the *ecological dimension* of the other, qualitative, factors should be analyzed and assessed (e.g. of site, business program, products / services, technology, investments, strategies, innovations, knowledge, management quality, etc.) (Knez-Riedl, Vezjak 1997).

The environmental creditworthiness can be assessed either **implicitly or explicitly** (see: Knez-Riedl 1997b; Knez-Riedl, Vezjak 1997). In the case of a lack of appropriate databases

or of undeveloped environmental information system it is assessed implicitly. The data describing the ecological profile of a firm are extracted from the existing databases for each of the other relevant factors affecting creditworthiness. In that way we work on what Fig. 6.3.1 summarizes.

Assessing the influence of environmental protection on costs, revenues, and financial results is much easier, when an **ecological balance sheet** is available. The prime purpose of the ecological balance sheet is to provide data helping their users optimize the inputs (raw materials, energy) and outputs (products, services and emissions). It enables a quicker and improved insight into the ecological profile of a firm by calculating the so-called **environmental indicators**. They should be a tool for decision and control for a firm itself and for its partners (other firms, government, public). They demonstrate the level of ecological awareness, the impact of a firm on environment. Tischler (1996) describes environmental indicators as *environment related behavior of a firm that can be quantified*. They are mainly distinguished into indicators about material, packaging, energy, water, and waste. Several industries developed special, relevant indicators.

What has to be emphasized is the **linkage** of qualitative and quantitative factors affecting the environmental creditworthiness of a firm. They complete up and explain each other. The indicators, either in absolute or in relative form (ratios), have a role of proof. They enable comparison, benchmarking and in this way a more profound judgment.

Fig. 6.3.1: Data describing the ecological profile of a firm

|                                                                     |                                                                                                                                                                                                                                                                                                          |
|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data aimed to search and assess</b> the ecological dimension of: |                                                                                                                                                                                                                                                                                                          |
| •                                                                   | firm's activity (input, output, impact on environment),                                                                                                                                                                                                                                                  |
| •                                                                   | location (site),                                                                                                                                                                                                                                                                                         |
| •                                                                   | characteristics of products/services (from input of raw material, energy, packages, waste, substitution, internal or external recycling, recyclable potential),                                                                                                                                          |
| •                                                                   | characteristics of technology, distribution, transportation (how clean are they),                                                                                                                                                                                                                        |
| •                                                                   | characteristics of management (key persons): the commitment to environment, their values and actions, their environmental policy and set of its instruments, the environmental impact of their decisions, their care for health and safety of employees, for their products throughout their life-cycle, |
| •                                                                   | characteristics of their facilities, innovations, strategies, and investments (are they environment friendly, do they meet environmental criteria, are they environmentally responsible),                                                                                                                |
| •                                                                   | the stage of their organization (who in a firm, or which part of it, takes care of ecology, in which stage is the organization of environmental management and the usage of environmental standards),                                                                                                    |
| •                                                                   | the availability of ecological information and, as consequence the environmental disclosure of a firm.                                                                                                                                                                                                   |

The environmental indicators can be classified in the following way (Knez-Riedl, Vezjak 1997), see Fig. 6.3.2:

Fig. 6.3.2: Environmental indicators

|                        |                                                                                   |
|------------------------|-----------------------------------------------------------------------------------|
| 1. Material indicators | * raw materials / production (monetary)<br>* raw material / production (quantity) |
| 2. Packages indicators | * packages / production (monetary)<br>* packages / production (quantity)          |
| 3. Energy indicators   | * energy (different units for different kinds of energy) / production             |
| 4. Water indicators    | * water input / production<br>* water input / water output                        |
| 5. Waste indicators    | * waste disposal costs / production<br>* waste volume / production                |
| 6. Emission indicators | * specific emissions                                                              |
| 7. Cost indicators     | * R & D costs<br>* cost of environmental projects                                 |
| 8. Investments         | * environmental investment / total investments                                    |

Some **other examples** of environmental indicators can be found in many sources, e.g. in Manski (1991), Hopfenbeck (1992), Tischler (1996), Seidel et al. (1997), European Green Table (1997), or in UN (1999).

The **environmental performance indicators** are discussed, especially their classification, external publication, and financial relatedness. The main attention is paid to **eco-efficiency**, because of several definitions. According to its definition by World Business Council for Sustainable Development (UN, 1999) it enables several industry specific eco-efficiency

indicators. Thus, the eco-efficiency can be measured and communicated in several formats: absolute, relative, indexed, qualitative, financial, aggregated, and weighed.

The existing **rating systems** are either qualitative or define environmental performance in narrow terms and only by what is measurable, such as waste emission. E.g. the Eco-Rating from Switzerland takes into account the following criteria (Harrison 1993; see Fig. 6.3.3):

*Fig. 6.3.3: The Swiss case of Eco-Rating*

- environmental impacts (emissions, use of natural resources, disaster risk),
- logistics (methods of transporting),
- infrastructure (construction of buildings, equipment),
- ecological profile of products,
- compliance with environmental laws and guidelines,
- environmental risks from research and development,
- management (delineation of responsibilities, qualifications, allocation of resources),
- soft issues.

IRRC (Investor Responsibility Research Center) rates corporations on the following environmental factors (Harrison 1993). See Fig. 6.3.4:

*Fig. 6.3.4: IRRC environmental factors*

- environmental disclosure in securities filings,
- liabilities resulting from past contamination of specific sites,
- reports of significant accidental spills of oil or chemicals,
- estimating routing emissions of toxic chemicals,
- environmental enforcement actions,
- company description of their environmental policies and programs

As a matter of fact they are mainly environmental risk rating procedures with **rather narrow**, one-sided financially related views at environmental performance of a firm.

Environmental awareness in the context of creditworthiness of a firm should be assessed from both, the **qualitative and quantitative** viewpoints. The first one, of a more *descriptive* nature, offers general information about the level of one's environmental awareness and about implications for the future. The second one, represented by a system of environmental *indicators*, illustrates the environmental awareness by quantitative, measurable arguments / proofs. It discloses the ecological profile of a firm, its environmental vulnerability, and communicates environmental risks connected with the firm. These factors can be investigated and analyzed by means of *checklists*, *interviews*, *site visits*. Both kinds of factors, quantitative and qualitative, should be evaluated by a *scoring* system. The rating scale could be spread (Knez-Riedl, Vezjak 1997) e.g. from:

- a) unsatisfying - satisfying - very satisfying, or
- b) insignificant - significant - very significant.

**Several scales** are possible. Selection depends on rater's attitude toward a less or more precise evaluation and, of course, on his/her/their environmental expert knowledge. The rating of

individual factors is integrated into the *holistic assessment* of the "environmental awareness", which is only a part of integral assessment of the creditworthiness. This one demands system thinking and holistic analysis (see: Knez-Riedl, 1996; Knez-Riedl, Mulej, 2001).

The ecological viewpoint of creditworthiness assessment enables us to recognize risks connected with environmentally irresponsible partners, but opportunities too. It helps us find and create new markets, customer groups and other business partners with environmental commitments. The creditworthiness assessment and information, which take into account the environmental dimension of a firm, enable a critical and constructive **stakeholders' dialogue** (see: Knez-Riedl 2001a). In this way, the creditworthiness assessment fulfils one of its main up-to-date roles, namely the one of improving the **strategic communication** (within and without firm).

#### 6.3.4 THE CHARACTERISTICS OF THE ENVIRONMENTAL CREDITWORTHINESS ASSESSMENT

In the environmental creditworthiness assessment the following **characteristics** can be found (see Fig. 6.3.5):

*Fig. 6.3.5: Characteristics of the environmental creditworthiness assessment*

|                                                                                   |                                                                                                                                                                |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Orientation toward business future                                                | No longer the former orientation towards past and current events, processes and results                                                                        |
| Strategic importance                                                              | Working on long-term goals, strategies, and relationships with different stakeholders to improve strategic position of a firm                                  |
| Identification, analyzing, and assessment of quantitative and qualitative factors | Combining tangibles and intangibles of a firm                                                                                                                  |
| Non-financial, the so-called qualitative disclosure                               | E.g. in the social report and environmental report                                                                                                             |
| Broad theoretical foundation                                                      | Especially in the theory of a firm, recent trends in management science, environmental economics, system thinking                                              |
| Intense search for evaluation criteria and metrics                                | E.g. by means of benchmarking in the broadest context, e.g. "Best Practice", "Best Results", or "Best in the Class" comparison, beyond industry or competitors |
| Problems of non-public data accessibility and information sources credibility     | Management of the unconventional, not standardized data, the need for information seeking strategies including choice of credible information sources          |
| Treatment of confidential data                                                    | The importance of protocols and codes of ethics                                                                                                                |

Creditworthiness assessment is frequently **combined with benchmarking**. Both of them have the following characteristics in common:

- The dynamic nature, which demands "dynamic" opinion or rating.

- The continuous process nature (both include specific, rational steps; the final one initiates the next process of assessment or of benchmarking).
- Assessment teams with interdisciplinary knowledge and skills are crucial.

### 6.3.5 CONCLUSIONS ABOUT THE ENVIRONMENTAL CREDITWORTHINESS ASSESSMENT

Among the information needs those of several stakeholders (owners, investors, managers, employees, suppliers, buyers, several intermediaries, government, several professional groups, interest groups, and public) are increasing, as well. The environmental creditworthiness (the so-called eco-rating) contributes to affirmation of the »sustainable business« by improving *environmental transparency* and thus decreasing of information asymmetry. Search, identification and development of appropriate metrics support the developing of up-to-date criteria and standards (especially the »best practice«) for a better judgment. Environmental performance has become an important selection criterion in building, maintaining, and developing relationship with business partners and other stakeholders. Therefore the eco-rating gains a growing importance. A special attention is paid to the methodology and opinions. Along with specialized agencies the traditional rating institutions (global and local rating agencies, banks, insurance institutions and bigger enterprises) are developing environmental criteria and including them into their assessment methodologies.

In this way information about environmental creditworthiness provides **reference** not only to the business partners. It helps its users gain **confidence** of other stakeholders, as well. Its role in building **public opinion** and **credibility** is tremendous. It contributes to improved, **fair** internal and external **communications**. The concept of environmental creditworthiness supports *proactive* behavior of a firm, which is seeking its new *opportunities* through perspective partners, finding and creating of new markets, customer groups and other stakeholders with **environmental commitment**,<sup>352</sup> and it can be supported and diffused by a contemporary design of new products' quality.

## 6.4 DESIGN FOR ENVIRONMENT AS A NEW DIMENSION OF PRODUCT'S QUALITY<sup>353, 354</sup>

### 6.4.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 6.4.

We saw in the Ch. 6.3 that the care for environment supports an organizational or individual creditworthiness that supports holistic thinking, if modern. Most environmentalists agree that *changing a product's design and the technology applied in the manufacturing* of the given products and services are among the fastest and the most reliable ways today to improve the quality of the environment to a level enabling a healthy life to our and future generations. The theory of *value innovation* and *attribute matrix* can be implemented to prove the hypothesis that the design for environment can fundamentally change the product's value curve and contribute to the higher profits. First experiences of big corporations also confirm this hypothesis.

#### 6.4.1 THE BASIS OF THE IDEA

<sup>352</sup> See more about organizations with such a commitment in Ch. 7.

<sup>353</sup> Majda Bastic

<sup>354</sup> We tackled the organizational processes outside production earlier in this book, especially in the Ch. 4.5, when we discussed USOMID (N.B. M. Mulej)

About *one-sixth to one-fifth* of the world's population live in developed countries of the market economy. These affluent societies account for more than *75% of the world's energy and resource consumption* and cause *the bulk* of industrial, toxic, and consumer waste. The need for economic growth in emerging economies will increase the consumption of vital environmental resources as well as the quantity of waste created during the product's entire life cycle. With economic growth comes *urbanization*, and demographers predict that by year 2025 there will be over 30 mega-cities with populations exceeding 8 million, and more than 500 cities with populations exceeding 1 million. Urbanization on this scale presents enormous infrastructural and environmental challenges (Hart 1997).

The rapid expansion of the market economy influences the existence in a survival economy, which is becoming increasingly precarious. Extractive industries and infrastructure development have, in many cases, *degraded the ecosystems* upon which the survival economy depends. Short-term survival pressures often force the rapidly growing populations into practices that cause long-term damage to forest, soil, and water. As it becomes more and more difficult to live on the land, millions of desperate people migrate to already overcrowded cities. The number of such 'environmental refugees' from the survival economy may be as high as 500 million people (Hart 1997).

Three decades ago, environmentalists such as Paul Ehrlich and Barry Commoner found out a simple, but powerful cognition about the total environmental burden caused by human activities. It is a function of three factors: *population*, *affluence*, which is a proxy for consumption, and *technology*, which expresses the way in which wealth is created. It is the product of these three factors, which determines the total environmental burden. *Sustainability* cannot be achieved without stabilization or even reduction of the environmental burden. That can be done by decreasing the human population, reducing the level of consumption, or changing fundamentally the technology applied to create goods and services.

The first option, i.e. *decreasing the human population*, does not appear feasible in a short time. Demographers generally agree that the world's population, currently growing by about 90 million people per year, will roughly double over the next 40 years. The developing nations will account for 90% of that growth, and most of it will occur in the survival economy. The second option, i.e. *reducing the level of affluence*, would only worsen the problem, as poverty and population growth go hand in hand: demographers have long known that birth rates are inversely correlated with the level of education and living standard. Thus stabilizing the human population will require improving the education and economic standing of the world's poor, particularly women of childbearing age. That can be accomplished only by creating wealth on a massive scale.

That leaves us with the third option: *changing the product design and the technology* used to manufacture goods and services. If economic activity must increase ten-fold over what it is today to be just able to provide the bare essentials to a population doubling its current size, then technology will have to improve twenty-fold merely to keep the planet at its current levels of environmental burden. Let us explain that by an example given by Shapiro (Magretta 1997). Most arable land is already under cultivation. Attempts to open new farmland are causing severe ecological damage. So, in the best case, we have the same amount of land to work with and many more people to feed, which brings up the problem of resource productivity. We have to obtain twice the yield from every acre of land just to maintain current levels of poverty and malnutrition. Even if we decide to do it in an unsustainable way, no technology today would let us double productivity. The conclusion is that **new technology is the only alternative to one of two disasters: not feeding people or ecological**

**catastrophe** (Magretta 1997). Technology can be applied for *cleaning up* the existing polluting processes by what are commonly described as ‘end-of-pipe’ devices or beyond this radically, new technologies should be developed to *avoid pollution* at its source and to enable a more effective utilization of resources.

Four primary approaches have been used to achieve a better performance:

- command and control,
- market-based incentives,
- industry self-regulation, and a
- visionary response aimed at maintaining the sustainable development.

The basic assumption behind the *command and control* approach is that governments must force businesses to respond to environmental issues by passing laws and ensuring their compliance with those laws. This approach is well known and understood by the various stakeholders. However, international standards tend to be difficult to design and enforce. Therefore, the reactive response shown by businesses to this approach was not at all surprising. The industry attitude reflected two important issues: first, companies were not convinced that the environmental demands were based on hard scientific evidence, and second, they felt such demands were either unjust or unnecessary both for them and for society as a whole. They felt that the cost of their meeting these demands was a waste of money that would make their products more expensive and eventually less competitive.

*Market-driven incentives* include market mechanisms, which will optimize the allocation of society’s resources. With this approach, pollution rights and resources are traded like any other good in the market until an optimal price for environmental quality is found between users and sellers. The market place for this approach is not well developed and the distribution of pollution permits may favor dirty industries over clean ones.

The *industry self-regulation* approach is an alternative response to the command and control method. It is based on the principle that businesses know best what is possible, what can be achieved at a reasonable cost, and the optimal way to focus technological efforts on environmental issues. It supports innovative solutions – and continuous improvement. The complexity of the particular environmental problem may exceed the capacity of a single industrial sector to solve it.

The fourth idea, a *visionary* one, is the topic of this chapter: it is aimed to show that the design for environment can change the product’s value curve and create competitive advantage.

#### 6.4.2 VALUE INNOVATION AS THE KEY SUCCESSION FACTOR

Corporations are the only organizations with resources to develop and apply new technology as well as to create new designs of products and services, which would substantially reduce the quantity of waste and the consumption of vital resources. However, they must have an *incentive to invest* a large amount of capital in the development of new technologies and designs. Environmental taxes and pollution permits<sup>355</sup> are one of such incentives but there is little hope that they will be enacted in developing economies with the biggest environmental problems.

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<sup>355</sup> See Ch. 6.6 about them.

It leaves us with an *economic incentive* for solving environmental problems. It should offer the decision-makers new opportunities for creating a competitive advantage and earning higher profits. Quality can be defined broadly as *superiority or excellence*. It is a totality of features and characteristics of a product that bear its ability to meet the customer needs. Therefore, the perceived quality defined as the consumer's judgment about a product's overall excellence regarding his/her needs and expectations determines the product's success or failure in a market. In literature nine dimensions of quality are mentioned for manufactured products that a consumer looks for in a product. They are *performance, features, reliability, conformance, durability, serviceability, aesthetics, safety and reputation*. Unfortunately, the requirement that the product must be *environmentally responsible* is *not* yet considered as one of the quality dimensions. This is one of the biggest reasons for the bad quality of the environment. Very few, if any, products excel in all nine dimensions. A fundamental question, which arises, is: How great are the chances that the **environmental design** becomes one of the quality dimensions and one of the key success factors? We can try to find the answer in the theory of value innovation and attribute matrix.

Kim and Mauborgne (1997) studied more than 30 companies around the world in approximately 30 industries. They looked at companies with high growth in both revenues and profits, and companies with less successful performance records. They wanted to explain the difference in performance between the two groups of companies. The difference was in the companies' fundamental, implicit assumption about strategy. The less successful companies took a conventional approach: their strategic thinking was dominated by the idea of staying ahead of the competition. In stark contrast, the high-growth companies paid little attention to matching or beating their rivals. Instead, they sought to *make their competitors irrelevant* through a strategic logic we call value innovation.

The logic of value innovation starts with an ambition to dominate the market by offering a tremendous leap in value. They monitor competitors but do not use them as benchmarks. Because value innovators do not focus on competing, they can distinguish the factors that deliver superior value from all the factors the industry competes on. The value innovators ask themselves the following four questions:

- Which of the factors that our industry takes for granted should be eliminated?
- Which factors should be reduced well below the industry's standard?
- Which factors should be raised well above the industry's standard?
- Which factors should be created that the industry has never offered?

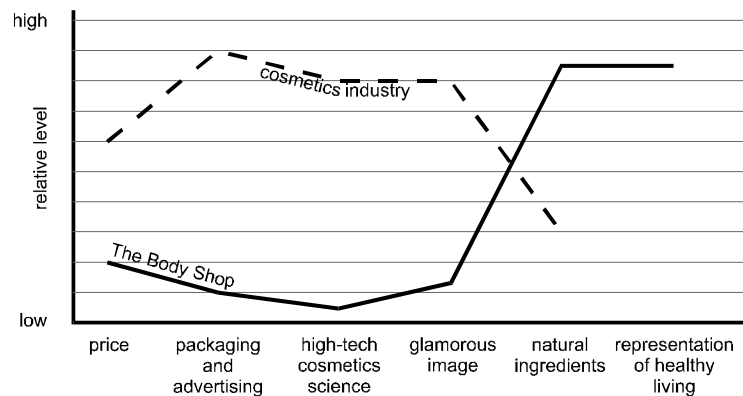
The first question forces managers to consider whether the factors that companies compete on actually deliver value to consumers. Often those factors are taken for granted, even though they have no value or even detract from value. The second question forces managers to determine whether products or services have been over-designed in the race to match and beat the competition. The third question pushes managers to uncover and eliminate the compromises their industry forces customers to make. The fourth question helps managers break out of the industry's established boundaries to discover entirely new sources of value for consumers.

The high level of the vital environmental resources' consumption in comparison with their stocks around the world and huge quantity of waste created during the entire life cycle of products present opportunities for value innovation.

A helpful tool in implementing the theory of value innovation is a **value curve**. It is a graphic depiction of a company's relative performance across its industry's key success factors.

According to the conventional logic of competition, an industry's value curve follows one basic shape. Rivals try to improve value by offering a little more for a little less, but most do not challenge the shape of the curve. All the high-performing companies the authors studied created fundamentally new and superior value curves. They achieved that by a combination (i.e. a dialectical system) of eliminating features, creating features, and reducing and raising others to levels unprecedented in their industries. For example, the value curve for products developed by Body Shop is presented in Figure 6.4.1 (Kim and Mauborgne 1999).

*Figure 6.4.1: Value curve for products of Body Shop*



The Body Shop created its new market space by shifting from an emotional appeal to a functional one. Few industries are more emotionally oriented than cosmetics. The industry sells glamour and beauty, hopes and dreams as much as it sells products. On average, packaging and advertising constitute 85% of cosmetics companies' costs. Since customers get no practical value from the money the industry spends on packaging, the Body Shop uses simple refillable plastic bottles. The Body Shop spends little on advertising, again because its customers get no functional value from it. The company's approach and its emphasis on natural ingredients and healthy living was so refreshingly simple that it won consumers over through common sense and created new market space in an industry accustomed to competing on a tried-and-true formula.

The similar conclusions are obtained from the attribute matrix shown in Figure 6.4.2 (MacMillan and McGrath 1996). It is a simple way to present the product's attributes considering their importance to customers. The columns of matrix capture the level of energy that the attribute generates – whether customers regard it as a basic, a discriminator, or an energizer. The rows reflect the sentiment that the attribute provokes in the target customer – positive, negative or neutral. A basic attribute is one that the target segment expects from all competitors. A discriminator is an attribute that distinguishes a product from its competitors. An energizer attribute is so powerful that it not only distinguishes a product from others, but often becomes the basis on which a purchase decision is made. The product's success depends on the differentiators and especially on excitors. On the other hand, dissatisfiers and enragers cause the product's failure. We can conclude that attributes classified as excitors create new value curve and present the true value innovation. (See Fig. 6.4.2)

*Figure 6.4.2: Attribute matrix*

|                 | <b>BASIC</b>  | <b>DISCRIMINATOR</b> | <b>ENERGIZER</b> |
|-----------------|---------------|----------------------|------------------|
| <b>POSITIVE</b> | nonnegotiable | differentiator       | exciter          |
| <b>NEGATIVE</b> | tolerable     | dissatisfier         | enrager          |
| <b>NEUTRAL</b>  | so what?      | not applicable       | not applicable   |

The **value innovation** creates a large part of the company's profit. In studying the business launches of about 100 companies, the Kim and Mauborgne were able to quantify the impact of value innovation on a company's growth in both revenues and profits. They reported that 86% of the launches were line extensions – that is incremental improvements – they accounted for 62 % of total revenues and only 39% of total profits. The remaining 14% of the launches – the true/radical value innovations – generated 38% of total revenues and a whopping 61% of total profits (Kim and Mauborgne 1997, p. 104).

What happens once a company has created a new value curve? Sooner or later, the competition tries to imitate it. In many industries, value innovators do not face a credible challenge for many years, but in others, rivals appear more quickly. Monitoring value curves may also keep a company from pursuing innovation when there is still a huge profit stream to be collected from its current offering. In some rapidly emerging industries, companies must innovate frequently. In many other industries, companies can harvest their successes for a long time: a radically different value curve is difficult for incumbents to imitate, and the volume advantages that come with value innovation make imitation costly.

*The need to improve  
the quality of the environment*

offers companies a strategic opportunity to develop radically new technologies, which avoid pollution at source and utilize materials more efficiently. Big corporations such as DuPont, IBM, and Xerox have shifted the focus of their environmental programs from cleaning up the damage to *preventing* it. In affect, they have moved their environmental investments up the supply chain to the point at which processes and products are *initially designed*. Not only is this approach environmentally sound; it also makes good commercial sense (Champion 1998).

The environmental behavior of *Slovenian consumers* associated with purchasing cookers was analyzed in the year 1995. We were interested in the response of future consumers to the new environmentally more responsible design of a cooker. Three intrinsic attributes such as functional characteristics of oven, hob and ecoenamel and brand name as an extrinsic attribute were included in the investigation.

*Ecoenamel* is an attribute contributing for the design to be environmentally responsible. Conjoint analysis was applied to find out the importance assigned to the attributes' level by potential buyers. The higher the importance assigned to the attribute's level is, the larger its impact on the purchasing decision is. The results of conjoint analysis showed that the Slovene consumers appreciated environmentally responsible products. In designing environmental cookers companies should consider the findings of the research in which the purchasing behaviour of Slovene buyers of cookers are analyzed with the Shocker-Srinivasan model. It was shown that the price of cookers played a significant role in purchasing decisions. Considering that finding we can conclude that only *environmentally responsible products* offered at *reasonable price* will succeed on the market. We can afford one conclusion more. Environmental problems offer a lot of *opportunities for value innovations* also on the Slovene market.

#### 6.4.3 MODERN APPROACHES TO INDUSTRIAL DESIGN

Industrial ecology involves both *products and processes*, and the distinction between the two is important.

*Processes* are much more universal than products, and a successful process design often has great importance to and great staying power for an entire industry. Once a process is thoroughly embedded in an industry, it is difficult and expensive to do more than make incremental changes, at least in the short term.

*Product* designers, in contrast, have considerable flexibility when choosing the processes needed for their products. It is often possible, for example, to use wood, plastic, or metal to accomplish the same design purpose, and the decision may rest on cost or aesthetics as much as on material properties. Product designers should consider industry-environment interactions that are largely outside the province of the process designer: choice of materials, product packaging, environmental impacts during product use, and the optimization of product recycling.

The sequence of events that culminates in a product begins with product definition, which is a statement of the features that a specific product should have when development is completed. The product definition list gives the designer many things to consider simultaneously, but modern designers have a list much longer still, because they need to consider related product attributes that may, in the end, determine the product's success or failure. The paradigm for these latter considerations is called '*Design for X*' (DFX), where X may be any of the following:

- DFA – design for assembly
- DFC – design for compliance
- DFE – design for environment
- DFM – design for manufacturability
- DFO – design for orderability
- DFR – design for reliability
- DFS – design for serviceability
- DFT – design for testability

DFX design practices are already being implemented by leading manufacturing firms. Accordingly, the least difficult way to ensure that environmental principles are internalized into manufacturing activities in the short term is to develop and deploy the design for environment as a module of existing DFX systems. DFE, a tool for creating products that are easier to recover, reuse, or recycle, is becoming increasingly important. With DFE, all the affects that a product could have on the environment are examined during its design phase. Moreover, the fact that DFE should become a part of an existing design process acts as a salutary constraint, requiring that DFE methods and analysis be implementable in the real world (Graedel and Allenby 1995).

## **Steps in Product Design for Environment**

**Product Definition.** Product definition is an initial and crucial stage in the product development process. It is at that stage where the environmental attributes of a product can be identified and built into the design. It is important to recognize that DFE will require some portion of the designer's effort, and that, like all other aspects of design, thoughtful choices made early in the design process are by far the most cost-effective. Given both the internal and

external impetus for environmentally responsible design, DFE should be automatically a component of the product definition and creation cycle.

**Materials Management.** Designers generally have at least a modest freedom within the product definition guidelines concerning choices of materials, and, once those choices are made, concerning the ways in which those materials are incorporated into products. Material may enter from three types of streams: the virgin materials streams, the process recycle streams, and the recycled material streams. Designers should try to utilize whatever external recycled material is available within the constraints of customer preference and existing price structures. The use of any recycled material stream thus involves a trade-off between ensuring its purity and suitability against the cost of using virgin finished materials.

Large companies can also create markets for recycled products in their purchasing decisions. McDonald's Corporation announced a series of 42 initiatives aimed at cutting the waste stream by more than 80 per cent at McDonald's 11000 restaurants. Many of McDonald's suppliers have had to adopt their products and packaging in order to keep doing business with the company (Buchholz, 1993).

**Detailed Product Design.** Detailed product design is the stage at which DFX considerations, including the DFE, are taken fully into account. Designs inevitably involve trade-offs among such attributes as utility, cost, reliability, and so forth. The designers have designed products bigger than they need to be because it is easier and because we all thought we had unlimited space and material. The product stewardship strategy should be incorporated in this phase. It focuses on minimizing not only pollution from manufacturing but also all environmental impacts associated with the entire life cycle of a product. Therefore, it requires both the reduction of pollution and the consumption of materials and energy needed for the manufacturing of products and their operation. The implementation of product stewardship leads to miniaturization of products, to substantial reduction of pollution and to the creation of more value without producing more stuff. There can be enormous potential savings in moving from very crude, massive designs to smaller and more elegant ones. Information technology is going to be one of the most powerful tools in implementation of the product stewardship. Multinational companies such as Dow, DuPont, Monsanto, Xerox, ABB, Philips, and Sony apply the product stewardship strategy. For example, a new type of herbicide was developed in the company DuPont. It has helped farmers around the world reduce their annual use of chemicals by more than 45 million pounds. It is also biodegradable in the soil and leaves no harmful effects on crops and other non-targeted species. Because it requires so much less material in its manufacture, it is also highly profitable (Hart 1997, p. 73).

**Product-Process Interactions.** In the case of many new designs, the products cannot be manufactured without concurrent evolution in industrial processes. DFE goals can be realizable only if process designers work closely with product designers to provide the manufacturing tools needed to make environmentally friendly products. They should decrease or eliminate un-recycled waste arising during the entire product's life cycle.

**Interactions with Suppliers.** It has become obvious within the past decade that the goals of efficiency, quality, reliability, and cost minimization cannot be achieved in the manufacturing process without the active participation of a corporation's suppliers. The partnership with which the most experience has been gained is probably the 'just-in-time' delivery of supplies, and 'total quality management', in the last years. From environmental standpoint, these relationships can be used to develop access to sources of recycled material, to create

customers for recyclable manufacturing residues, and to create environmentally appropriate standards and specifications for purchased items.

Levels of pollution are relatively low in the developed economies. Three factors account for this seeming paradox: stringent environmental regulations, the greening of industry, and the relocation of the most polluting activities (such as commodity processing and heavy manufacturing) to the emerging market economies. Thus to some extent the greening of the developed world has been at the expense of the environments in emerging economies (Hart 1997). Since the 1980s, big corporations such as DuPont, IBM, and Xerox have shifted the focus of their environmental programs from cleaning up damage to preventing it. After all, the long-run costs of cleaning up a mess can dwarf any savings from using a 'dirty' production technology or process. The gains from this new approach, though, have largely been restricted to industrial nations. Developing countries, which often face the most pressing environmental problems, have seen little benefit because up to 95 % of the economic activity in developing nations is carried out by small businesses, and they have neither the resources nor the expertise to launch environmental initiatives. The solution to the problem may require another change in the way big companies think about environmental management. Rather than concentrating their investments in programs within their own corporate borders, as they currently do, they may want to consider devoting a significant portion of their environmental spending to the numerous small companies that serve as their suppliers. When big manufacturers launched their quality programs a few years ago, they included their suppliers as partners in those efforts. It may be wise to follow a similar model with environmental management. (Champion 1998).

**Marketing Interactions.** Product designers and product managers can promote industrial ecology goals by working with customers as well as suppliers. Often the customers will be retailers rather than individuals, and this permits the designer to optimize product packaging (including packaging return or other recycling), minimize stocks of unneeded products (thus minimizing reprocessing or disposal), minimize unnecessary transportation, and make information on environmentally related aspects of products and their eventual recycling widely available. A clear and fully integrated environmental strategy should also shape the company's relationship to customers, suppliers, other companies, policy makers, and all its stakeholders. Companies can and will have to change the way customers think by creating preferences for products and services consistent with environment. Companies are required to become educators rather than mere marketers of products.

Such a broad concept of the design will be successful if it is the result of a close co-operation of different experts, such as designers, marketers, environmentalists, customers, suppliers, experts for manufacturing processes, and cost accountants.

#### 6.4.4 ASSESSMENT OF ENVIRONMENTAL IMPACTS CAUSED BY THE PRODUCT DESIGN

There is a common characteristic at the root of practically all the environmental problems. This is concerned with a failure in the way in which markets operate with respect to the environment. Ideally all costs and benefits will be reflected in market transactions. Firms undertaking production will have to pay for all of the cost which are caused by their production, for the inputs which could have been put to alternative uses, and for any damage or inconvenience which

arises. They will also receive payment for all of the benefits, which are produced, most obviously in the form of any product or service produced. Where this occurs, society will put its available resources to the most valuable uses. Where costs or benefits arise, which are not reflected in market transactions, this is referred to as a problem of externality and is an example of market failure.

Since the decision-makers usually cannot manage what they cannot measure, the quantitative criteria are needed. They should show how much the new design of a product is improved from the environmental viewpoint. It is also important that such criteria are expressed in terms, which are familiar to decision-makers (Crosbie and Knight 1995).

If we want to establish the significance of losing elements of the environment, we would want a measure of their value and we would want to describe this value in monetary terms. This represents the most straightforward and convenient way of comparing the significance of their loss with the significance of other non-environmental costs and benefits. Money is simply a familiar and convenient measure of value.

Life-cycle assessment (LCA) is an attempt to measure or otherwise assess all environmental impacts or effects of a product 'from cradle to grave'. A fundamental concern about present LCA methodologies is that they are too complex and detailed to be useful in decision-making in companies. It is concerned solely with the environmental aspects of a proposed development and makes no direct comparison between the environmental damage, which may result and the other types of benefit, which are expected. The environmental impacts are described in different units. An effective LCA methodology must be able to quickly and easily identify and differentiate between critical environmental impacts (Graedel and Allenby 1993).

For this reason, we suggest two measures: eco-efficiency ratio of output and eco-efficiency ratio of input (Bastic 1997). The ideas for these two measures are based on the cost-benefit analysis and averting behavior. In some circumstances individuals or firms will have the opportunity to take actions, which either reduce or avoid completely the consequences of environmental damage. This is generally referred to as averting behavior. If the actions taken in response to the environmental damage completely remove the impact, then the cost of the action would represent a good measure of the cost of the environmental impact. Clearly in practice it would be unusual for an action to remove all of the impact. In these cases, the cost of the action can only represent a part of the environmental cost: a minimum estimate.

The eco-efficiency ratio of output considers both the amount of waste and pollution arising from the manufacturing and consumption of products as well as the products' profit presenting the benefit evaluated by the market. Measuring the amount of waste and pollution in quantitative units would cause the problems associated with the choice of an appropriate quantitative unit for different types of waste (Kirkwood 1995). Those problems can be avoided if costs of recycling or preventing of all kinds of waste are considered instead of their quantities. These costs depend on the quantity of waste as well as on efforts needed to transform waste into harmless and useful materials. Due to this fact, the costs offer more information than the quantity of waste itself (Bastic 1998).

The costs associated with environmental protection in companies can be split into:

- a) prevention costs
- b) appraisal costs
- c) internal failure costs
- d) external failure costs

Prevention costs are the costs of trying to prevent the production of products and sub-products with negative impacts on the environment. Costs of designing environmentally responsible products, the costs of purchasing or designing new technologies, which avoid pollution at source and utilize materials more efficiently, training costs caused by developing and putting on environmental training programs for employees and management, and maintenance costs all have a significant impact on the prevention of environmental damage.

Appraisal costs are associated with inspection and testing of pollution arising during the manufacturing process and after it has been released into the environment. Internal failure costs are related to cleaning or recycling the environmentally harmful elements to avoid their release into the environment. External failure costs are incurred by recovering of the environmental damage caused by the release of the environmentally harmful elements.

In the past, and now especially in developing countries, the internal and external failure costs have not arisen because companies have not recognized environmental problems as problems.

The eco-efficiency ratio of output, denoted by ERO, is defined by:

$$ERO = \frac{P}{CE}$$

where P means profit, and CE equals the sum of appraisal costs, internal and external failure costs. ERO shows the amount of profit created per one monetary unit of environmental costs. All the company's actions such as substitution of technology and resources as well as the changes in design, which increase the value of ERO, contribute to the design for environment.

The design for environment requires not only pollution prevention but also a reduction of vital environmental resource's consumption. The company's contribution to the achievement of this goal can be measured by the eco-efficiency ratio of input, defined by:

$$ERI = \frac{P}{CVR}$$

where P means profit and CVR total costs associated with the net consumption of the vital resources. It shows how many monetary units of profit the company creates per one monetary unit of the vital resource's consumption. We can say that it expresses the environmental price for achieving profit.

#### 6.4.5 CONCLUDING REMARKS

The current state of the environment presents a serious threat to the lives of our and future generations as well as it creates the opportunities for development of new technologies and products. The design for environment is one of the most effective tools for solving big environmental problems caused by manufacturing and consumption of products and services. On the other hand, it offers companies the opportunity to create fundamentally new value curves and consequently higher profits. The successful implementation of the design for environment in real life requires more innovative knowledge and efforts of designers. However, it also demands quantitative indicators, which transform the improvements of the product's design into figures

supporting the right choice and comparison – and its application depends a lot on managers' values, not only on their knowledge (see Ch. 4 and 6.5), making their mental quality (see Ch. 2).

## 6.5 MANAGER AND VALUES<sup>356</sup>

### 6.5.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 6.5

Holistic thinking, as we have seen so far in this book, is a precondition of success that depends a lot on the subjective starting points of the influential members of an organization, such as managers. So is the success in the issue of climate change. A crucial subsystem (and partial system, because of its permanent interdependence and interaction with knowledge, emotions, talents, needs, and possibilities) of the subjective starting points are values. This is what we are going to concentrate upon in this chapter.

#### 6.5.1 BASIC FINDINGS, THE PROBLEM, AND THE LIMITS OF THE RESEARCH

Values are *acquired ingredients* of the human 'personality'<sup>357</sup> (Musek 1993/a):<sup>A1]</sup>, which together with character, temperament, intellect, 'human abilities'<sup>358</sup> (Udovicic 1996):<sup>[2]</sup> and physical appearance determine an individual and his/her possibilities of co-existence, promotion and fulfillment in society and environment. The relationship between an individual and 'value' can simplistically be understood as a feeling (experience) of a lure (magnet), which draws an individual and/or 'forces' him/her to a certain behavior, treatment, attitude or, to put it simply: makes him/her to act in a particular way. Values usually do not differ from an individual to an individual when those individuals belong to a particular *cultural* circle; what is different is their *understanding and reacting*. The acquisition of values is facilitated and/or conditioned mostly by the cultural pattern, typical of a particular society, which means that *values are socially conditioned* and limited within a valid framework or 'system of values'.

This system has its own ingredients (subsystems of values) which are valid in particular areas of society (morality, ethics, economy, science, politics, religion, aesthetics, hedonism, ...; care for the environment, the main topic of this book definitely also belongs here) and individual groups in society (sportsmen, doctors, people with special needs, convicts, substance abusers, ...). As regards individual groups their value systems are not pure sets of values of the above areas since different groups strive to develop their *own subsystems of values* or at least supplement standard values with their own specific ones. When marginal groups are in question the proportion of standard values is significantly diminished, if not entirely dismissed, and substituted with an entirely new set which can be far from the standard (valid) values of a society. Nevertheless, there still remain serious beliefs that it is possible to form a compilation of general, all encompassing (global) values, which can be classified in the form of a hierarchy. One of the promoters of these views is the Club of Rome which among others states, "no culture is possible without agreement on a foundation or solid base of common ethical values...", and goes on to add that one of the most recent forms of this need to have a consistent set of mental images is

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<sup>356</sup> Karli Udovicic

<sup>357</sup> Besides a number of definition of personality (Allport had long ago sorted them into the groups) let me mention a characteristic (typical) summary of them, made by Janek Musek – see note[1]: "Personality is a relatively constant (lasting) unique whole of mental, behavioural and physical features (characteristics) of an individual".

<sup>358</sup> The notion (its content and classification and meaning have been developed for the purpose of another research I carried out), concerns the set of characteristic personal values required of the managers in an organization – see note [2]. The 'human abilities' is compound of: 'knowledge', 'experiences', 'capabilities' and 'talents'.

represented by ‘human rights’, and also puts emphasis on the importance of the relationship between an ‘individual and society’ (Club of Rome<sup>[3]</sup>):

Their viewpoint and other above statements can be used as a bridge between the broadly set starting points of the problem and the derived narrowed down aspect of the same problem, which shall be dealt with here. In general we speak about the *understanding of the meaning of values in the context of managing climate changes*, which significantly determine environmental conditions vital for humans’ survival. A narrower (studied) aspect of the same issue reflects the problematic relationship between typically *personal* values of an individual and/or groups and the values of an *organization*, a typical man-created interests-based form of bringing people together following the aim of fulfilling their goals.

We shall discuss various aspects of the above differences which testify to the importance, typology, differentiation, classification, and changing of values. This will serve as an aid to defining the core dimension of the issue, i.e. the *switching of priorities* when implementing the interests of participants in an organization (owners, management, employees) with an emphasis on management and interests of the organization. The switches, which occur and cause a loss to an organization many times, either directly or indirectly, also environment, mostly take place due to the *prioritizing lower ranking interests* of the participants who are according to their character put at the level of either ‘individual’ or ‘group-specific’ and before the highest ranking interests of an organization which are at the level of ‘general’. (See Fig. 3.2) Errors are typical consequences of the disregard for the ‘Hierarchy of Succession and Interdependence’ (Mulej 2000).<sup>[4]</sup> Moreover, they also occur due to the inobservance of the personal values and/or perverted understanding (or forming) of the so-called organizational values. The general aspect of the issue shall not be the object of this study since it is contained in various other studies. The aspect of environment is implicitly contained especially in those parts of the study, which deal with the relation between personal values of individuals or groups within organizations and organizational values of an organization through the prism of implementing the priorities of interests of the former and the latter.

#### 6.5.2 DEFINING THE NOTION VALUES, ITS TYPES, AND THE PROBLEM OF INTER-DISCIPLINARITY

It seems that an everyman would not have any serious problems with his/her own understanding or at least “sensing” the meaning(s) and extensiveness of the notion of values, should he/she be asked to explain it, which does not mean he/she could easily explain it in a way of definition or in a simple manner of discourse. Such an idea (hypothesis) of knowing, which is attributed to an everyman (to be more precise, a layperson), is typically enforced / supported/ by science (field), which defines values in their historical perspective as a phenomenon, which has developed in its ancient (prehistoric) starting point as inherent to humankind (Musek 1993/b).<sup>[5]</sup>

The subconscious but omnipresent *internal feeling binding relationship between good and evil, right and wrong*, which dictated an individual’s behavior in the day-to-day fulfillment of his/her principle of being and interaction with other individuals, beings, objects and phenomena was together with the appearance of critical cognition already researched (experienced) by ancient philosophers (Gaarder 1997)<sup>[6]</sup>. However, some scientists maintain that scientific interest in the phenomenon of values in psychology has only been on the increase since the end of the 20th century or at least during the last 20 years (Musek 1993/b):<sup>[5]</sup>. This statement is probably accurate, when compared with Wicker’s definition of values as:

“unusable vagueness, not because they can not be usefully defined, but because they have not yet been sufficiently analyzed” (Vickers 1973)<sup>[7]</sup>. Since a number of definitions of values will be mentioned later on (6.5.3 Personal values – phenomenon, definitions, classifications), a specific contrast should be stressed here. At this point let me just draw attention to the typical *antagonism*, which can be observed when values are studied in relation (interaction) with some other personality determinants or an individual’s behavior. For example: needs, motives, or other types of stimuli on the one hand, and principles, ideals, values and also goals on the other. The first group is characterized by – to use a term typical of management – the so-called “push strategy”, and the second represents the “pull strategy”. J. Musek provided a comparable way of deliberation, also, as a psychologist (Musek 1993/b):<sup>[1]</sup>.

Since values, which act in the sphere of personality as its *important movers*, are determined by the relation between good and evil, a non-critical observer can easily come to the logical conclusion that good triggers positive meanings or reactions in an individual, and bad does the negative ones. However, a critical approach and/or analytical testing of a personal experience should make it quite apparent that this is usually not the case, which means that the *understanding of values and emerging relations vary according to individuals* (possibly also groups) environment (what is the most important are the cultural paradigms (*patterns*), which determine it/them), and *circumstances*, which the bring about the reactions. This statement (hypothesis) is confirmed by the historical experience of humankind, which is at the same time one of more important conditions/proofs of the necessity of researching and uncovering the phenomenon of values. Moreover, a couple of more complex hypotheses should be added to the above statements. They can be drawn from the research of *functions*, which determine an individual’s life (way of thinking, behavior, responses/acting) and the psychologists have been dealing with for a long time. What is important here is the finding on which is based Trstenjak’s rather bold idea that not only the *mind but also emotions* are to a large extent determined (also) by the cognitive function, whereby emotions become the determining dimension of the basis of the accepted judgments. The above statement logically refers only to those judgments the subject of which is “a value or a lack of value” (Trstenjak 1953)<sup>[8]</sup>. This statement typically corresponds to Whiting’s rather specific view – which is taken over by my own notion about a ‘functional principle’ – which determines the implementing (affecting) of values. In this way Whiting brought about the conclusion that there is an interesting *intertwining of cognitive and emotional elements of human behavior*. He pointed out the difference between the two functions (judgment and evaluation), which determine and enable men’s life and development (Whiting 1958):<sup>[9]</sup>.

The *implementation* of values (understanding and reactions) in the every day life of those who implement them – influenced by the environment and the circumstances – *differs*, hence a few words about the typology and classification of values should also be added. In general we speak about types of values in the way they were classified by philosophers (e.g. Aristotle) in ancient times, or philosophers in the semi-past period of the 20<sup>th</sup> century: (Veber 1925):<sup>[10]</sup>, (Spranger 1930):<sup>[11]</sup>, (Ingarden 1975):<sup>[12]</sup>, (Heller 1981):<sup>[13]</sup> or/and psychologists: (Kluckhohn 1951):<sup>[14]</sup>, (Morris 1956):<sup>[15]</sup>, (Hofstede 1980):<sup>[16]</sup>, (Musek 1991):<sup>[17]</sup>, Musek 1993/b:<sup>[5]</sup> in Musek:<sup>[18]</sup> and others. Moreover, the same scientists as well as experts from other fields (sociology, theology, political science, ecology, and-last but not least-management) *classified values also on the basis of implementation*. For example: National values (Piciga 1992):<sup>[19]</sup>; social and/or political values: (Rus 1971):<sup>[20]</sup>, (Arrow 1994):<sup>[21]</sup>, (Shapiro 1999):<sup>[22]</sup>, (Tos et.al. 1999):<sup>[23]</sup>; religious values, which are not infrequently connected to family values: (Ratzinger 1995):<sup>[24]</sup>, (Jagger, Wrifith 1999):<sup>[25]</sup>, (Sedej 1998):<sup>[26]</sup> or the values of different historical

periods: (Marsden 1993):<sup>[27]</sup>; and environmental values: (Gurrier 1995):<sup>[28]</sup>, (Milton 1993):<sup>[29]</sup>. Values which are typical of particular groups which can also be marginal, e.g. adolescents (Bennett 2001):<sup>[30]</sup>; people with special needs (Brejc 1998):<sup>[31]</sup>; and some others should also be mentioned.

While listing *influential areas* of human existence, within which specific principles of shaping and implementing of values were formed, one would sooner or later come across the material or gaining sphere of human life and thereby business, or more appropriately, *organizational values*, which are the main concern of this study/chapter.

A great number of authors deal with values of that kind exclusively, or more frequently in parallel – usually while studying the phenomenon of organization and especially organizational culture, and management especially with regard to *employee motivation*: (Tavcar 1996):<sup>[32]</sup>, (Robbins 1993):<sup>[33]</sup>, (Schermerhorn, Hunt, Osborn 1994):<sup>[34]</sup>, (Kreitner 1999):<sup>[35]</sup>, (Griseri 1998):<sup>[36]</sup>. Not always do the authors use the term values or organizational values directly, and yet it is implicitly present in their discussion about organizational culture, employee motivation, problem solving, change management, etc.: (Rue, Byars 1992):<sup>[37]</sup>, (Donnelly, Gibson, Ivanchevich 1995):<sup>[38]</sup>

All of the above mentioned points to the fact that also values were, at the beginnings of scientific interest in them, generally dealt with by philosophers and more thoroughly later by psychologists. Therefore, they became the subject of *multidisciplinary scientific interest*. This kind of development is not only logical but also necessary if the conditions of specialization, globalization and other “...-ations”, which essentially determine the living conditions of modern society, are taken into account. What actually deserves critical rethinking is the question of scientific coherence and possibly also consistency together with actual application of values in other fields (spheres) of scientific interest. In this respect our main interest lies in the increasingly typical phenomenon of “organizational values”. Not infrequently, namely, one can observe a mix-up of the basic meaning (use) of values, a typically psychological category, which should be understood as an individual’s personal interest acquired in the process of socialization and through his/her experiences of social growth, with some other, usually impersonal interests, for example of the organization.

### 6.5.3 PERSONAL VALUES – PHENOMENON, DEFINITIONS, CLASSIFICATIONS

To be able to prove the above ideas (hypotheses), which generally define the issue under scrutiny, it is necessary to define the hinted-at differences. To do that in this study we will adhere the general understanding of values (basically, but not necessarily, those researched by psychologists), which clearly shows that they are personality determinants and/or movers of an individual and/or a group. Moreover, when personal values interact with some non-personal ones, e.g. those of typically organizational social formation, all of them should be studied exclusively from the perspective of the values, which determine the *personality of individuals or groups*, which take part in this organization. The above said should not be seen as an aspiration to not acknowledge the “values” of organizations as legitimate – scientifically impeccable and usable elements of its culture. Quite on the contrary, it should be understood as an aspiration to establish a consistent bridge of mutuality and coherence between typically personal values and the corpus of organizational values an organization forms throughout its course of development.

There is another point, which should be made here. Personal values are not given priority over other types – in this case organizational values – due to their exclusiveness but due to a very simple reason the “generic overlapping”. The purpose of this notion, which is offered here as an original idea, is to express a common origin and ultimate goal of all values (and value systems) which are the same in both cases – the *personality of an individual*. In other words, if a person (an individual or a group) is an important / vital protagonist of the actions he/she provokes and or takes part in, the hypotheses could be adopted that it is personal values of a person (individual or group) as a source and goal of processes, which shape the values of social, economic, ideological and other social formations. An approach of this kind imposes upon an individual and/or group an extremely important (unavoidable) task, which demands him / her / them to selectively tackle the *interest ranking* and the related *adopting* (following) and *implementing* of values.

Let me add a peculiarity or a practical *example*. It is frequently the case that a person *takes advantage* (e.g. abuse of authority) of the organization, which he/she initially formed with the purpose of fulfilling his or her own purposes. The reason for this act lies in that person’s short-sightedness or lack of critical thinking in interest ranking: such an individual often ranks his or her own *personal interests before the “general” interests of the organization*, and not infrequently before the *interests of the environment*. Cases when personal interests of individuals unify into a special interest of a group within an organization aimed at reaching partial goals incompatible with the interests of the organization, are just a variation of the above case. This peculiarity could be transformed into an even greater peculiarity, if we wanted to make use of it as a starting point for the criticism of the above ideas that there is a (lack of) felt *importance of coherence and consistency* between typically personal (psychologically based) values and the values of other sources and uses. However, this is not the purpose here, since what we wish to emphasize is the actual necessity of coherence and consistency.

Attention should be drawn to the above case of authority abuse, which clearly shows in what kind of fiasco a perfectly legitimate *network of interests* – usually a constituent part of the organizational culture – can end up, when the individual interests manifested in perverted forms of typically personal values, gain *dominance over the organizational values*. The above mentioned *deformations* are fragments and can be due to the inobservance of the Mulej’s Law of Hierarchy of Succession and Interdependence (Mulej 2000).<sup>[4]</sup> The observance of this law, which we presented in Ch. 4 and which ensures a requisitely holistic definition and

implementation of interests in an organization, can be set up and maintained in different ways. The *procedures* can be either hard (the carrying out of legislative laws, formal and informal pressure of owners, management, and other subjects, e.g. from the external environments) or soft (persuasion, motivation, rewarding). Practice shows that neither group of measures alone is sufficient. For this reason organizations tend to choose *combinations* of individual measures when internal measures are concerned (owners, management), and legislative obligation (state) when external conditions are concerned. In spite of this the results are usually insufficient, which is proved by the unceasing aspiration of the above subjects to make better the processes of ranking and then to reach goals of individuals and various groups. We firmly believe that this problem could be solved, if an appropriate change in the notion of organization was ensured. (Let me just briefly mention that we also offer a relatively original solution in the form of ‘personalized subjectivity’ of an organization (Udovičič, 2002):<sup>[39]</sup>, which is not the subject of this study.)

To define the frequently mentioned problem in all its complexity, we will adopt and summarize some definitions and classifications. In the process of evaluating from the viewpoint of personal perception of an individual and/or group, we expect those definitions to point out some aspects of possible reasons for the issue under scrutiny. This can facilitate the basis for people to understand differences between the personal and values of other kinds and the resulting incompatibility of priorities, or even better, inobservance of the Law of Hierarchy of Succession and Interdependence, and the problems of incoherence and inconsistency between the two mentioned types of values.

The already mentioned authors and also some others have offered *numerous definitions and classifications of values*. The Collins Cobuild English Language Dictionary offers the following definition, “The values of a person or group are the *moral principles and beliefs that they think are important in life and that they tend to live their lives by*” (HarperCollins, 1993):<sup>[40]</sup>. One of the most frequently cited definitions says something to the effect: ... personal values are *statements of the ideal* (Kluckhohn):<sup>[14]</sup>; or: “A value is ‘an enduring belief that a specific *mode of conduct or end-states* of existence is personally or socially *preferable* to an opposite or converse mode of conduct or end-state of existence” (Rokeach):<sup>[41]</sup>. There are also some *simplified* definitions of the type: Personal values are inherently positive constructs and important determinants of attitudes and behaviors (McCarty, Shrum ‘2002’):<sup>[42]</sup>. Another typical definition is significant since it places values into *social environment*, ... ‘values are social cognitions that facilitate adaptation to one’s (social, N.B. KU) environment’ (Kahle 1983):<sup>[43]</sup>. Many scientists see a connection between values, behaviour and attitudes, ... ‘values may be considered to function as prototypes (= functionally conditioned starting points, op. UK) from which attitudes, as well as behaviors, are derived’ (Homer, Kahle 1988):<sup>[44]</sup>. Janek Musek’s definition should also be mentioned, “Values are generalized and relatively stable *ideas about goals and phenomena*, which are highly *appreciated* and refer to broad categories of subjugated objects and relationships, and influence our interests and behavior” (Musek 93/a or /b ) :<sup>[1]/[5]</sup>. Let’s conclude with Schwartz-Bilsky’s definition, “Values are cognitive representations of *universal human requirements*: biological needs, social interaction requirements, and social institutional demands toward the individual” (Schwartz, Bilsky 1987):<sup>[45]</sup>, which Musek recognizes as a summary perfect of the most important definitions (Musek 93/a):<sup>[1]</sup>.

A common denominator of the above and similar definitions is the fact that they focus on an *individual* or take into account *valuable (or obligatory) issues* of his/her *behavior* and *attitudes* toward others (subjects, beings, creatures, objects and phenomena in his/her

environment), which he/she implements aimed at maintaining and bettering his/her attitudes toward the above mentioned categories of co-existing or just present individuals trying to better their position in society and environment he/she belongs to.

It is not our aim to offer a new definition, presenting such a summary of the above stated notions, but to set a new basis / idea for *rethinking various implications* offered. If such a summary (hopefully solidly grounded) is valuable, then a commonly accepted (acquired / imposed) *priority of values of humans* – creators and ‘end-users’ of any ‘artificial (= man-made) super-system’ within the ‘natural super-system’ (Udovicic 2002):<sup>[39]</sup> – should be revitalized at least by the ‘rights’ (not only the legal ones) of ‘subjects of the life process’, such as organizations. This priority definition should be performed as an organizational issue related to fulfillment of the basic principles of existence, denoted by the relation between acquiring and using (Udovičič, 2002):<sup>[39]</sup>. As said above, organizations – as described above – definitely can be included among the so defined subjects. I have purposely avoided the rights of other beings, creatures, objects and phenomena – that are usually derived from the recognized necessity of a harmonized cohabitation, as a survival principle of humankind itself – because other individuals and organizations deal with them more or less successfully.

When reading through the lists of values one stumbles on various *groupings* of values, which, however, overlap in some segments. The quality we wish to focus on here reflects the *contents aspect* of value characteristics included in the grouping. This clearly points to the fact that most of these collections are “*personality*” oriented. As an example we can provide Musek’s classification of 54 values, which are arranged in clusters and reflect also a hierarchical organization (Musek 1993/a):<sup>[1]</sup>. We should also mention the broad study “Human Values”, which has been in progress since 1972 as a part of the project “Encyclopaedia of World Problems and Human Potential”:<sup>[46]</sup> run by “Union of International Associations” aided by the European Union. At its start the project included 614 entries (words denominating values), which were arranged in clusters of synonyms and antonyms of a particular value related word. Further on the procedure of classification was modified and a differentiation between a constructive value-related word for positive and a destructive value-related word for negative values was introduced. In the modern period this has been coded with special codes.

Another characteristic testifies to the *lack of classifications of typically “organizational” values*, which would exhibit their difference from the personal values, and also the role and importance experts ascribe to them. This lack questions the implicit hypothesis of this study contained in the definition of the issue, which seeks in these differences the reasons for the gap between the interests of individuals and/or groups and organization and resulting problems in various segments of the functioning of organizations, including those, which have to do with environment. This is probably not the case since the absence of classifications is substituted by the practice of forming *statements about corporative philosophy and/or mission*, and last but not least, values of organizations organized by their *management*. All of the above reflects a significant gap between theory and practice where the latter (the managerial) is not capable of summarizing or substituting the important contributions of the former (the psychology).

#### 6.5.4 PERSONAL VERSUS ORGANIZATIONAL VALUES AND SUCCESS OF ORGANIZATION

Which and whose values prevail in an organization (including the ones related to the natural environment, the natural super-systems of humans)? This is important here, because the climate and climate change are under impact of both the organizations and individuals (but families are a type of organizations, of course).

First of all the notion of organization should be defined in this context. Various authors offer a great variety of definitions, therefore we shall present a couple of our own, which define organization in its basic (common, general) meaning: “An organization is an all encompassing mass reflection of nature manifested in managing principles taken on and carried out also by humans as a part of it.” (Udovicic 2002).<sup>[39]</sup> Derived from this the following definition defines organization from the viewpoint of its gaining: “Organization, in the way it manifests itself as a fulfiller of interests, can also be understood and explained as an indisputable source, means, and final goal, of the fulfillment of its duty to gain / acquire (goods, profit, wealth), as it has begun to appear after the bourgeois and industrial revolutions and took its ultimate shape in the modern marketing of the 20<sup>th</sup> century.” (Udovicic 2002).<sup>[39]</sup>

To reach the phenomenon of values within the framework of organization we must focus also on the notion of *organizational culture*, which is well known not only in the theory of organization but also in the theory of management. We offer the following definition: “The organizational culture is a subtle, fluid, essential mixture of everything the organization has created during its existence and that conditions its place and possibilities in the environment.” (Udovicic 2002).<sup>[39]</sup> This definition comes with the following explanation: “Organizational culture cannot be a product of the planned, organized, managed and monitored process of creating one of the purports (postulates) of organization (unlike the organizational structure). It can only result from the interaction of all processes, which take place both within and without the organization and have a direct/indirect influence on it. For this reason, the direct influences related to the enforcing of desired changes, seem to be extremely difficult and many times ineffective, at least when the short term changes are concerned.” (Udovicic 2002).<sup>[39]</sup>

The above statement (about the organization and organizational culture) leads us to the fact that an *organization should be regarded as a subject of a higher order (synergy) or be found equal to the subjects* (participants/stakeholders) who form and use it. Thus, one could avoid the above problems of interest changes, which occur due to the disregard of the Law of Hierarchy of Succession and Interdependence. It could be concluded that the subjectivity, comparable with the one all three groups of stakeholders have, should be acknowledged to the organization, too. As has already been stated (Ch. 6.5.1), this problem is not the subject of this chapter, therefore, only the basic idea related to the subjectivity of the organization is offered here: “An organization as a subject lacks the capacity to think and for this reason it suffers the consequences of this handicap/lack all too often” (Udovicic 2002).<sup>[39]</sup> This is important when we talk about the organizational values as a basis of e.g. the business decision-making, including the one concerned with climate change.

Most theorists of organization, organizational culture and/or management, mentioned above, take different approaches to defining values. However they all have one common characteristic, which is the *relative absence of a psychological point of view when dealing with personal values of an individual and an inclination towards finding typically ‘organizational values’*; this is particularly apparent in texts written by practitioners, i.e. managers (McAllister 1998).<sup>[47]</sup> or

organizations themselves (Studiel):<sup>[48]</sup>. There are many examples, and only some typical patterns have been mentioned here. Another peculiarity, which is more typical of theorists, who sometimes endeavor to include also the psychological viewpoint, is the fact that they usually treat values in the *context of managing an individual within organizations*.

This means, together with differences that are less important for our line of research, that they place values in a general framework of an organizational culture, or to rephrase, they see values as a '*basic ingredient*' of culture (Tavcar 1996):<sup>[32]</sup>. This idea is based on the views of other authors who define culture as follows: 'a system of values which belong to the vital factors, which determine the success of an organization' (Peters and Waterman 1982):<sup>[49]</sup>; 'a system of common living ideas about values and believes' (Reutinger 1986):<sup>[50]</sup>; 'a compilation of symbols, rites, mythology which gives colleagues basic ideas about values and believes' (Ouchi 1981):<sup>[51]</sup>.

The above theorists limit their understanding of values in the *context of relations* (interpersonal, N.B. KU) *and cognition processes*, which enables their transition to 'work satisfaction', needs and motivation (Schermerhorn, Hunt, Osborn 1994):<sup>[34]</sup>; or they leave outside the context the processes of cognition, and link values to relations with 'work satisfaction' and reach motivation from here (Robbins, 1993):<sup>[33]</sup>. What is typical of them, as has already been stated, is: they also make use of psychological definitions, at least as far as definitions are concerned. Robbins summarizes the already mentioned Rokeachov's definition, whereas Schermerhorn, Hunt, Osborn base on another definition, which says: 'Values can be defined as *broad preferences* concerning appropriate courses of action or outcomes. As such, values reflect a person's sense of *right and wrong* or what "ought" to be' (Jacoba, Flink, Schuchman 1962):<sup>[52]</sup>.

It is quite clear that the above mentioned and other theorists who study organization and management try to *adjust* the more or less psychologically defined values in order to use them in the managerial sphere, which is a quite understandable and logical aspiration. However, they usually run into a 'manager in an everyday situation', which means the problem of his/her 'capability' of handling people in an organization. This is where the aspirations of the management theorists usually stop, since they too frequently omit dealing with the *manager's* personality itself, i.e. his personal traits, character, temperament, values, etc. or at least with that part of the above mentioned characteristics, which meets the needs of an organization and is called 'human abilities' (Udovicic, 2002):<sup>[39]</sup>.

It seems that the theorists more frequently deal with the problems of values concerning '*consumer behavior*', or '*employee behavior*', when employees come from different *national cultures*<sup>359</sup> (Hofstede 1984):<sup>[53]</sup> etc. than with typically managerial values. In both cases their interest is quite understandable: they are following the current marketing problems and/or various types of differences among employees both of which directly and very tangibly influence organization. The most significant are those studies, which deal with the problems in an interdisciplinary way. We have in mind studies that focus on original explanations and solutions and consider the findings derived from psychological researches. As a typical example we could offer the Kamakura-Novak's article, which deals with 'marketing segmentation'. They used 'human values' (LOV<sup>360</sup> exactly) as a basis for segmentation (Kamakura, Novak 1992):<sup>[54]</sup>. On the other hand there is the article by three Australians studying differences among cultural values

<sup>359</sup> Hofstede identified, while studying value differences across national culture, four dimension of national culture (power distance, uncertainty-avoidance, individualism-collectivism, and masculinity-femininity). His research included 116.000 employees in a U.S.-based multinational corporation dispersed in more than 40 countries.

<sup>360</sup> List of Values. The Rokeach's LOV is composed of 18 values reflecting the 'ideal mode of behaviour' (instrumental values) and 18 values reflecting the 'ideal end-skates of existence' (terminal values).

of employees from two countries (Australia and Japan) that shows the potentially detrimental influence which may cause misunderstandings between co-workers (Soutar, Grainger, Hedges)<sup>[55]</sup>. Neither pays explicit attention to the above viewpoints of manager personality. It is rather obvious that the research and resulting knowledge and control of the above would also offer a better grounded basis for making the expectations/demands the interested party (owner) sets before managers.<sup>361</sup>

Since a few words have already been said about the relation between personal and organizational values, attention should be drawn to a rather interesting approach, which takes into account some of the mentioned characteristics or problems, which refer to *values in the field of organization*. This approach acknowledges the differentiation between soft and hard ways of ensuring the efficiency of the Law of Hierarchy of Succession and Interdependence, and at the same time follows the psychological and organizational viewpoints of values. It is, at the same time, based on the relation to other categories, which are relevant to the here researched viewpoint of values, i.e. *needs and motivation*.

We are referring to Mulej's idea about some *conditions for ensuring the success of an organization* – in particular those, which have to do with the managing of people in an organization, or understanding of imaginary conditions for reaching/fulfilling the expected (desired) reactions of people's (co-workers') behavior in an organization (Mulej 1992, and earlier, since 1974).<sup>[56]</sup> Mulej accepted also Anton Trstenjak's interpretation of the relation between the phenomena of *needs, motivation and values*, which explains *needs and motivation* with the help of *values* – he equates those with the 'values of the higher rank' and translates them into 'the world of needs' (Trstenjak, 1981).<sup>[57]</sup> Mulej formed his hypothesis putting 'needs' as 'objective starting points (alongside needs also possibilities are put into this category) and 'values' as 'subjective starting points' (together with knowledge on contents and knowledge on methods) as a basis for a person to choose his or her dialectical system of viewpoints. In a specifically important case this is 'methodological training for creative work' (Mulej, 1974).<sup>[58]</sup> Similarly, Mulej does at again in a slightly more developed form (he places emotions alongside values) showing that he appreciates the above mentioned Trstenjak's ideas (Mulej, 1992).<sup>[56]</sup> and later again, when he elaborates his old idea about the interdependence of objective and subjective starting points (Mulej, 2000).<sup>[4]</sup> He also develops a possibility of influencing the subjective starting points, explains the form of synthesis of subjective starting points, and makes a distinction between the subjective starting points of employees and managers. (See Ch. 4 here.)

All of the above mentioned must have influenced his understanding of the *meaning of a human* (individual) in an organization who conditions the (lack of) success of an organization, which is cleverly reflected in the following idea about the eight Fs. This idea came into existence when Mulej added to Kanter's preconditions of success, her four Fs: 'more Focused', 'Faster', 'more Flexible' and 'more Friendly' (Kanter 1983).<sup>[59]</sup>, four more Fs, suggested by himself: Fit, Free, Fun, and Function (Mulej 1992).<sup>[56]</sup>

What has to be done is to *compare both F groups*. Mulej summarized Kanter's Fs and her explanation with which she tied her Fs more or less tightly to the microeconomic aspects of economy and business. In other words, Kanter's Fs deal with the employees only from a rather or entirely impersonal, typically microeconomic aspects, e.g. price and/or work expenses, qualification structure, experiences, references of individuals in an organization, and similar. However, there is an occasional macroeconomic aspect, e.g. the rate of employment whereas

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<sup>361</sup> This problem is also dealt with more thoroughly in the already mentioned research (Udovicic, 2002).<sup>[39]</sup> the findings of which shall not be offered in this contribution.

Kanter seems to disregard the influence of individual ‘human capabilities’, personal traits and values.

What actually gives emphasis to Mulej’s Fs is the fact that each and everyone of them is *focused on an individual*, which defines them as softer dimensions of understanding and utilizing an individual’s capabilities, personal traits and values in processes, which take place in an organization. This approach is definitely in line with the *growing importance* of an individual in an organization, which does not stem so much from the fact that he or she cannot be replaced but more so from the fact that he or she must not be removed easily. Such understanding is rather similar to that of the majority of authors in the already mentioned study (Udovicic, 2002).<sup>[39]</sup>

Mulej does away with the inconsistencies when he states that *physical and mental readiness* to work, individual *freedom*, work *pleasure* and the *function* and significance of each task an individual tackles represent an important part of the new methods of management. All his Fs seem to be focused on an actual individual or various parameters, which determine that individual. The same is also true of the already known ‘*human abilities*’ (Udovicic, 2002).<sup>[39]</sup> along with the *personal traits* (especially character and temperament), and *values*. All of the three components are necessarily in co-dependence, which enables holistic understanding of the inevitable (unfortunately mostly inseparable) unity of an individual’s personality.

- Knowledge: Basis for him or her to be able to do what he/she is supposed to do, educationally.
- Experiences: Basis to like one’s work and master it, added to education.
- Capabilities: Basis to accept more difficult and demanding tasks.
- Talents: Natural background to enable sensitivity and make the work meaningful.

#### 6.5.5 PERSONAL TRAITS AND VALUES

Along with the so-defined ‘human abilities’ there are also personal traits (temperament and character), which also influence Mulej’s understanding of Fs. According to Musek they are relatively difficult to define scientifically. In the following part of the contribution I will summarize *four classical types of temperament*, defined already by Hypocrites, from the same source. I will list them together with *typical behavioral patterns*. Hypocrites’ interpretation was valid until the emergence of modern psychologists, such as Pavlov and Eysenck, both of whom defined the same typology from different viewpoints, Pavlov on the basis of the nerve system, and Eysenck according to the co-ordinates of personality dimensions (See Fig. 6.5.1).

*Fig. 6.5.1: Personal traits in the traditional classification by Eysenck*

| <i>Types of temperament</i> | <i>Typical behavioral patterns</i>                                                                      |
|-----------------------------|---------------------------------------------------------------------------------------------------------|
| Choleric                    | Over-sensitivity, restlessness, aggression, irritability, moodiness, impulsiveness, optimism, activity. |
| Sanguine                    | Sociability, openness, talkativeness, ease, vivacity, leadership abilities, carefree attitude           |
| Phlegmatic                  | Passivity, tidiness, prudence, composure, reliability, indifference, coolness                           |
| Melancholic                 | Sullenness, timidity, rigidity, moderation, unsociability, pessimism, restraint, calmness               |

According to Eysenck's typology choleric and sanguine are considered to be extroverted and the other two types introverted, and at the same time choleric and melancholic are regarded as unstable, whereas sanguine and phlegmatic as stable.

Below are listed six *typical varieties of character* with a description of character traits, which Musek took from Spranger (Spranger 1930):<sup>[11]</sup>

*Fig. 6.5.2: Six typical varieties of character according to Spranger*

| <i>Variety of character</i> | <i>Character traits</i>                                                                                                                                                                        |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Theoretical                 | Inclination towards cognitive values, the search for truth and knowledge, solving problems, learning field laws, with an emphasis on scientific interest, objectivity, logic and systematicity |
| Economic                    | Inclination towards pragmatism, materialism, utilitarianism, ownership interest, possessiveness                                                                                                |
| Aesthetic                   | Orientation towards the beautiful, art, design, expression, creation. A desire for formalistic symmetry, subjectivity                                                                          |
| Social                      | Selflessness, altruism, philanthropy, compassion                                                                                                                                               |
| Political                   | A desire for power, decision making, self – assertion, dominance, subjugation of others                                                                                                        |
| Religious                   | Orientation towards religion, the search for primal reasons and the highest spiritual principles. Pantheism, transcendentalism                                                                 |

If we exclude the 'human abilities', it seems rather useless to list typological characteristics of temperament and character due to their frequent presence in scientific texts. We wish to emphasize their *typical comparison with values*, which reflects at least the quantitative difference between the three categories of personality determinants. If we accept the hypothesis that the structure of temperament and character is almost ascetic, and yet effective, we cannot claim the same about values although many attempts to classify them can be found in expert writing. It should also be mentioned that in the last couple of decades a significant change in terms of development took place in the sphere of personal values, which caused relative complications in this field as well. While studying human personality, Cattell created a system of 'personality factors'. He divided them into primary<sup>362</sup> and secondary<sup>363</sup> factors of personality, on which he based his personality questionnaire 16PF<sup>364</sup> (Cattell 1975:<sup>[60]</sup>). Musek lists 19 classifications of values, 17 of which are scientist-created and 2 are universal (Musek 1993/b):<sup>[5]</sup>. As examples we shall offer only a few of the chosen ones, which might point to the already mentioned differences about the success of structuring.

<sup>362</sup> He earmarked them with a letter (A-O) - or a letter with number (Q1-Q4): fA: Warmth (Reserved vs. Warm), fB: Reasoning (Concrete vs. Abstract), fC: Emotional Stability (Reactive vs. Emotionally Stable), fE: Dominance (Deferential vs. Dominant), fF: Livelines (Serious vs. Lively), fG: Rule-Consciousness (Expedient vs. Rule-Conscious), fH: Social Boldness (Shy vs. Socially Bold), fI: Sensitivity (Utilitarian vs. Sensitive), fL: Vigilance (Trusting vs. Vigilant), fM: Abstractedness (Grounded vs. Abstracted), fN: Privatness (Forthright vs. Private), fO: Apprehension (Self-Assured vs. Apprehensive), fQ1: Openness to Change (Traditional vs. Open to Change), fQ2: Self-Reliance (Group-Oriented vs. Self-Reliant), fQ3: Perfectionism (Tolerates Disorder vs. Perfectionistic), fQ4: Tension (Relaxed vs. Tense); Summarised from: [http://assessments.ncs.com/assessments/tests/sixtpf\\_5.htm](http://assessments.ncs.com/assessments/tests/sixtpf_5.htm), 11.2002

<sup>363</sup> These are earmarked with letters and number (Q1-QVIII): QI: Exvia, QII: Anxiety, QIII: Corteria, QIV: Independence, QV: Discreetness QVI: Subjectivity, QVII: Intelligence QVIII: Good Upbringing; Summarised from: <http://www.ship.edu/~cgboeree/eysenck.html>; 11.2.02

<sup>364</sup> Sixteen Personal Factors.

A *common denominator* between various classifications is not easy to determine. An exception might be (the already mentioned) *approach to values*, which is based on various aspects (philosophical and psychological) of the approach. *Superficiality* of the majority of classifications and the values within them – reflected in the examples where in the column ‘individual values’ values cannot be listed and are only structured into subgroups – is not the only problem. What is essential is the managing of those values in the managerial practice.

*Fig. 6.5.3: Selected classifications of values*

| <b>Author/universal aspect</b> | <b>Categories of classification</b>                                                                                                                                                                                                  | <b>Individual values</b>                                                                                                                                                                                                                                                                                                  |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aristotle                      | dianoetic (cognitive) virtue<br><br>ethical virtues                                                                                                                                                                                  | mind, science, wisdom, art, common sense<br>courage, balance, self-control, generosity<br>self-respect, mildness, dignity, friendship, honesty                                                                                                                                                                            |
| Traditional antique values     |                                                                                                                                                                                                                                      | 'pulchum' (beauty), 'verum' (truth), 'bonum' (goodness, nobility)                                                                                                                                                                                                                                                         |
| Christian values               |                                                                                                                                                                                                                                      | faith, hope, love                                                                                                                                                                                                                                                                                                         |
| Spranger                       | theoretical values<br>aesthetic values<br>economic values<br>social values<br>political values<br>religious values                                                                                                                   | truth<br>beauty, harmony<br>benefit<br>altruism<br>power<br>holy, divine                                                                                                                                                                                                                                                  |
| Heller                         | primary<br>secondary      hedonistic values<br>utilitarian values<br>values of success<br>values of<br>appropriateness<br>cognitive values<br>aesthetic values<br>moral values<br>religious values<br>tertiary          e.g. musical | good – evil<br>pleasant – unpleasant<br>useful – useless<br>successful – unsuccessful<br><br>appropriate – inappropriate<br>true – false<br>beautiful – ugly<br>morally appropriate – inappropriate<br>sacred – worthless<br>harmony, melodious<br>sensual experiencing<br>action, promotion<br>self-control, fulfillment |
| Morris                         | Dionysian values<br>Promethean values<br>Buddhist values                                                                                                                                                                             | e.g. wisdom<br>e.g. world peace<br>e.g. honesty<br>e.g. capability                                                                                                                                                                                                                                                        |
| Rokeach                        | terminal values                      personal<br>societal<br><br>instrumental values<br>moral competence                                                                                                                             |                                                                                                                                                                                                                                                                                                                           |
| Hofstede                       | values of individualistic culture<br>values of collectivistic culture                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                           |

|            |                   |       |                                                                                                                                                                                                                                |
|------------|-------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Musek (93) | Dionysian values  | moral | hedonistic values (sensual experiencing, pleasure), sensual hedonism, social hedonism (amusement ...)                                                                                                                          |
|            | Exponential       |       | status values (success, achievements ...)                                                                                                                                                                                      |
|            | Apollonian values |       | patriotic values                                                                                                                                                                                                               |
|            | Actualization     |       | traditional moral values and ideals (honesty, family values, goodness, moral), democratic values, values of harmony and welfare<br>cognitive values, cultural/spiritual values, self - actualization values, religious values. |

#### 6.5.6 THE MANAGING OF VALUES AS A CONTRIBUTION TO SUPERIOR DECISION-MAKING

An answer to such an essential question as the one posed in the title of this subchapter is extremely complex. What has been said so far barely offers a framework for the answer. Let's begin with the finding about the complexity of psychological (scientific) definitions of the phenomenon of values which is definitely extremely/too sophisticated for practical use in management – probably useless without due modifications – not only simplification. If we add the cited statements how relatively complex are the approaches to the study of personality traits as formed by Cattell to the findings that there are an almost uncontrollable number of values and the complexity of classification, the statement about the problems of practical management turns out to be well-grounded. However, the above said does not free either the practitioners or the theorists from their need to *interdisciplinarily* consider the arrived-at findings. A fact a manager should be aware of when dealing with employees is that the well known *Human Resource management within an organization cannot be based on 'some' acquired experiences or lay understanding of the human nature*. What is even more important is the awareness that it is necessary to enable managers to develop these skills (increasing the scope of this kind of knowledge and acquiring appropriate experiences) as well as seek out and encourage the given abilities of handling people (abilities and talents for understanding and influencing people).

To acquire such abilities the *qualification process* cannot simply take place only by the in/formal education, e.g. 'ex-cathedra' for instance. Due to the *subtlety* of the process of managing people at work in organization, which is without any doubt extraordinary, it is quite obvious that not even the most educated and/or experienced managers could handle these processes successfully. Successful will be only those – well equipped with knowledge and experiences – talented and 'capable' as well. This is so, because we are faced with the well-known consequences of *extremely sophisticated human personality*, which is expressed by individual's reactions (1) to the stimuli from the environment and (2) also to those, which are processed in him/her-self. This indicates that at first we should determine whether the *managers personality fits* such high demands, which means: whether or not his/her personal traits and value system are of that kind that – on the basis of additional education for him/her – a convenient system of managers 'human abilities' could be established. By *convenient* we understand a system, which allows the manager to locate, estimate and implement in practice that employee's 'human abilities', which they offer to manager for his combining them with other material and non-material resources into 'managing', 'informational' and 'basic' processes (Kajzer, 1987):<sup>[61]</sup>, which take place in the organization. The examination process of the mentioned personal traits and values which manager has, can be established at the proper level of quality when the adequate (suitable) tool (personal questionnaire, or a set of them) to perform a specific personal traits research is available. Such tool was developed and tested in

practice on a pilot basis (Udovicic 2002):<sup>[39]</sup>), however the first practical use in the actual, e.g. Slovene management is still ahead.

#### 6.5.7 SOME CONCLUDING REMARKS CONCERNING VALUES IN TERMS OF THE CLIMATE CHANGE<sup>365</sup>

Implementation of the Agenda 21 can hardly take place with no acceptance of it on the part of managers and other individuals and their organizations of any kind. The door opener to their acceptance of Agenda 21 has to do with their capabilities and their personality traits, hence with their values. As we saw in Ch. 6.2, the change agents tend to be biased because their idea has a high rank in their own values; this may blind them and hamper their diffusion process concerning their idea, which may kill their idea rather than make it implemented. The importance of creditworthiness (See Ch. 6.3) lies to a high degree in its impact over the values: the more somebody is trustworthy, the more highly valued this individual / organization is. The research methods (see Ch. 6.4, 6.7, 6.9 and 6.10) can produce more insight and, on the basis of interdependence of the knowledge, emotions and values, support making the values more supportive of a change agent's suggestion. But all this is not necessarily enough: the organizational values of business systems respond best to taxation (Hawken 1994; etc.). Thus, let us turn to taxation – in the next chapter.

### 6.6 TAX REFORM TO REDUCE THE CLIMATE CHANGE: AN ENERGY CASE FROM SLOVENIA<sup>366</sup>

#### 6.6.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 6.6

In the foregoing subchapters of the Ch. 6 we discussed a number of ways that hopefully lead toward a more systemic thinking about the climate change, such as its inclusion into diffusion of novelties, into criteria of creditworthiness, into methods of research with quantifying methods, and values, which are influenced by motivation. It is a well-known economic truth that taxation belongs to the crucial governmental means of motivation influencing the organizations and individuals as business systems. That's what we will tackle here. We will take a look at a case of the energy sector in Slovenia in terms of her way to meet her obligations resulting from her signing the Kyoto protocol.

By signing the Kyoto protocol (on 21 October 1998) Slovenia committed to reduce the emissions of greenhouse gases prior to 2008-2012 by 8% compared to 1986 (the year in which the emissions of greenhouse gases reached its peak). When the Kyoto protocol is ratified by a sufficient number of countries, it will become legally binding for the participant countries.

In this contribution we will present measures and instruments for reduction of greenhouse gas emissions, paying special attention to the energy sector. The most important instruments are CO<sub>2</sub> and energy taxes, which should internalize external costs. For this purpose, Slovenian CO<sub>2</sub> tax will be analyzed in details. But we will also discuss the suitability of the so-called "second best" approach, which consists of subsidizing energy production from renewable sources. However, we should keep in mind that energy/CO<sub>2</sub> taxes alone are probably not enough to change the consumer's behavior substantially so other complementary measures are necessary and will be discussed in this contribution.

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### 6.6.1 REDUCING THE EMISSIONS OF GREENHOUSE GASES (CURRENT SITUATION AT THE EU LEVEL)

To reduce the emissions of greenhouse gases to the levels set by Kyoto targets, countries can use several different instruments. One of the ways to reduce the emissions of these gases is to introduce or increase environmental (excise) and energy/CO<sub>2</sub> taxes or other taxes, e.g. SO<sub>2</sub>, NO<sub>x</sub> taxes. The proposals of the European Commission concerning the above mentioned taxes have been changing over the years. They ranged from the first proposal about combined energy/CO<sub>2</sub> tax with exception of renewable sources, or the 1995 proposal that allowed EU member countries to prepare their own time schedules for introduction of the tax and determine their individual tax rates; to the last proposal in 1997. It anticipated expansion of the existing lowest excise taxes and legislation concerning oil and oil derivatives to all energy products (with the exception of renewable sources). Additionally, it proposed gradual increasing of the lowest excise taxes in three steps: in 1998, 2000 and 2002. Despite the fact that the last proposal received strong support of the European parliament, the European council did not approve it (Vourc'h and Jimenez 2000, p. 17; Kirkpatrick et al. 2001, p. 31).

The suggested minimal excise taxes for electricity, natural gas and coal are presented in Fig. 6.6.1. These are the energy products that are not taxed under the existing system of excise taxes.

*Fig. 6.6.1: Proposed minimal excise taxes for selected energy products*

|             | Excise tax                                                        |
|-------------|-------------------------------------------------------------------|
| Electricity | 1 EUR/MWh                                                         |
| Coal        | 0,15 EUR/GJ for companies and 0,30 EUR/GJ for private consumption |
| Natural gas | 0,15 EUR/GJ for companies and 0,30 EUR/GJ for private consumption |

Source: European Commission, 1997.

Countries that have already introduced the energy/CO<sub>2</sub> tax are striving to form a multilateral agreement within the EU on the amount of the tax (or tax rate) and details about what is subject to taxation and its purpose. This would contribute to reaching uniform business conditions on the whole territory of the Union. EU members that haven't introduced the taxes yet or have set taxes low have a competitive advantage compared with the members that have already implemented the tax. In 2000 all the member countries as well as Slovenia had excise taxes for motor fuels and other fossil fuels. However, only a handful of countries also had an independent CO<sub>2</sub> tax (Denmark, Finland, Netherlands, Sweden, Slovenia) or energy tax (Austria, Belgium, Denmark, Netherlands, Sweden). In Italy both CO<sub>2</sub> and energy taxes have been included into the excise tax since 1999. Belgium, France and Great Britain started to introduce a CO<sub>2</sub> tax only in 2001 (Forum for the Future 2000).

There exists an important difference between CO<sub>2</sub> (SO<sub>x</sub>, NO<sub>x</sub>) tax and energy tax: when the tax basis is the quantity of carbon dioxide (SO<sub>x</sub>, NO<sub>x</sub>) released when burning a unit of fuel we are dealing with CO<sub>2</sub> (SO<sub>2</sub>, NO<sub>x</sub>) tax. However, with the *energy tax*, the tax basis is the energy produced when burning a unit of fuel.

The energy sector can substantially contribute to the reduction of greenhouse gas emissions. This sector is also among the biggest producers of emissions. However, in most countries, the negative external effects caused by the production of electricity are not included in the price.

The external costs of electricity production depend on the technology used. The European Commission presented the results of the research that estimated the external costs of different production methods for electricity. The study found that (for the entire EU) the price of electricity produced using coal would double when taking into account external costs, and the price of electricity produced using natural gas would be 30% higher (EC 2001a).

There are two ways to tackle environmental costs:

- internalize the external costs by taxing the polluters, which would cause a substantial increase in energy prices ("first best" approach);
- promote or subsidize "clean technologies" and in this way avoid the costs of environmental damage ("second best" approach).

Since the possibility of introducing a CO<sub>2</sub>/energy tax ("first best" approach) for the whole EU seems to be relatively limited, the European Commission decided to support the "second best" approach. This may be concluded from the statement of the commissioner P. Busquin (20 July 2001). Additionally the "Community guidelines on State aid for environmental protection" published by the EU explicitly state that the EU member countries may grant the plants producing electricity from renewable sources subsidies within the unavoidable external costs (but they are not to exceed 0.05 EUR/kWh) (EC 2001b). Regardless of the European Commission support for the subsidies for production based on the use of renewable sources, the countries have in different ways been subsidizing the production of electricity from renewable sources for a long time. However, due to higher production cost based on renewable as compared to classical (fossil) fuels, the share from renewable sources in the past was not encouraging.

Subsidizing, due to its effects on costs, can always lead to loss of economic efficiency (and it is no different in energy sector). Here we can notice it in the following ways (IEA and UNEP, 2001):

- subsidizing of consumers and/or producers decreases prices, reduces stimuli for more efficient use of energy; the consumption of energy is increased (negative quantity effect);
- higher energy consumption leads to more imports and reduces the export of energy. Changes in import and export of energy affect the status of the balance of payments and additionally, due to higher dependence on imports, decrease reliability of the energy supply;
- subsidizing of certain types of technologies can prevent development and commercial use of other technologies that would perhaps through time become economically and environmentally attractive.

The negative quantity effect has become a frequent subject of discussions, especially after the deregulation of the electricity market in the EU, which due to keener competition led to decreasing electricity prices. However, observing this trend one cannot avoid asking, how can the energy from renewable sources, which is usually more expensive than classical, compete on the energy market? In this context it is possible to see subsidizing of electricity production from renewable sources as the second best solution, while the first best is the taxation of the fuels for electricity production based on their contribution to emissions, which would in turn require a consensus at the EU level.

Deregulation of the electricity market, subsidizing of production from renewable sources, and the resulting negative influence on the consumption of energy therefore requires complementary measures for reducing the consumption of electricity. This is necessary to

fulfill the Kyoto commitments. Therefore the countries should pay close attention to (EC 2001c):

- *energy demand* due to lower prices for electricity (and natural gas), which are a consequence of stiffer market competition, the energy saving and investment in energy-efficiency improving technologies are reduced, which increases the consumption of energy. This effect can be weaker if energy supply companies are incentivised to introduce a tariff structure which encourages energy saving. It is possible to reduce total energy expenditures by lowering fixed charges, leaving the tariff per unit of consumed energy unchanged. Another possibility presents a more radical measure such as increasing of the so-called block tariffs. Another possibility is introduction of taxation measures that become "more severe" as the consumption of energy grows;
- *energy supply*: electricity from renewable sources or from CHP (combined heat and power) electricity plants is usually not competitive with electricity from classical sources, which may cause lower production from cleaner sources.

The following are complementary measures that have been adopted so far in the EU with the purpose to prevent an increase in energy consumption or a decrease in production from renewable sources when deregulating the electricity market:

- *Renewable energy sources*: European Commission presented on 17 May a proposal for a Directive on the promotion of renewable energy sources in the internal electricity market (COM (2000) 279 final, 10 May 2000); Member States are obliged to set and meet national targets for the domestic consumption of electricity generated from renewable energy sources. These targets must be consistent with the EU targets and Kyoto obligations. The proposal also includes other measures: measures that assure that transmission system operators and distribution system operators in their territory grant priority access to the transmission and distribution of electricity from renewable energy sources; introduction of a system for determining the source of energy; improving administration procedures with the purpose of eliminating legal deficiencies that are hampering production from renewable sources.
- *Combined heat and power production*: In 1997 the European Commission prepared Communication on CHP (COM (97) 514 final, 15 October 1997), in which it suggested that by 2010 CHP provide 18% of all produced electricity (in 1999 the share was 9%). The action plan for improvement of energy efficiency in the EU from 2000 (COM (2000) 247 final, 26 April 2000) states this same target (the current share of production in CHP is 10%).
- *Emissions standards*: in 1988 The Large Combustion Plants Directive (LCPD; 88/609/EEC), stated emission standards and the upper possible limits of emissions for SO<sub>2</sub> and NO<sub>x</sub>. The above Directive was corrected in 2000: they set a stricter upper limit for emissions from new electricity plants. The emissions from new power plants are also regulated by the 1996 issued Directive on Integrated Pollution Prevention and Control - IPPC Directive (96/61/EC, 24 September 1996): power plants with a capacity over 50 MW have to introduce the best available technologies.
- *Energy efficiency*: There exists a large potential for improvement of energy efficiency within the EU. It was estimated to be over 18% of energy consumption in 1998. The action plan for improvement of energy efficiency from 2000 (COM (2000) 247 final, 26 April 2000) called for 1% annual improvement (decrease) in energy intensity.
- *Energy taxation*: For electricity and natural gas, VAT and specific energy taxes (indirect taxation) are collected. VAT is already largely harmonized at Community level. Concerning the specific energy taxes or excise taxes, in 1997 the European Commission suggested expansion of existing excise taxes to other energy products, except for renewable sources, and gradual increasing of excise taxes in three steps: 1998, 2000 and

2002 (COM (97) 30 final, 12 March 1997). In 2001 the European Commission published Community guidelines on State aid for environmental protection (OJ 2001/C37/03), which also include the mentioned tax exceptions/deductions for energy intensive companies.

- *Other measures:* Communication on emission trading with greenhouse gases in the EU was published by the European Commission in 2000 (COM (2000) 87 final, 8 March 2000). It states that emission trading both in the EU and in other industrialized countries can contribute to reduction of costs, related to meeting the environmental commitments. Emissions trading, which after 2008 will be compulsory for countries, is one of the flexible mechanisms of the Kyoto protocol; the other two mechanisms are: projects of joint implementation, and mechanism of clean development.

## 6.6.2 REDUCTION OF GREENHOUSE GAS EMISSIONS IN SLOVENIA (ACTIVITIES, INSTRUMENTS, CAPACITIES TO FACE CLIMATIC CHANGES)

### 6.6.2.0 COMMITMENTS

After gaining independence or even before that, environmental problems did not receive much attention in Slovenia. The economy was at the time overburdened with transition into a free market economy, reorientation of its industry into exports, privatization, denationalization, and other processes of achieving capitalism. Today the policy of preventing climate changes presents a big challenge for Slovenia.

The Kyoto commitment should be understood not only as a burden but, mostly, as an opportunity to increase the efficiency of energy use. The economically justifiable potential of reducing energy consumption in public buildings in Slovenia is 30%. Inefficient consumption in schools alone (poor insulation of roofs and outside walls, loose window frames, obsolete boilers and other installations, radiators without self-regulating valves) costs around 5.7 billion SIT annually (25.6 million EUR). Since most of the energy comes from fossil fuels (electricity from power plants fueled by coal, heating oil or natural gas), we could substantially reduce emissions of greenhouse gases with some investment in more energy efficient technologies, which would pay off in 4 to 6 years. For this we would need to prepare a strategy and system of promoting public awareness, motivating consumers, managers and owners, and also form rules for investing, which would encourage instead of hampering engaging of private homes or foreign knowledge and capital in energy optimization of the public sector. Both substantial initial budget resources and political willingness would be needed. Without the latter, different sectors (school, financial, energy) will not find a consensus to achieving the common goals (Klemenc 2000, p. 7-8).

In 1997 the Slovenian government established a committee for issues of climate change, whose task was inter-sectoral coordination of questions related to climate change or to the activities for reducing emissions of greenhouse gases (Official Gazette 59/97).

In 1999 the Slovenian parliament passed both the Energy Act and the National Program for Protection of the Environment. This includes goals, guidelines and strategy for environmental protection and the use of natural resources for the time period of at least 10 years.

In 2000 the Ministry of the Environment and Physical Planning published a Strategy and Short-run Action Plan for Reduction of Greenhouse Gas Emissions. This includes also measures for the reduction of emissions in different sectors defined according to the methodology in Directive on Integrated Pollution Prevention and Control – IPPC (EC 1996) as: energy, manufacturing, transportation, households, public and service sector, agriculture and waste and recycling. We

will present some of the measures in what follows, but before that let us have a look at the fundamental characteristics of taxation of energy products in Slovenia.

#### 6.6.2.1 ENVIRONMENTAL AND ENERGY TAXES FOR INDIVIDUAL ENERGY PRODUCTS

As one of the first countries in Europe and the first among the transition economies Slovenia introduced the CO<sub>2</sub> tax on 1. January 1997 - an instrument that should help reduce emissions of CO<sub>2</sub> and increase budget revenues<sup>1</sup>. In the same year the decree was twice augmented and extended, in 1998 again twice, in 1999 once, and additionally twice in 2000. The decree and its changes set the tax for emissions of CO<sub>2</sub> into the air when burning fuels or other organic compounds, its amount, the way of its calculation, and terms for its payment (Official Gazette 68/96, p. 5874).

The following energy products are subject to the CO<sub>2</sub> tax: gasoline, kerosene, diesel fuel, heating oil, liquid petroleum gas, natural gas, smelting furnace gas, petroleum gas, coke gas, anthracite, coke, black and brown coal, lignite, ethane, waste oils and communal waste (ibid., p. 5875). A tax for electricity production fuels (except coal) has to be paid since January 1999 (Official Gazette 65/98, p. 4937), tax for coal used in production of electricity is scheduled to be collected in 2004 (REC 2000; Official Gazette 68/96, p. 5875).

The basis for calculation of the CO<sub>2</sub> tax is a unit of the air pollution with emission of CO<sub>2</sub> and it is equal to the emission of 1 kg of CO<sub>2</sub><sup>2</sup>. The tax basis is a sum of pollution units of the bought quantity of energy products subject to the CO<sub>2</sub> tax (Official Gazette 68/96, p. 5875). The tax is paid by

- the taxpayers subject to the excise tax, importers and fuel producers (Official Gazette 51/99, p. 6459) (which shifts the burden to the final consumers of fuels and flammable organic compounds - the retail price of the fuels increases), and
- operators of heating devices, industrial furnaces and incinerators.

The Slovenian government determines the price for a pollution unit; when introduced it was 1 SIT per pollution unit (Official Gazette 68/96, p. 5874).

There are numerous exceptions to the tax, which in nominal terms has increased four times since 1998 (from 1 to 3 SIT per pollution unit - Official Gazette 24/98, p. 1571). In general, however, its purpose is to increase the budget revenues, which hardly includes any expenditures related to reduction of greenhouse gas emissions.

Taxpayers are to pay the following amount as a CO<sub>2</sub> tax (Official Gazette 124/00, p. 13859):

- 10% of the basis for flammable organic compounds that are incinerated as dangerous waste, and fuels that are used for incinerating of dangerous materials in incinerators of dangerous materials;
- 25% of the basis for flammable organic compounds that are burnt in combustion furnaces for cleaning of waste gases by burning, which do not operate as individual incinerating facilities;
- 50% of the basis for flammable organic compounds that are incinerated together as waste in heating facilities and industrial furnaces, or are burnt as waste in incinerators for waste;
- 100% of the basis for burning of other fuels.

<sup>1</sup> Slovenian government passed the CO<sub>2</sub> Tax Act (Official Gazette, 32/96), which was based on Environment Protection Act (Official Gazette, 68/96) and took effect 1 January, 1997.

<sup>2</sup> The quantity of carbon released when burning extra light heating oil is 0.0202 kg C/MJ, quantity of carbon released for natural gas is 0.0153 kg C/MJ. Number of air pollution units due to CO<sub>2</sub> emissions for extra light heating oil is 2.6 EO/l and 1.3 EO/m<sup>3</sup> (Official Gazette, 68/96).

When paying the CO<sub>2</sub> tax, the flammable organic compounds (according to the 1996 Act this includes: ethane, waste oils and communal waste, liquefied petroleum gas and natural gas - Official Gazette 68/96, p. 5874; Official Gazette 51/99, p. 6459) are treated preferentially.

It is not necessary to pay the CO<sub>2</sub> tax for the following fuels (Official Gazette 68/96, p. 5874; Official Gazette 51/99, p. 6459):

- wood for heating;
- wood oddments, if they are used as fuel in heating facilities;
- solid, liquid and gas fuels produced from biomass;
- biogas produced in waste water cleaning facilities or in land fill;
- mineral oils and gas used as fuel for specific purposes mentioned in the article 54 for the Excise Tax Act (Official Gazette 84/98);
- flammable organic materials which contain no more than 0.005 kg C/MJ of flammable carbons, when an annual consumption does not exceed 1000 kg.

For mineral oils and gas used as fuel, for propelling purposes the CO<sub>2</sub> tax was abandoned after the introduction of the Excise Tax Act, thus only excise tax is paid for them.

In 1998 the government passed a decree on changes and extensions of the existing CO<sub>2</sub> Tax Act (Official Gazette 65/98), which regulates permissions for the consumption of fuels that are not subject to the tax. This means that there exists a certain quantity of fuel for which no tax is paid. The purpose of permissions was both to preserve the guiding effect of the tax (in the negative preventive and positive encouraging sense) and to lower the fiscal burden for the enterprises concerned.

The commercial companies and individual entrepreneurs, who are owners or are managing a facility, can obtain permissions for the tax-free consumption of fuel (Official Gazette 65/98, p. 4935- 4937), if they:

- were operating on the day when the corrected decree took effect (1 October, 1998) and in which the consumption of fuel in one calendar year in the time period 1986-1998 did not produce more than 10 t of CO<sub>2</sub> emissions annually;
- started to operate after the decree took effect and due to the consumption of fuel produced more than 100 t of CO<sub>2</sub> emissions annually;
- started to operate after the decree took effect and is supplying electricity into high-voltage transmission network,
- are producing electricity in a facility for combined heat and electricity production;
- their facility is under reconstruction or replacement of the existing devices, based on different pollution reducing programs.

Enterprises that would like to obtain such permissions for the tax-free use of fuel submit a request to Directorate of the Republic of Slovenia for Environmental Protection. If the request is approved, the companies are granted the permission for three calendar years. The permission is linked to the device in which the fuels are burned (Official Gazette 65/98, p. 4936).

The highest annual quantity of tax-free fuel consumption equals 67% of the CO<sub>2</sub> emissions in one calendar year, which means the use of CO<sub>2</sub> tax-free fuel for eight out of twelve months. For some devices that operated on the day that the changed decree on the CO<sub>2</sub> tax took effect (1 October 1998) the highest annual quantity of tax-free fuels is as follows (ibid., p. 4937):

- 100% exemption for devices for production of heat insulation materials;

- 92% exemption for power plants, public air traffic and public railway traffic;
- 50% exemption for devices used in local provision of households with heat or gas for the share of fuel used for production of heat.

The highest annual quantity of tax-free fuel consumption for production of electricity is set by a special standard<sup>3</sup>. The permission states the permitted annual quantity of CO<sub>2</sub> tax-free fuel consumption for the current calendar year, so that it causes at most 0.4 kg CO<sub>2</sub>/kWh of emissions. For production with low voltage, the standard of exemption is set at 0.44 kg CO<sub>2</sub>/kWh (Official Gazette 42/00, p. 5763).

The Directorate of Republic of Slovenia for Environmental Protections issued 945 permissions in the time period 1998-1999 (Klemenc et al. 2000, 25). The value of issued permits and the shares of individual classes of the companies entitled to permissions are given in Fig. 6.6.2. As can be seen, the Slovenian budget for 1998 due to the issued permissions for the CO<sub>2</sub> tax-free use of fuels was smaller by 24.3 billion SIT, and in 1999 by 2.4 billion SIT<sup>4</sup>.

Revenues from the CO<sub>2</sub> tax in 1998 amounted to 17.7 billion SIT and represented 2.3% of total budget tax revenues. In 1999 they were 15.1 billion SIT (1.7% of total tax revenues) and in 2000 7.5 billion SIT (0.8% of total tax revenues) (Ministry of Finance 2001). Revenues from the fee on CO<sub>2</sub> emissions after 1998 decreased, which is likely the consequence of the introduction of permissions for CO<sub>2</sub> tax free consumption of fuels and additionally the exemption of paying the fee for some propulsion fuels. These revenues were not used for environmental investments, but were channeled directly into the government budget.

*Fig. 6.6.2: Value of the permissions for CO<sub>2</sub> tax-free consumption of fuels in years 1998 and 1999 and the share of individual classes of recipients*

| Classes of recipients                                                | Value of permissions 1998 (mio SIT) | Value of permissions 1999 (mio SIT) | Total 1998 and 1999 (mio SIT) | Share (%) |
|----------------------------------------------------------------------|-------------------------------------|-------------------------------------|-------------------------------|-----------|
| 100% exemption (insulation materials)                                | 248,67                              | 1,00                                | 249,68                        | 0,93      |
| 92% exemption (power plants, public air and railways transportation) | 18.557,91                           | 179,01                              | 18.736,92                     | 70,02     |

<sup>3</sup> This is a standard for production of electricity using the best available technology (higher than 50 % efficiency) and the least environmentally damaging fuel (natural gas) (Tomsic, 1998, p. 178).

<sup>4</sup> Since it is possible that the companies transfer the permissions to the next calendar year and since they acquired the CO<sub>2</sub> tax-free fuel permissions in the fall of 1998 when they started to grant them, it happened that some companies did not pay any CO<sub>2</sub> fees for emissions until almost a year and a half after obtaining the permissions.

|                                                              |           |          |           |       |
|--------------------------------------------------------------|-----------|----------|-----------|-------|
| 50% exemption (production of heat in local public utilities) | 667,16    | 77,95    | 745,11    | 2,78  |
| Heating devices                                              | 1.376,77  | 1.106,52 | 2.483,30  | 9,28  |
| Burning devices (industrial processes)                       | 1.746,34  | 711,23   | 2.457,58  | 9,18  |
| Combined production – heat                                   | 1.307,84  | 3,55     | 1.311,39  | 4,90  |
| Combined production – electricity                            | 427,77    | 348,70   | 776,46    | 2,90  |
| Total                                                        | 24.332,47 | 2.427,96 | 26.760,44 | 100,0 |

Source: Klemenc et al., 2000, p. 25.

The main criticism concerning the CO<sub>2</sub> tax is that the tax is mostly a fiscal source for the state budget, since the tax basis is not comprehensive enough and the tax rate is not high enough<sup>5</sup>.

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<sup>5</sup> While the tax rate in Slovenia amounts to 14.5 EUR/t CO<sub>2</sub>, in Sweden it is 43 EUR/t CO<sub>2</sub> (Slabe Erker, 2001, p. 94).

Therefore the Ministry of the Environment and Physical Planning is preparing a change of the CO<sub>2</sub> Tax Act (Nared 2001, p. 6), which should in the future be directed mainly into investments and the measures harmonized with the Community Guidelines on State Aid for Environmental Protection. In accordance with these guidelines, this is the area where the widest range of schemes for state aid is permitted. This is the area of key importance in the environmental protection policy.

We have already mentioned that the Kyoto commitments are to be understood not only as a burden, but mostly as an opportunity for increasing energy use efficiency in all sectors, thus also in households.

Concerning the energy sector, many challenges appeared in the process of deregulation of the energy market in Europe, which also has the support of the European Commission in its directives. Deregulation caused decreasing prices of electricity, which could negatively affect the consumption of energy (which may increase). At the same time it could influence lowering of the share of electricity production from renewable sources, which has weak negative external effects (it contributes to decreasing emissions of greenhouse gases) and is more costly to produce compared to the production from classical fossil fuels.

Energy/CO<sub>2</sub> and environmental taxes can compensate for the decrease in price brought about by the deregulation of the energy market. However they have a stronger effect on big consumers of energy. For the latter, the costs of energy may represent 10 to 45% of all costs. Thus they have a strong motivation to decrease the consumption of energy<sup>6</sup>. A company in which the consumption of energy represents only a small share of costs usually will not pay much attention to its consumption and energy efficiency, regardless of the price. The effect on its market position will in no way be a substantial one. However, it is possible that there are such a large number of these enterprises that their cumulative share in the consumption of energy and substantial room for improving energy efficiency may not be overlooked. The prices of energy are thus important. However, the prices alone will not lead to a sufficient decrease in primary energy consumption to meet the Kyoto commitments. To fulfill the Kyoto goal we need a whole range of harmonized measures (Egenhofer 1999, p. 2).

Despite the absence of a climate change policy in the past years, Slovenia took some important steps, such as the replacement of fuels in manufacturing and households, restructuring of coal mining, institutionalization of its energy efficiency program, and other similar measures. On 1 January 2002 the government passed a Decree on Purchasing Prices for Electricity for Qualified Producers of Electricity. With a guaranteed price, qualified producers are insured against market risks when selling electricity. In Slovenia the subsidies for qualified producers of electricity amount to 5-6 SIT/kWh, which is approximately half of the recommended limit set by the European Commission (11 SIT/kWh). They include partial compensation for their contributions to the distribution network (Institut J. Stefan 2001, p. 9).

In our opinion, we should use more money collected through environmental fees for energy saving purposes (replacement of boilers and other devices for heating, energy labeling, insulation of buildings etc.) following the lead of some EU member countries. Besides this, households should be encouraged to use energy more efficiently, since it was households that in the last years increased energy intensity (the ratio of total consumption of energy and GDP) in contrast with manufacturing. Reasons for this jump include among others market failures

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<sup>6</sup> For now in most countries the big energy intensive companies are exempt from paying the energy and environmental taxes, or they pay lower taxes than other enterprises and households.

such as insufficient information concerning the possibilities of saving energy, lack of environmental consciousness, insufficient supply of good devices and materials for efficient use of energy, incomplete and often obsolete legislation to promote efficient use of energy, imperfections in the capital market, lack of adequate measures for promoting efficient use of energy in households, lack of renter's motivation to invest in improving energy efficiency in apartments, and other. When the mentioned market imperfections occur, it seems that direct investments in the market for achieving energy efficiency are sensible. Examples include financial incentives in cash, or tax deductions for energy saving investments.

As we mentioned, the Ministry of the Environment and Physical Planning published in 2000 Strategy and Short Run Activity Plan for Reducing Emissions of Greenhouse Gases (Strategy) in which the details of measures for reducing the emissions in individual sectors are stated. We will present some of these measures in what follows, while focusing on sectors of energy, manufacturing and households.

#### 6.6.3.2 *ENERGY SECTOR*

The Strategy states that the exchange of old coal based electricity plants with modern gas based electricity plants and with the partial replacement of cogeneration potential (with a stable quantity of purchased heat) in the energy sector should bring about further reduction of greenhouse gases (Ministry of the Environment and Physical Planning, 2000, p. 20). This measure means negative costs at the enterprise level, while additional various financial incentives will be needed for renewable sources, district heating and energy efficiency. It is estimated that due to additional positive influences (on employment, regional development, emission reductions of other harmful substances) these incentives may be justifiable from the macroeconomic point of view. Without a major reduction (up to about 40%) in current coal consumption, the energy sector will not be able to achieve its "Kyoto goal": a reduction in sector emissions by 8%. In this way, the lowering of the quantity of mined coal or assuring the conditions for political acceptability of this reduction (programs of early retirement for miners, career changes, and economic restructuring of coal mining regions) is the most important individual measure (Klemenc et al. 2000, p. 12).

Besides subsidies and credits with lower than market interest rates for efficient use and renewable sources of energy, the following measures would be necessary (ibid., p. 12-13):

- selective increase of the CO<sub>2</sub> tax and its broadening to the consumption of electricity at least for households and service industries;
- introduction of a 2% fee on energy consumption;
- energy labeling of devices and machines (the basis for which is stated in the Energy Act).

#### 6.6.3.3 *MANUFACTURING / BUSINESS SECTOR*

The Ministry of the Environment and Physical Planning expects that in the manufacturing sector we will observe a slight increase in emissions related to an increase in electricity production<sup>7</sup>. Compared to 1986, the manufacturing sector has already reduced emissions due to energy use of fossil fuels by more than 40%, which is mainly a consequence of reducing the

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<sup>7</sup> Electricity production in hydro power plants and in the nuclear power plant in Krško contributes no emissions of greenhouse gases. The largest source of CO<sub>2</sub> emissions are coal-based power plants (steam power stations) in which a bit more than 1/3 of Slovenian electricity is produced. In the future, the coal-based power plants are to be replaced by more environmentally friendly gas-based power plants. However, the replacement of all the production of the nuclear power plant Krško by the production in power plants based on fossil fuels would cause an increase in greenhouse gas emissions in Slovenia by at least 10% (Ministry of the Environment and Physical Planning, 2000, p. 22).

quantity produced, restructuring of the production, replacement of some fuels (coal, fuel oil and heating oil) with fuels containing less carbon (light heating oil, natural gas), and lately also projects of energy management, supported by the Agency for Efficient Use of Energy (Ministry for the Environment and Physical Planning 2000, p. 22). Despite this, there is still a lot of room for improving the use of energy in the manufacturing sector, especially in wood processing companies, where most of the boilers are obsolete, and that still do not take full advantage of wood wastes. Also the guideline of the EU on integral prevention and control over emissions ("Intergovernmental Panel on Climate Change" - IPPC), which will become effective in Slovenia in 2007, is expected to additionally contribute to the reduction of specific emissions<sup>8</sup> (ibid., p. 23). Despite better energy efficiency, measures for efficient production and use of renewable energy sources, the decree on CO<sub>2</sub> tax, and the changed structure of manufacturing, no reduction in emissions of greenhouse gases is expected by the Strategy. Instead a slight increase is anticipated due to a larger quantity produced in most manufacturing sectors. Favorable conditions for combined heat and electricity production can cause lower specific emissions, not only in manufacturing, but also elsewhere.

To achieve reduction of greenhouse gas emissions also for the manufacturing sector, additional taxing of energy products is needed, mainly for electricity, which has not yet been subject to a CO<sub>2</sub> tax. The effects on international competitiveness could be compensated through partial exemptions for certain energy intensive sectors in exchange for voluntary agreements of emission reductions or improved energy efficiency. Additionally the system of emission trading of greenhouse gases could contribute to a more efficient reduction of emissions.

#### 6.6.3.4 *HOUSEHOLDS*

Emissions of greenhouse gases in households are a consequence of using fossil fuels for heating private dwellings, preparation of warm sanitary water, and to a lesser extent for food preparation. In the period 1986-1996, the emissions of households increased, which is mainly a consequence of larger dwellings and a higher level of heating (Ministry of the Environment and Physical Planning 2000, p. 25).

Concerning the reduction of greenhouse gas emissions, the most suitable fuels are in the following order (ibid., 26): renewable sources (wood, biomass, wastes and biogas, geothermal and solar energy), district heating from renewable sources or combined heat and power production, natural gas, liquified petroleum gas, heating oils, coal and electricity (used in special devices).

The pricing is of course an important element affecting the choice of energy products. Prices of fossil fuels are already subject to a CO<sub>2</sub> tax, which is lower for the fossil fuel with a lower content of carbon. For natural gas, a fuel with the lowest content of carbon per unit of energy, the CO<sub>2</sub> tax is additionally reduced, and biomass is not subject to the tax. Partial exemptions of the CO<sub>2</sub> tax for the consumption of fuels for district heating production and deductions for production of electricity for independent producers are intended for promotion of district heating and increasing a share of combined production in it.

For households, the Ministry of the Environment and Physical Planning (2000; p. 21, 26-27) defined in the Strategy the reduction of greenhouse gas emissions as a sectoral goal. It should

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<sup>8</sup> Specific emissions are CO<sub>2</sub> emissions per unit of electricity (kgCO<sub>2</sub>/kWh) or per unit of consumed fuel (kgCO<sub>2</sub>/kWh; kgCO<sub>2</sub>/J).

be achieved by improving urban planning, construction regulations and education of architects, new standards for energy efficiency of boilers and heating devices, favorable credits for improved heating insulation of windows and walls, energy labeling of kitchen appliances, and a state aid program for construction of about 50 larger systems of district heating based on wood biomass.

Several studies estimating the possibilities for energy saving in apartment buildings have been conducted since 1992. Based on analysis of 18 typical apartment buildings, they determined that the use of quality energy technologies available in the market could save on average 64% of the necessary energy for heating<sup>9</sup> (Malovrh 2001).

#### 6.6.4 CONCLUSIONS

By signing the Kyoto protocol, the EU member countries committed to reduce the emissions of greenhouse gases. For this purpose, countries can use several different instruments. One of the ways is to introduce or increase environmental (excise) and energy/CO<sub>2</sub> taxes or other taxes, e.g. SO<sub>2</sub>, NO<sub>x</sub> taxes. Due to the lack of consensus about the energy/CO<sub>2</sub> tax at the EU level, currently the countries can individually choose the instruments.

Slovenia is one of the first countries in Europe and the first among the transition economies, which introduced the CO<sub>2</sub> tax in 1997. Until now, the CO<sub>2</sub> tax Act has changed several times. At first the changes included increases in CO<sub>2</sub> tax rates and then additional exemptions for industry because of reduced competitiveness. In 1998 permissions for the tax-free consumption of fuels were introduced. The purpose of permissions was both to preserve the guiding effect of the tax (in the negative preventive and positive encouraging sense) and to lower the fiscal burden for the enterprises concerned.

Energy and environmental taxes increase costs and prices, which is a burden for both households and companies. However, we should keep in mind that substantial changes in energy consumption behavior will be required in the future. This in turn can be brought about by appropriate market prices, which will also include the external costs. Also additional complementary measures will be needed.

But there is also possibility that enterprises take their own actions.

### **6.7 POSSIBLE REACTIONS TO PUBLIC MEASURES CONCERNING ENVIRONMENT: FROM REGULATION TO ONE'S OWN INITIATIVE<sup>367</sup>**

#### **6.7.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 6.7**

On the basis of empirical research in Slovenia, we present in this chapter the key drivers of environmental management and their impact on the environmental behavior of Slovenian enterprises. Data indicate that it is not only compliance and regulation, but also competition and enterprise's own initiatives that drive their environmental management. They expressed their need for some completed tools and methodologies, too. Hence, we brief a method for environmentally oriented business decision-making. It is based on simulation using

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<sup>9</sup> This means reduction of necessary heat from 350 kWh/m<sup>2</sup> of apartment surface to 113 kWh/m<sup>2</sup> for older apartment buildings that are not properly insulated, or from 115 kWh/m<sup>2</sup> to 50 kWh/m<sup>2</sup> for a larger building with several apartments (Malovrh, 2001).

<sup>367</sup> Vesna Cancer

optimization models concerning the business process as scenarios and completed up to a multi-criteria decision-making method aimed at choosing the most preferred environmentally oriented business alternative. This approach can help organizations and individuals develop their environment friendly mental quality, thus adding to the dialectical systems of such measures that we are dealing with in the other parts of the Ch. 6.

#### 6.7.1 APPROACH

Environmental management in Slovenia has already been studied at the macro level (see, e. g. Cerne 1995; Radej et al. 1999). Since the industrial/manufacturing sector is identified as a driving force of environmental pollution in Slovenia (Ministry of the Environment and Physical Planning 1998), we deal with environmental management in Slovene *enterprises of the processing industry*.

The purpose of our research was to identify, analyze and present our findings on environmental management; its role in strategic decision-making; its distribution across the business functions; the usefulness of the methods for environmentally oriented business decision-making; the use of eco-efficiency measures, and the developmental tendencies of environmental management in Slovenian enterprises.

Although the benefits of environmentally oriented strategies are already described (see, e. g. Ruffing 1998) and illustrated by successful company cases (see, e.g. Callan and Thomas 2000; Reijnders 1996; Szekely et al. 2000), *eco-efficiency* is only becoming a competitive advantage, and managers in industrial enterprises will accept the goals of environmental management only if they are motivated enough. Thus, managers can apply the methods for environmentally aware and successful business decision-making.

As economic and environmental goals may conflict in a short term, the decision makers should consider *multi-criteria decision-making methods* (see, e.g. Vincke 1992). Besides quantitative eco-efficiency measures, the ecological dimension of qualitative factors should be included in the decision-making process (see, e.g. Epstein 1996). The Analytic Hierarchy Process technique (see, e. g. Saaty 1990; Saaty 2001) can be recommended to choose the most preferred environmentally oriented business alternative.

#### 6.7.2 ENVIRONMENTAL MANAGEMENT IN SLOVENIAN ENTERPRISES: RESEARCH RESULTS

##### 6.7.2.0 RESEARCH

The results of our research on the environmentally oriented business decision-making are based on the reality of the Slovene business practice. The research is founded on entrepreneurial politics, strategic management, environmental management, economics, entrepreneurial planning and analyzing, as well as qualitative and quantitative methods for business decision-making. Top managers and environmental managers, pollution prevention experts as well as the experts from different enterprise business fields (for example purchasing, production and services, research and development, and human resources) from 79 enterprises in the Slovene processing industry took part in our inquiry during November and December 2001.

##### 6.7.2.1 ENVIRONMENTAL MANAGEMENT IN BUSINESS DECISION-MAKING

Environmental management is becoming very important for business strategy. Of a sample of 79 enterprises surveyed, three quarters claim that the *environment is a central strategic issue*. Managers ascribe to the environment different roles in strategic decision-making. Figure 6.7.1 shows that more than a half of them see the environment as an important part of strategic decisions, almost one fifth see the environment as a vital part of strategic decisions and the same proportion of them consider the environment mainly because of regulatory compliance. The environment is occasionally considered in 6.3 % of the sample enterprises.

*Special working groups* that deal with environmental problems were formed in 62.0 % of the sample enterprises in top management, first level management and mainly in middle management, respectively. The proportions of these enterprises for the management process levels are depicted in Figure 6.7.2.

Almost all (97.5 %) of the sample enterprises evaluate that the *influence of the environment in business is increasing*. They evaluated the role of nine causes for the increasing influence of the environment in business where 1 means the most important and 9 the least important role. Analyzing the results of the causes for the increasing influence of the environment in business, numerical values can be transformed into verbal values. We define these causes as:

- strongly important when the number of numerical values 1, 2 and 3 presents at least one third of the number of numerical values for the considered cause,
- moderately important when the number of numerical values 4, 5 and 6 presents at least one third of the number of numerical values for the considered cause, and
- weakly important when the number of numerical values 7, 8 and 9 presents at least one third of the number of numerical values for the considered cause.

The causes for the increasing influence of the environment in business and their importance are presented in Table 6.7.1. *Environmental regulation and globalisation* are the most important causes in the Slovene processing industry since the numerical value 1 was given to them by 54.4 % of the sample enterprises. Since numerical values 1, 2 and 3 were given by 79.7 % of the sample enterprises, we can define environmental regulation and globalisation as strongly important causes for the increasing influence of the environment in business. *Standards* are the second most important cause since the numerical value 2 was given by 34.2 % of the sample enterprises. The above statements are strongly important since numerical values 1, 2 and 3 were given by 60.8 % of the sample enterprises. *Emerging markets* for qualitative, environmentally friendly products are evaluated with the numerical value 1 by 21.5 % of the sample enterprises. It can be defined as a strongly important cause as well. According to the results of the evaluation in Table 6.7.1, we can evaluate *business success* as a weakly to moderately important cause for the increasing influence of the environment in business. The most frequent numerical value is 8 (11.4 %), tightly followed by 5 (10.1 %) and 9 (10.1 %).

Similarly, Table 6.7.2 shows that the most frequently perceived cause for environmental activities in enterprises is performance in *accordance with compliance or regulation*, followed by performance in accordance with *standards*, and *pollution prevention* and *environmental improvement*. *Market-related causes* such as customer satisfaction and new opportunities in marketing seem to be *weaker* initiators of environmental activities. Only a quarter of the sample enterprises perform environmental activities for business results. However, when the frequencies of environmental influence on firms' goodwill or creditworthiness, and the covering of business and pollution prevention goals are considered, the comprehension of the

environmental influence on business success increases. Only around a fifth of the sample enterprises perform environmental activities because of the consumers' environmental awareness and - similarly - because of the environmental awareness of employees.

#### 6.7.2.2 DISTRIBUTION OF ENVIRONMENTAL MANAGEMENT ACROSS THE BUSINESS FUNCTIONS

Figure 6.7.3 shows the importance of environmental management in the following business functions: in human resources, finance and accounting, logistics, marketing, research and development; in purchasing the environmental management is important in approximately two thirds of the sample enterprises - that means that enterprises are aware of environmentally oriented supply management; in production it is important in almost all of the sample enterprises where experts and managers emphasize also service supported production. However, the data about the importance of environmental management in business functions show a *shift from additive* environmental protection that is characterized by the removal of wastes and emissions after they appear in the production process *to integrated* environmental protection that is characterized by the rational use of raw materials and by the prevention of wastes and emissions or by their return into the circular flows of transformation processes.

#### 6.7.2.3 ENVIRONMENTAL PERFORMANCE IN BUSINESS PROCESSES

83.5 % of the enterprises invest in environmental programs that contribute to the environmental performance. With Figure 6.7.4 we can determine the causes for environmental program investments that contribute to the environmental performance in enterprises in the current and in the next investment period following the percentage of the enterprises that determine the considered cause. Environmental management is being driven mainly by compliance and regulation because all of the investing enterprises see *compliance and regulation* as the cause for the environmental program investments, pollution prevention, which is determined as the *cause for environmental investments* in the next investment period by the same percentage of enterprises, and energy efficiency. The drivers of environmental management in the next period are, according to the causes for environmental investments, pollution prevention and energy efficiency, compliance and regulation, and recycling. In the next investment period the proportion of the enterprises that determined the following causes for environmental investment programs will also increase: measure performance and benchmarking, design, and environmental marketing. Enterprises determined 10 % more causes for environmental investments in the next investment period.

Increasing roles of *design* and especially of *environmental marketing* show that the environmental management is becoming a competitive issue. However, environmental performance of the firm is evaluated as the key factor of competitive advantage in 38.0 % of the sample enterprises in the Slovene processing industry.

Lent and Wells (1994) concluded that the increasing role of design for environment shows that it could be the next step in product development. Our research results show that environmental criteria are included in the design process of new or in redesign of old products in 81.0 % of the sample enterprises. Three quarters (74.7 %) of the enterprises claim that *environmental management and total quality management are in synergy*. Further, almost all (94.9 %) of the sample enterprises evaluate the importance of environmental consideration in both *product and packaging* development and design as very important or important. In both product and packaging development and design, the environment is included with ISO 14001 (see, e.g. ISO14000 Infocenter) in some enterprises. More than three quarters (77.2 %) of the

enterprises in our sample select and control the *suppliers* that supply them with *environmentally friendly* elements of the business process.

Environment is extremely important in the *production processes* selection: it is considered in 92.4 % of enterprises.

Growing environmental investments, new investment program patterns, an increasing role of pollution prevention, energy efficiency, recycling, environmental purchasing, environmental marketing and design for the environment indicate that *environmental performance* in Slovene enterprises of the processing industry *is improving*.

#### 6.7.2.4 TOOLS AND METHODOLOGY FOR ENVIRONMENTAL MANAGEMENT

43.0 % of the enterprises in our sample use the *tools and methodology for environmental management in business decision-making*. 86.1 % of the sample enterprises express the need to use the completed basic tools and methodology for environmental management, e.g. measures that bring together environmental and business performance, and financial indicators of success. Approximately one quarter (26.6 %) of the sample enterprises simulate the effects of environmental activities on business results with models, used as scenarios of the business process.

Table 6.7.3 presents the percentages of the sample enterprises that consider the fields of environmental assessment as the management tools in business decision-making. The greatest part of the sample enterprises considers emissions into the environment and their control and monitoring. Managers emphasize that environmental performance of suppliers is very *problematic*, if a supplier is a *monopolist*. The field of *public relations and information* on environmental issues is least considered in the sample enterprises of the Slovene processing industry. 11.4 % of the sample enterprises consider *all* of the environmental assessment fields.

*Environmental benchmarking* (see, e. g. Szekely et al. 2000) is performed by 38.0 % of the sample enterprises, 76.7 % among them are benchmarking inside their industry, 30.0 % are looking outside their industry, and 20.0 % at global leadership firms.

Almost three quarters (72.2 %) of the experts found *developing eco-efficiency measures* a very difficult process, while the others found it a difficult process. No one (!) evaluated this development as an easy process.

All of the sample enterprises use *compliance or regulation* related measures. Almost a half (46.8 %) of the enterprises use the measures of impact on the environment. Approximately a third of the sample enterprises use the measures connecting environmental performance to the market (35.4 %) and environmental performance or efficiency related measures (31.6 %). Risk measures are used by 17.7 % of the sample enterprises.

67.1 % of the sample enterprises think that their environmental performance *impacts customer satisfaction*. However, only 36.7 % of the sample enterprises ascribe their changes in sale to their environmental activities. According to our sample results we can conclude that the necessity of environmental marketing has to be proved in one third of the Slovene processing industry and that environmental marketing management must be initiated or seriously improved in two thirds of the Slovene processing industry.

Further, 65.8 % of the sample enterprises include *environmental costs* in the products' cost/price.

38.0 % of the sample enterprises measure the *financial effects* of their environmental performance. This means that in 62.0 % of the Slovene processing industry the benefits of financial measurement have to be presented and proved with the business process models, used as scenarios in simulations. Namely, some enterprises believe that environmental activities only increase costs.

A great stimulus for our research on environmentally oriented business decision-making is the firm belief of 73.4 % of the sample enterprises that environmental management *helps enterprises to achieve business success*.

### 6.7.3 METHODS FOR ENVIRONMENTALLY ORIENTED BUSINESS DECISION-MAKING

To link environmental and business performance, managers can apply the methods for environmentally aware, but successful business decision-making.

Since specialized methods like cost-benefit analysis, environmental impact assessment, localized public participation and social impact studies can be used for the appraisal at the project level (see, e.g. Lee and Kirkpatrick 2000) and other modern methods have already been developed for investment decision-making (see, e.g. Babic and Tomic-Plazibat 1999), we focus on the method for current decision-making.

Beinat (1997) concludes that due to the intrinsic complexity of environmental systems and the lack of information for the decisions, the *integration of decomposed and holistic strategies* is needed when approaching to environmental problems. To support decomposed and holistic decision-making, optimization of the total multiphase business process is needed. Further, to support environmentally oriented business decision-making, a general optimization model of the multiphase business process can be used as a scenario in the business process simulation.

Mesko (Mesko and Mesko, 1994) constructed their *model for a multiphase business process* where production elements of the business process and semi-products are processed into final products. For each relevant element a material balance constraint is needed. Market limits and capacities of production means give rise to market constraints. Limited financial sources for environmental purposes may give rise to budget constraint.

In the optimization model of the multiphase business process we included the possibilities for an *integrated approach to environmental protection* in the processing industry, for example substitutions of raw materials, suppliers, semi-products and final products as well as recycling processes and technology improvements; special attention is given to the *waste* by-products of the production process, the waste created by consumers after the use of products, and the packaging waste (Cancer 1998). We decomposed the possibilities of integrated environmental protection in the business process optimization according to the type of the considered element by using zero-one variables (Cancer 1998). With the objective function the contribution, decreased by progressive fixed costs,

$$\sum_{i \in Z} p_i(z_i) - \sum_{i \in Z} g_i(z_i) - \sum_{i \in Y} s_i(y_i) - \sum_{i \in Y} c_i(y_i) - \sum_j v_j(x_j)$$

is expressed. The income from the sale of primary and environmentally friendly products, semi-products as well as waste is expressed with  $\sum_{i \in Z} p_i(z_i)$ . This income is decreased by the costs of the waste disposal and the variable market cost of marketing activities. In the enterprises with a *proactive environmental strategy* we consider not only the obligatory costs of the waste disposal, caused by environmental laws, but also non-obligatory ones that are caused by the initiation of clean technologies and the development of the markets for environmentally friendly products. The progressive fixed costs of the sale of the environmentally friendly final products and semi-products as well as the waste sale and disposal are expressed with  $\sum_{i \in Z} g_i(z_i)$ . For example, the promotional cost of green promotions can be expressed with this sum. The variable costs that are caused by the purchase of the relevant elements are expressed with  $\sum_{i \in Y} s_i(y_i)$ . The progressive fixed costs of the purchase of environmentally friendly elements of the business process and semi-products are expressed with  $\sum_{i \in Y} c_i(y_i)$ . Other variable costs of production activities due to the consumption of irrelevant elements are expressed with  $\sum_j v_j(x_j)$ .

We completed the decision-making tools with the criteria of efficiency. Callan and Thomas (2000) emphasize that allocation efficiency and technical efficiency are relevant to all applied economic disciplines, including environmental economics. The concept of eco-efficiency implies that we have to make optimal use of both ecological and economic resources (see, e. g. De Simone and Popoff 1997). For the preparation and making of environmentally oriented business decisions, *comprehensible and useful tools* should be generated. Eco-efficiency measures should be integrated in the existing decision-support system. We completed the tools for environmentally oriented business decision-making, so that managers can apply them as indicators to assess and evaluate the progress towards eco-efficiency and as the constraints of the business process realization at a business level.

Allocation efficiency as an important economic criterion can be evaluated through the use of the *marginal analysis*. Optimal solutions of the described optimization models contain the sensitivity data as well. We can evaluate the allocation efficiency of particular elements, e.g. environmentally friendly products or wastes, with the *shadow price analysis*. Namely, the enterprise increases the production of an element as long as the unit income of this element is higher than its shadow price.

In the context of environmental economics, *technical efficiency* - as another important economic criterion - should be evaluated. Peattie (1995) concludes that the green challenge has mainly focused on unwanted outputs in terms of *pollution and waste*. He emphasizes that another important measure in terms of environmental performance is the *resource efficiency* of the production system, which can be written as the ratio between economically valuable outputs, and material and energy inputs. Following Peattie (1995), resource efficiency is one important aspect of eco-efficiency in practice.

We constructed the *resource efficiency measures* using the described optimization models. When the possibilities for an integrated approach to environmental protection and improvement are included in the business process simulation, the overall resource efficiency

measure of the environmentally oriented business process is expressed as the quotient between income and the sum of variable and progressive fixed costs:

$$\frac{\sum_{i \in Z} p_i(z_i)}{\sum_{i \in Z} g_i(z_i) + \sum_{i \in Y} s_i(y_i) + \sum_{i \in Y} c_i(y_i) + \sum_j v_j(x_j)}$$

We can complete the obtained measure with the *minimal value* of the resource efficiency measure that has to be achieved and include it in the optimization model of the environmentally oriented business process as the constraint.

The model can be written as a linear, linear mixed integer or fractional optimization model (Cancer 2000).

It is important that simulation results can show managers the possibilities for *income increasing* and *costs decreasing*, caused by decisions for environmental protection and improvement in these enterprises, even in a short run. Furthermore, the models that are used as scenarios of the business process can be completed with new possibilities of environmental performance in different simulations.

When the results of the simulations of the environmentally oriented business process are obtained by using the described optimization models, other *potential indicators of the production process efficiency* - like materials efficiency, materials quotients, within company recycling efficiency, energy efficiency, energy coefficient (see, e. g. Reijnders 1996), eco-productivity indices, resource productivity index, eco-points, eco-compass (see, e. g. De Simone and Popoff 1997) - can be developed in co-operation between experts of different professions, considering the characteristics of a particular system. Considering the characteristics of the presented business process we can express the within-company-recycling-efficiency measure as the quotient between the optimal values of the cost of the waste disposal and contribution.

The presented method has already been applied in Slovene enterprises of the processing industry.

As economic and environmental goals may conflict in a short term, the decision makers should consider *multi-criteria decision-making methods*. Besides quantitative eco-efficiency measures, the ecological dimension of qualitative factors should be included in the decision-making process. Using the described method for environmentally oriented business decision-making we can perform *simulations* for different  $m$  alternatives:

$$A = \{a_1, a_2, \dots, a_m\}$$

when different environmentally oriented business decisions are included in the business process. Optimal values obtained by the described method in different simulations can be included as the quantitative values of the attributes, e.g. for the  $j$ -th attribute:

$$h_{j1}^*, h_{j2}^*, \dots, h_{jm}^*.$$

Further, the ecological dimension of qualitative factors, e.g. interaction of the business activities with the environment, site, the choice of raw materials, energy types, noise, knowledge, innovations, technology, services, environmentally oriented supply chain, product and packaging development and design, changes of existing and the selection of new production processes, should be included in multi-criteria decision-making. We obtain the attributes

$H_1, H_2, \dots, H_n$ .

The *Analytic Hierarchy Process* (see, e. g. Saaty 1990; Saaty 2001) technique can be recommended to choose the *most preferred* environmentally oriented business alternative. The Analytic Hierarchy Process defines the utilities of a set of alternatives by having us directly compare their performance on an evaluation measure. For qualitative criteria, we do this comparison intuitively, without defining an explicit scale for the measure (Logical Decisions, 1999). This technique converts preferential relation  $P$ , e. g.:

$h_1 P h_2 \rightarrow h_1$  is preferred to  $h_2$

into utility function  $f(h_i)$ , which determines the degree of preference of the attribute:

$h_1 P h_2 \Rightarrow f(h_1) > f(h_2)$ .

Further, using this technique, we can perform *environmental benchmarking* not only for products and services, but also for processes and other environment related issues, e. g. equipment redesign and technology modification (as perceived by Knez-Riedl 2001), compliance and regulation, risk, customer satisfaction, sustainable use of resources and global change. The Analytic Hierarchy Process technique can be recommended to measure overall relative value of a company (Amen, 2001) and competitive advantages arising from environmental management.

#### 6.7.4 CONCLUSIONS

Following the results of our research on environmental management in enterprises of the Slovene processing industry we can conclude that *environmental management is becoming a very important part of the business strategy*. Environmental experts and managers evaluate that the influence of the environment in business is *increasing*. Performance in accordance with compliance or regulation, standards, pollution prevention and environmental improvement, and goodwill / creditworthiness are most frequently emphasized causes for environmental activities in enterprises. Market-related causes are less important drivers of environmental management at the moment. Business success is defined as weakly to moderately important. *Most managers can still not connect business goals and results with environmental prevention and improvement*.

Research findings regarding the importance of environmental management in business functions show a *shift to integrated* environmental protection with emphasized importance of environmental management in production, purchasing, research and development, and marketing. The increasing role of design for the environment, the importance of environmental consideration in the production processes selection in almost all of the sample enterprises, as well as the selection and control of suppliers in the majority of the sample enterprises indicate integrated environmental protection.

Although *regulatory compliance is still a key force* in environmental investment programs, new investment patterns reflect the *new drivers of environmental management*: pollution prevention is the surprising finding and it reflects a higher environmental awareness, whereas energy efficiency, recycling as well as new efforts to measure and benchmark environmental performance may reinterpret environmental management as a contributor to eco-efficiency. Environmental performance of the firm is evaluated as the key factor of competitive advantage in the minority of the sample enterprises. However, increasing roles of design and especially of environmental marketing show that environmental management is becoming a competitive issue. Further, the increasing role of *design* for the environment shows that it could be the next step in product, packaging and process development.

Growing environmental investments, new investment program patterns, increasing role of pollution prevention, energy efficiency, recycling, environmental purchasing, environmental marketing, and design for the environment indicate that in Slovene enterprises of the processing industry the environmental management could *decrease costs and increase eco-efficiency*. However, *methods* of environmentally oriented business decision-making and the measures of the consequences of environmentally oriented business decisions on business success and on the environment *have to become more sophisticated*.

Around

- two fifths of the sample enterprises that use the tools and methodology for environmental management, perform environmental benchmarking, and measure the financial effects of their environmental performance,
- a quarter of them that simulate the effects of environmental activities on business results with the models - scenarios of the business process, and
- two thirds of them that include environmental cost in the cost price

clearly indicate that they consider the environment not only as a *competitive issue* but that environmental management is becoming the *enterprises' own initiative*. Since almost all of the sample enterprises expressed the need to use the completed basic tools and methodology for environmental management, e.g. measures that tie environmental performance to business performance, and financial indicators of success, comprehensible and useful *tools* that are part of the existing decision-support system *should be generated*.

The presented *methods* for environmentally oriented business decision-making, so that environmental performance is improved and business results of enterprises are increased, are especially *applicable in the processing industry*. The completed tools for environmentally oriented business decision-making enable managers to apply them as indicators to assess and evaluate the progress towards eco-efficiency and as the constraints of the business process realization at a business level. Moreover, the described method can be included in the multi-criteria decision-making process, so that both quantitative and qualitative factors can be considered when choosing the most preferred environmentally oriented business alternative.

Figure 6.7.1: Role of the environment in strategic decision-making.

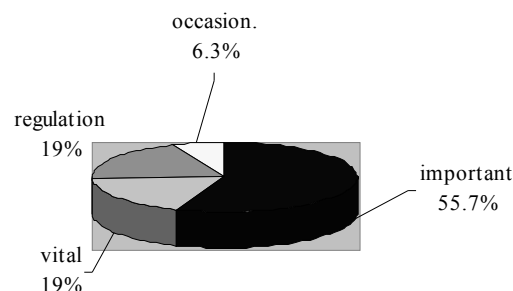


Figure 6.7.2: Enterprises with special working groups that deal with environmental problems.

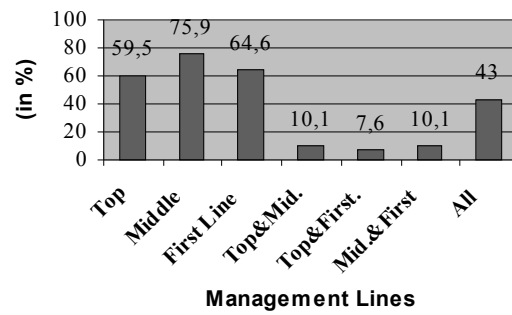


Figure 6.7.3: Environmental management in business functions.

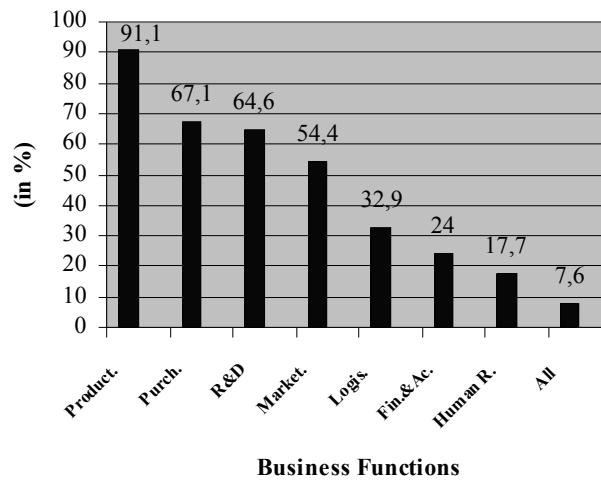


Figure 6.7.4: Causes for the environmental investment programs in enterprises.

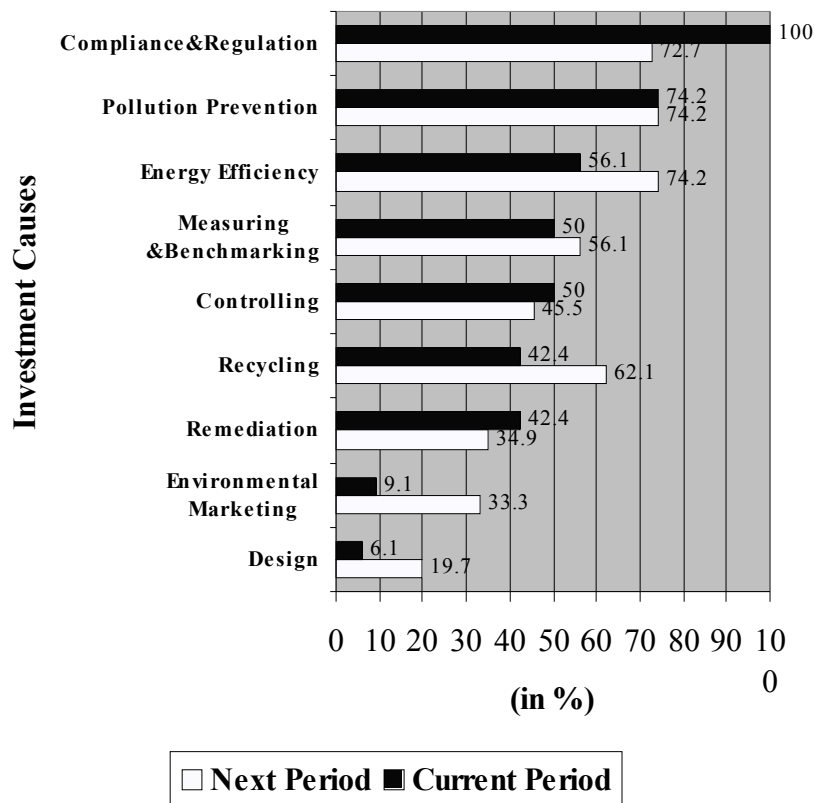


Table 6.7.1: Causes for the increasing influence of the environment in business

| Cause for the increasing influence of the Environment in business   | Numerical value |                           | Verbal value |                           |
|---------------------------------------------------------------------|-----------------|---------------------------|--------------|---------------------------|
|                                                                     | Mode            | Percentage of enterprises | Importance   | Percentage of enterprises |
| Environmental regulation and globalisation                          | 1               | 54.4                      | STRONG       | 79.7                      |
| Standards                                                           | 2               | 34.2                      | STRONG       | 60.8                      |
| Emerging markets for qualitative, environmentally friendly products | 1               | 21.5                      | STRONG       | 48.1                      |
| Changed customer expectations                                       | 1               | 17.7                      | STRONG       | 36.7                      |
|                                                                     | 4               | 17.7                      | MODERATE     | 34.2                      |
| Competitiveness                                                     | 2               | 15.2                      | STRONG       | 32.9                      |
|                                                                     | 4               | 15.2                      | MODERATE     | 35.4                      |

|                                               |                   |                      |                  |              |
|-----------------------------------------------|-------------------|----------------------|------------------|--------------|
| Greater consumer awareness                    | 1<br>(5*)         | 21.5<br>20.3         | MODERATE         | 38.0         |
| Business success                              | 8<br>(5*)<br>(9*) | 11.4<br>10.1<br>10.1 | MODERATE<br>WEAK | 35.4<br>36.7 |
| Expectations of employees                     | 8                 | 25.3                 | WEAK             | 48.1         |
| The public availability of environmental data | 9                 | 24.1                 | WEAK             | 38.0         |

Note\*: the second most frequent numerical value for the considered cause

*Table 6.7.2: Causes for environmental activities in enterprises*

| Cause for environmental activities in enterprises                  | Percentage of enterprises |
|--------------------------------------------------------------------|---------------------------|
| Performance in accordance with compliance and regulation           | 93.7                      |
| Performance in accordance with standards                           | 72.2                      |
| Pollution prevention and environmental impact                      | 63.3                      |
| Environmental activities influence firm's goodwill                 | 55.7                      |
| Customer satisfaction                                              | 44.3                      |
| Covering of business and pollution prevention goals in some fields | 38.0                      |
| Ecology is a strategical potentiality                              | 32.9                      |
| New opportunities in marketing                                     | 31.6                      |
| Business results                                                   | 26.6                      |
| Environmental awareness of consumers                               | 22.8                      |
| Environmental awareness of employees                               | 19.0                      |

*Table 6.7.3: Fields of environmental assessment in business decision-making*

| Environmental assessment field                                             | Percentage of enterprises |
|----------------------------------------------------------------------------|---------------------------|
| Emissions to environment, their control and monitoring                     | 86.1                      |
| Selection and rational use of raw materials, water management              | 84.8                      |
| Minimisation, recycling, transport and disposing of waste                  | 83.5                      |
| Selection and rational use of energy sources                               | 77.2                      |
| Noise                                                                      | 70.9                      |
| Selection of new production processes, changes in old production processes | 55.7                      |
| Education                                                                  | 55.7                      |
| Accident procedures, emergency preparedness                                | 48.1                      |
| Environmental performance of suppliers                                     | 26.6                      |
| Public relations and information on environmental issues                   | 26.6                      |
| All                                                                        | 11.4                      |

## 6.8 SPACEGUARD – MYTH OR REALITY?<sup>368, 369</sup>

### 6.8.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 6.8

I will leave the introduction to a scientist, a wordsmith, one of the most recognized bards of science fiction and the author of the cult SF novel »Space Odyssey 2001« - Arthur C. Clarke. He's the exception among writers because he personally, as a scientist, shaped the time we live in today, weaving his future worlds within the peaks of today's science. From his books arise the futures, which are becoming reality, today, slowly.

#### 6.8.1 MYTH

One of his novels, »Rendezvous With Rama« (1973) cuts a little deeper into the future, depicting a dark scenario that alarms and teaches us. Here's the excerpt from the novel's first page:

#### **Rendezvous With Rama, by Arthur C Clarke CHAPTER ONE - Spaceguard**

<sup>368</sup> Korado Korlevic

<sup>369</sup> Head of the Visnjan Observatory, the best astrometry observatory in Europe, Visnjan, Croatia

*»Sooner or later, it was bound to happen. On 30 June 1908, Moscow escaped destruction by three hours and four thousand kilometers - a margin invisibly small by the standards of the universe. Again, on 12 February 1947, yet another Russian city had a still narrower escape, when the second great meteorite of the twentieth century detonated less than four hundred kilometers from Vladivostok, with an explosion rivaling that of the newly invented uranium bomb.*

*In those days, there was nothing that men could do to protect themselves against the last random shots in the cosmic bombardment that had once scarred the face of the Moon. The meteorites of 1908 and 1947 had struck uninhabited wilderness; but by the end of the twenty-first century, there was no region left on Earth that could be safely used for celestial target practice. The human race had spread from pole to pole.*

*And so, inevitably, at 09.46 GMT on the morning of 11 September, in the exceptionally beautiful summer of the year 2077, most of the inhabitants of Europe saw a dazzling fireball appear in the eastern sky. Within seconds it was brighter than the sun, and as it moved across the heavens - at first in utter silence - it left behind it a churning column of dust and smoke.*

*Somewhere above Austria it began to disintegrate, producing a series of concussions so violent that more than a million people had their hearing permanently damaged. They were the lucky ones.*

*Moving at fifty kilometers a second, a thousand tons of rock and metal impacted on the plains of northern Italy, destroying in a few flaming moments the labor of centuries. The cities of Padua and Verona were wiped from the face of the earth; and the last glories of Venice sank forever beneath the sea as the waters of the Adriatic came - thundering landwards after the hammer-blow from space.*

*Six hundred thousand people died, and the total damage was more than a trillion dollars. But the loss to art, to history, to science - to the whole human race, for the rest of time - was beyond all computation. It was as if a great war had been fought and lost in a single morning; and few could draw much pleasure from the fact that, as the dust of destruction slowly settled, for months the whole world witnessed the most splendid dawns and sunsets since Krakatoa.*

*After the initial shock, mankind reacted with a determination and a unity that no earlier age could have shown. Such a disaster, it was realized, might not occur again for a thousand years - but it might occur tomorrow. And the next time, the consequences could be even worse.*

*Very well; there would be no next time.*

*A hundred years earlier a much poorer world, with far feebler resources, had squandered its wealth attempting to destroy weapons launched, suicidal, by mankind against itself. The effort had never been successful, but the skills acquired then had not been forgotten. Now they could be used for a far nobler purpose, and on an infinitely vaster stage. No meteorite large enough to cause catastrophe would ever again be allowed to breach the defenses of Earth.*

*So began Project SPACEGUARD.«*

## 6.8.2 REALITY

Is such an introduction just another bizarre idea from a writer, just to make the novel a bit more interesting by adding a strong, bloody beginning? Probably not, maybe yes?

Statistical references of collision probability and the historical facts are *unfortunately real*; the writer's poetic license just added the destruction of a good part of Europe and half of humankind's of today cultural treasures. In this scenario the other side of the Adriatic is not mentioned, but there wouldn't be much left here, either. Before that, an earthquake would shake us, far stronger than any quake our planet could produce. Then the water from the Adriatic would rise as a tsunami wave and take over a part of the hinterland.

Put aside his literary value, A. C. Clarke still remains a careful follower of scientific and technological trends. Just before this novel a few scientific works came up *doubting the »pure« evolution of life on Earth*. These works pointed at the black layers of clay that separate geological layers as proofs of the *colossal ecological disasters* that took place in eras of the past. According to those scientists, the majority of plants and animal species would have suffered in these catastrophes.

Monolithic criticism by the scientific establishment of that age was cast against those authors and their works. Nevertheless, A. C. Clarke recognized in them not the »Velikovski-like catastrophists<sup>370</sup>«, but rebels who dared to *question* the paradigm of *heavenly harmony* and *universal predictability* that the science of astronomy shared back then.

And...?

And he saw that their arguments were justified, that the puzzle they were putting together was yet incomplete, but still the wholeness of the picture was quite visible.

Clear and present **danger**. A danger bigger than any previously suspected, and the probability that such an event could one day even bring our civilization to an end. He saw the pictures of Earth colliding with comets and asteroids in the past and the future as imminent.

In the novel »Rendezvous With Rama« he gave his support to those plotters and today they give back with gratitude. Projects

searching for potentially dangerous  
bodies in the Solar system

were given the name »Project and Foundation SPACEGUARD« in honor of A. C. Clarke.

What did Luis Alvarez, Eugen Shoemaker, Brian Marsden, Tom Gehrels and a few others try to prove to their colleagues some twenty years ago? Has the proof about the possible danger and impacts of the past they presented been strong enough?

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<sup>370</sup> The novel "Worlds in Collision" by Immanuel Velikovski regarded the End of the World with naïve pseudoastronomical explanations outside the laws of physics. Regardless of the obvious quackery, the novel offered answers to questions science was not able to answer. The novel was immensely successful, with the number of languages it was translated into as well as with the negative attitude of entire scientific community towards any research regarding issues from the novel.

Yes, but science was still unprepared to accept catastrophic change alongside the all-accepted graduality of evolution. The explosion in Tunguska and the iron shower in the far eastern Russian mountain range of Sihote -Alin that were mentioned in the introduction of Clarke's novel are only a small part of the information on that subject. Geological and mathematical stories are harder to read and tell, but it was *geologists and mathematicians* who found a ***dissonance in the ruling harmony of the universe.***

Mathematicians had found the *orbits of some bodies chaotic*, some twenty years before the theory of chaos was accepted. On the Earth geologists have been finding colossal valleys edged with mountain chains of rubble rocks with glass ends and glassed edges, some with a kilometer and some hundreds of kilometers in diameter, and craters, which were not the consequence of volcanic eruptions. In these indents on Earth core crystals have been found that can only originate in extreme circumstances that couldn't possibly be produced on Earth surface, apart from the *impact from out of space*. They watched and kept in their hands the traces of past collisions of Earth with mountain-size objects that smashed the Earth with the speed twenty times faster than gunshot. Everything was suggesting that even more potential »villains« were hiding somewhere in the dark of the night.

### 6.8.3 SMALL SPACE OBJECTS HITTING JUPITER

Prompted by these findings, geologist Eugen Shoemaker, alongside his wife and friends, started the quest for something that so far has not been observed flying past the Earth. Something so small, just a few kilometers in diameter, and so fast that the ordinary telescopes were unable to see it. Then more and more of these special objects, ***asteroids and comets*** started to be discovered. Hundreds of objects quickly approaching Earth on their lengthened trails around the Sun were found. Statistical analysis of what has been discovered shows that somewhere out there, there are probably *thousands* of potentially dangerous bodies bigger than one kilometer and very hard to find. Nevertheless, in 1993 one unusual object called »comet SL-9« was found. After a few days of observation, mathematicians from the Center for Small Objects came out with some unbelievable news: » In one year from now 22 pieces previously known as comet SL-9 will hit Jupiter!«

That news was hard to accept. Is it our turn to become the witnesses of what we thought was impossible? Someone must be wrong, we thought.

After a year of preparing telescopes, space probes, computer simulations, came the day of the first impact. It hit Jupiter on the far side, but the splash of thrown up matter rose high above the edge of Jupiter. Due to the planet's orbital progress, a hot scar was still visible from Earth's telescopes an hour after the impact. The ***energy released*** by the collision was thousands of times greater than the one that all our nuclear resources could release together. On average, another impact followed every seven hours 22 times in a row.

Along with the impact of the ice and silicates-made comet, dark dust rose above Jupiter's white clouds and its movement within the planet's atmosphere was easy to see for months.

After that event, ***collisions*** between sky objects were no longer hypotheses, charts and curves. Now it was a ***reality***, right in front of our eyes. Under public pressure, the US Congress ordered NASA and USAF to protect our planet from similar dangers.

### 6.8.4 SMALL SPACE OBJECTS HITTING THE EARTH

In military research facilities simulations were underway. Instead of Jupiter, the one remaining particle of comet SL-9 was about to hit Earth. The result would be destruction never thought possible. The majority of plant and animal life would be wiped out, *climate disorders* would remain for hundreds of years after the impact, and our civilization would not survive. So,

a couple of years ago a new era began  
in the way we comprehended the Universe.

Out there is hidden **the biggest of all enemies** humankind has ever had to face.

#### 6.8.5 PROJECT SPACEGUARD

Project »Spaceguard« was created for our defense. Its task was to *discover, track and destroy* anything that could represent a threat to planet Earth. New observatories were erected; the old ones were reinvented to tackle the new task: to watch the Earth's immediate neighborhood.

Inspired with new findings during the past years, historians and anthropologists started to connect the *Australian* Aboriginal legends of the »wall of water« that had come into the desert, or mummified fish from the deserts of *Chile*, with computer simulations of gigantic waves of water which arise following the impact of an asteroid or a comet into the ocean. The atavistic fear of a human of today towards comets was suddenly seen with new eyes. And, naturally, there arose a connection of description of floods with the *Biblical flood*. Astronomic knowledge of our ancestors tells us that the roots of tracking the skies cut much deeper into the past than we thought. All these are just parts of the big picture that show us that the *End of the World is something normal, periodical and has so far been unstoppable during our millions of years of history*.

#### 6.8.6 IN SEARCH OF STONE DEBRIS FROM THE UNIVERSE

One of the centers of a worldwide computer web, which connects data gathering telescopes, is in Visnjan<sup>371</sup>. Those telescopes, night after night, film the skies in search of dangerous stone debris. We're all in a **big hurry**, now that we know that the yearly probability of impacts is 1:100,000. Probability, which is rather higher than we ever imagined, a probability that creates discomfort and calls for action. We need twenty years, just twenty years at our current rate of discoveries.

Yes, our civilization had some luck during the past six thousand years.

Hopefully for twenty more to come as well...

#### 6.8.7 SOME CONCLUSIONS ABOUT IMPACTS FROM UNIVERSE OVER THE CLIMATE<sup>372</sup>

It is not only the humans of today who cause the climate change and have been so for long, long times, and it is not only the nature on the Planet Earth, but it is also the nature out there in the Universe. This empirical novelty does not allow us humans to sit back and to wait for

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<sup>371</sup> One of these observatories operates in Visnjan and at this moment a new one is being built in central Istria, Croatia. Its task will be to take over observing newly found objects indicated to represent imminent danger by preliminary parameters. Apart from the instruments, some students are also having specialized training for that task

<sup>372</sup> Matjaz Mulej

the impacts from the Universe to ruin our conditions of life, or to go on to think one-sidedly and pollute the planet Earth. The information of the chapter 6.8 reads more like that:

*Let us urgently extend our definition  
Of our requisite level of holism  
To an even broader horizon than  
The one, which LvB has urged us to accept.*

And let us accept the experience: Even if an elephant is made of chocolate, it is eaten in many small bytes, with a lot of endurance and permanent work. Let us do more work on preparation and realization of the Local Agenda, Local Agenda 21, documents with scientific findings and political agreements about the actions concerning the climate change. And let us – as individuals and small groups of specialists – work on issues, which are closest to our local part of the Planet Earth and our own profession/s and capacity of co-operation! And let us be dynamic and creative (see Ch. 4 and 6.9 for some general guidelines)!

## **6.9 DYNAMIC CREATIVITY MANAGEMENT AS A TOOL FOR SUSTAINABILITY – A CONSTRUCTIVIST POINT OF VIEW<sup>373</sup>**

### **6.9.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 6.9**

It is obvious, we hope, from the foregoing chapters that it is creativity, which may help humankind (if activated in a requisitely holistic way, of course), even in the case of a danger from Universe. This chapter will present a basic overview of a dynamic creativity management model and its implications in the context of sustainability. Some of the key characteristics of the described model are:

1. The division of the overall process into a preliminary creative problem solving process and the creative problem solving process itself,
2. The inclusion of emotional intelligence as a prerequisite within the creative problem solving process in teams, and
3. The peculiarities of team composition and achievements in the context of creative performance.

Similar to a holistic yin-yang philosophy, the author intends to make a contribution to a more holistic than dual perspective: Similar to the yin that cannot exist without the yang, the core philosophy behind this chapter is that for a sustainable development the creative problem solving process has to include both:

1. Logical-analytical and creative problem solving,
2. Individual and group achievements,
3. Vertical and lateral thinking (or convergent and divergent thinking),
4. IQ and EI (emotional intelligence),
5. Extrinsic and intrinsic motivation,
6. Specialization and holism,
7. Linearity and circularity, and
8. Structure and deterministic chaos.

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The dynamic creativity management model described here is still undergoing development and is the basis for further discussion. It is intended for use in a wide variety of fields, from single enterprises to whole regional systems:

1. First-hand experiences supporting the development of the model described here were gained when we were accompanying and guiding innovative product development processes in the field of industrial design.
2. Additional input was gained from organizing workshops for vision and strategy development for single companies and cooperation networks of companies in various fields.
3. Further practical experience was gained in the field of sustainable regional development in the region of Eisenerz, once one of the most influential regions in Austria, which is now an abandoned iron ore mining area. Due to its extraordinary economic, ecological, and socio-cultural problems, this region is especially suited as a test case in model application.

### 6.9.1 META-OBJECTIVE: SUSTAINABILITY

#### 6.9.1.0 BACKGROUND

Change very much determines today's economy. In fact, change more or less determines the whole society, with its value system/s, norms, attitudes and behaviors throughout all fields of the daily life, including work, family life, hobbies, and other spare time activities as well. Every kind of development inevitably involves change. This is certainly also valid when talking about sustainable development: If sustainability is the goal, we have to bear in mind that human behavior has to change (Scholz, Tietje, 2002, p. 27).

According the *Brundtland-Report* „sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987, p. 8).” Strebel (2002) stresses here that it is also necessary to make a distinction between renewable and non-renewable resources in order to take into consideration the potential future shortages of natural resources. He points out that, in an economics sense, only a limited sustainability is possible since the use of non-renewable resources inevitably leads to their depletion and therefore a sustainable use of resources seems to be a practicable concept for renewable resources only.

In this contribution, sustainability is understood in a broader sense not exclusive to environmental issues. Instead, sustainable development also has to include economic and social considerations. In the words of Elkington (1997, p. 20) “sustainability is the principle of ensuring that our actions today do not limit the range of economic, social, and environmental options open to future generations.”

What are the main characteristics of the single dimensions of sustainability with regard to individuals, enterprises and regions?

1. Environmental sustainability is directed towards the preservation of natural conditions for living in the long run. As regards the preservation of natural resources, a distinction must be made between renewable and non-renewable resources in qualitative and quantitative respects.
2. Economic sustainability aims to secure permanent economic success. The central importance lies on the preservation and further development of capital stocks in the form of tangible and intangible assets, also including intellectual and social assets. “In a world where markets, products, technologies, competitors, regulations and even societies change

rapidly, continuous innovation and the knowledge that enables such innovation have become important sources of sustainable competitive advantage” (Nonaka, Toyama, Konno, 2000).

3. Social sustainability strongly depends on cognition and aims, very generally speaking, towards living conditions that are perceived as an improvement in the quality of life for the individual under the minimum request of maintaining the prevailing situation. The focus on the individual point of view is central to the constructivist approach: Each individual has his/her own perspective of quality of life and something good for one person does not have to be good for their neighbors. The cognition based on totally different life experiences and established value systems cannot be directed towards an “absolute truth”: With ten individuals we will have to deal with ten varyingly different perceptions of a so-called “objective reality” (which does not exist in the sense of radical constructivism). A limitation to educational systems, social contributions, fringe benefits, population stabilization, human rights, female empowerment, to mention but a few aspects, do not form an appropriate procedure for addressing social sustainability.<sup>374</sup>

To sum up, sustainable development comprises the interacting sub-systems of economic, social, and environmental sustainability as parts of an integrative approach. However, whereas the definition of a triple bottom line of sustainability takes into consideration the objectives of future generations, we have to be aware that our actions are not only a limitation, but partly also a prerequisite for future generations in their attempt to reach their established set of objectives concerning economic, social, and environmental issues. Further, it has to be stated critically that the well-being of “Gaia” is not equivalent with the well-being of humankind, but comprises the whole system Earth! Consequently, this contribution calls for a right of nature itself, not only in the context of how much nature is able to contribute to the satisfaction of humankind’s needs.

Sustainability also requires the adaptation of economic, social, and environmental sub-systems since they are strongly interconnected and the breakdown of one sub/system (i.e. a round-off unit) unavoidably leads to the collapse of the overall system. Not only are the three sub-systems and the whole system affected, but also elements within the systems, from the simplest individual units up to the most complex industrial networks. As a consequence, it is imperative that any system, which attempts to take sustainability into account, must be capable of adapting to the environment in which it is embedded.

As a consequence, adaptation to changing conditions requires not only logically structured procedures based on available alternatives, but also innovative and therefore new and uncommon ways to reach the derivative or announced objectives of sustainability. Therefore, old paradigms often have to be abandoned or even destroyed in order to give space for new solutions based on creative problem solving.

The dynamic creativity management model introduced below is based on the assumption that sustainable development has to take into account the three strongly and dynamically interdependent dimensions of *economic prosperity*, *social justice*, and *environmental quality*.

#### 6.9.1.1 PREREQUISITES FOR SUSTAINABILITY

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<sup>374</sup> Concerning the obvious challenge and difficulties when trying to define social sustainability, the comments in Elkington (1997, pp. 141) provide further interesting statements.

Since sustainable development is a highly complex task, purely deterministic paradigms are much too limited for observing, perceiving, and steering such systems – whether we are talking about families, companies, networks of companies, regions, economies, countries or the whole world.

Instead of rigid policies, sustainability calls for

1. the application of the *dialectical systems theory* to obtain a holistic systems view that considers all and only essential viewpoints and systems (Mulej, 1976),
2. *interdisciplinary creative cooperation* (Mulej, 1998; Steiner, Posch, 2002),
3. *transdisciplinary cooperation with stakeholders* (Steiner, Posch 2002), and
4. *dynamic creative problem solving* approaches based on a synergetic application of *vertical and lateral thinking*, requiring *logically but also emotionally rooted intelligence*.

#### 6.9.1.2 THERE IS NO ONE WAY OPTION TO SUSTAINABILITY: A CONSTRUCTIVIST POINT OF VIEW

If we are aware of all the above-mentioned factors of influence in the problem solving process, is it possible to draw something like an inevitable, optimal route towards the given set of objectives?

Definitely not! Even when the problem, problem solving agents, stakeholders, set of objectives, behavior typologies, team constellations, and working atmosphere are the same, the way to reach the goal can be very different from one scenario to the next, while still reaching the same objective or coming to a similar solution.

Why? If an individual or people in general think that things are a certain way, it does not necessarily follow that things are really that way, even if all of us agree (Wittgenstein, 1969; Watzlawick, 1992). As Glasersfeld (1992, p. 33) explain, objective reality from our point of view is usually own experience confirmed by others. The only thing we know about the “real” reality is at best what it is not (Glasersfeld, 1981).

In the context of the (creative) problem solving process, this implies that the experience of one solution only tells us that this specific solution fits a given problem and that the solution is viable but it does not say anything about other solutions unrealized as yet. Even when the whole system constellation is unchanged, with the same problem solving actors, the same stakeholders etc., the solution can be totally different. As Hesse states in *Siddhartha*, one can watch the water constantly flowing down the river, it has always been there, always the same, but nevertheless new at every moment in time (Hesse, 1974, p. 83).

If the solution is not stable for the same acting individuals, it cannot be assumed that there is one “real”, one “right” solution for different actors. There is no “real” or “objective” reality and consequently no typical right way of creative problem solving or one-way path to the

solution.<sup>375</sup> At the best, all that can be done is to provide assistance in orientation. However, the way will differ and this therefore must be designed according to the given situation.

## 6.9.2 DYNAMIC CREATIVITY MANAGEMENT (DCM)

In order to provide for a broadened perspective towards the creative problem solving process, we will first ask a set of questions based on a dialectical systems thinking<sup>376</sup> perspective. Based on this, a dynamic model of creativity management will be introduced together with implications for sustainability considerations.

### 6.9.2.1 QUESTIONS TO BE ASKED

This contribution does not call for a new thinking paradigm: it is not about killing the paradigm of logical thinking together with the underlying philosophy of a deterministic world; it is about flexibly applying the “most suitable thinking tool” in the given situation. Therefore, the following questions have to be asked:

1. Do we already know the problem and if not how can we find out about it?
2. What kind of problem is it?
3. Who are the stakeholders in the context of the problem?
4. What objectives can be defined for the different stakeholders?
5. What are the overall objectives for the problem solving process in the context of sustainability?
6. What resources can be made available for the problem solving process (including human capital in the form of field-specific competence, methodological competence, and social competence)?
7. What actors have to be involved at which stage of the problem solving process?
8. Are there certain behavior typologies and patterns of attitudes, which are characteristic for the single problem solving agents?
9. When is an individual and when is a team problem solving needed?
10. What sort of working atmosphere is required in order to be as supportive as possible to the problem solving process?

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<sup>375</sup> The following metaphor should give a better understanding of what *viable* solutions are about:

The extreme skier Windstone always looks for opportunities for powder snow skiing. Windstone goes up to the top of a 3.300 meter mountain he has never been to before by cable car and is looking forward to enjoying the downhill ride. In the snow field there are some crevasses slightly hidden by a thin layer of snow. Unfortunately, as is typical for the weather conditions on glaciers, fog arrives suddenly with no sign of clearing up. In this situation Windstone has two choices: He can go back down the mountain by cable car or do the unbelievable: He can ski down the glacier field with the hidden crevasses, without being able to rely upon his eyes, just to get an emotional "high". Although the second choice is full of risk Windstone decides to ski, aware of the high risk situation he is going into. The longer the ride lasts, the more comfortable he feels. Relying on his luck he goes through the field of crevasses without dropping into one and without crashing towards a rock.

What does this tell us? If the objective is to ski down the glacier field, the fact that Windstone reached the valley unhurt does not imply that

1. this is the “only right way” to reach the objective and
2. even though Windstone built a certain picture of the environment in which his downhill powder snow action took place, it does not tell him if his picture corresponds with the “true”, the “real” reality.

From Windstone’s point it is meaningless if the picture is true – for him it is of importance that his way down the glacier field was *appropriate* to the given problem; his individual way down the glacier field was *viable*.

Here lies the big difference from other traditional scientific views whose objective is to attain knowledge and cognition which is as truthful and as close to the “true” reality as possible instead of finding alternatives and ways that are viable in the context of the given objective.

<sup>376</sup> Mulej (1976) points out that one can speak of a “dialectical system” if all and only essential viewpoints / systems are considered, and their relations and synergies (see Ch. 4 here).

11. How much guidance or instructions are needed in relation to allowing freedom for flexible acting?
12. How do the system and its characteristics and the internal and external pattern of interaction develop over time?

This form of sensitizing by asking these first-hand questions is the basis for designing a problem solving process that is used as a framework on the journey from finding or defining the problem to working on appropriate solutions. This is used instead of establishing a set of instructions that does not take into account the peculiarities of the given system.

#### 6.9.2.2 *A DYNAMIC CREATIVITY MANAGEMENT MODEL: AN OVERVIEW*

What are the core characteristics of a dynamic creativity management model?

1. Dynamic creativity management has its field of application as an approach for handling complex problems, i.e. as a supporting tool in the process of attaining sustainability.
2. The whole process of creative problem solving deals with highly complex problems, requiring logical-analytical procedures based on convergent thinking as well as creative intuitive procedures based on divergent thinking.
3. The whole process of creative problem solving is a complex system in itself, dynamically changing over time, with permanently interacting system elements, it requires a systems thinking perspective in order to be understood and applied.

Whereas most previous creative problem solving approaches have usually been applied to generate solutions to a given set of problems, the approach developed here moves a step back and takes as its starting point the earlier stage of problem finding. This is then followed by problem analysis and formulation, generation of objectives, coordination with the focused vision and strategy, generation of problem solutions and finally, the evaluation and choice of the most promising alternative against the backdrop of sustainable development.

Central to such an approach is the idea that all of these phases are seen to be constantly reacting and interacting with one another as part of a dynamic whole, embedded within an innovative climate that can be influenced to different degrees. (The potential for reorganizing or changing the characteristics of the single system elements differs, especially as regards the duration of the necessary intervention). Imperative competences comprising IQ and EI are also essential. The linearity of cause and effect can no longer be assumed!

#### 6.9.2.3 *KEY FACTORS INFLUENCING THE CHOICE OF APPLICABLE PROBLEM SOLVING TECHNIQUES*

As mentioned before, it is of tremendous importance to design the problem solving process in an appropriate way according to the given system (i.e. selected topic from the selected viewpoint/s) peculiarities. One specific step within the design process is the choice of applicable problem solving techniques.

There are countless techniques for the different stages of problem solving available, but in order to build a framework of general conditions – including the choice of applicable techniques – supportive to the whole process, there has to be an awareness that the system has to be dynamically adapted to the prevailing system situation according to the characteristics of the single influencing factors (for the single factors see 6.9.2.1 *Questions to be Asked*). If these factors are not considered in the choice of applicable techniques, then, similar to a mechanical

factory, the application of the wrong tool, even if it is of the highest quality and reliability, will not lead to a contribution for the solution of the problem or task, but will instead be useless or even harmful.

The given stage of the problem solving process and the prevailing characteristics of the system elements as described in the model build the platform upon which a set of creativity and problem solving techniques can be chosen for application within the problem solving process.

#### 6.9.2.4 PATTERNS OF BEHAVIOR

As an example, within the choice of the problem solving techniques (creativity techniques included), the patterns of behavior and attitudes – including the position in the organization or group, general patterns of behavior, and also the private background of the individuals etc. – have to be taken into account. A practicable possibility to guide through the process of finding out the prevailing patterns of behavior from a neutral point of view is the application of analytical instruments such as LIFO (Czichos, 2001). The main objectives with the application of instruments such as this are to help the problem solving actors get to know themselves and their problem solving team members better, consequently establishing a kind of proactive conflict management, and a basis for team formations with special regards to required patterns of behavior for specific stages and tasks in the creative problem solving process.

#### 6.9.2.5 TYPES OF PROBLEM: THE RIGHT PATH TO THE SOLUTION

Also determining the choice of the problem solving techniques are the specific characteristics of the problem itself as well as the mutual relations within the overall context of the influencing systems (i.e. tools, methods, etc.). These could include managing tasks undertaken or required for the development of specific solutions in the form of products for companies or even for the generation of alternatives for the development of whole regions facing problems of a holistic nature, where the mutual interactions of economic, ecological, social and cultural aspects all need to be taken into account.

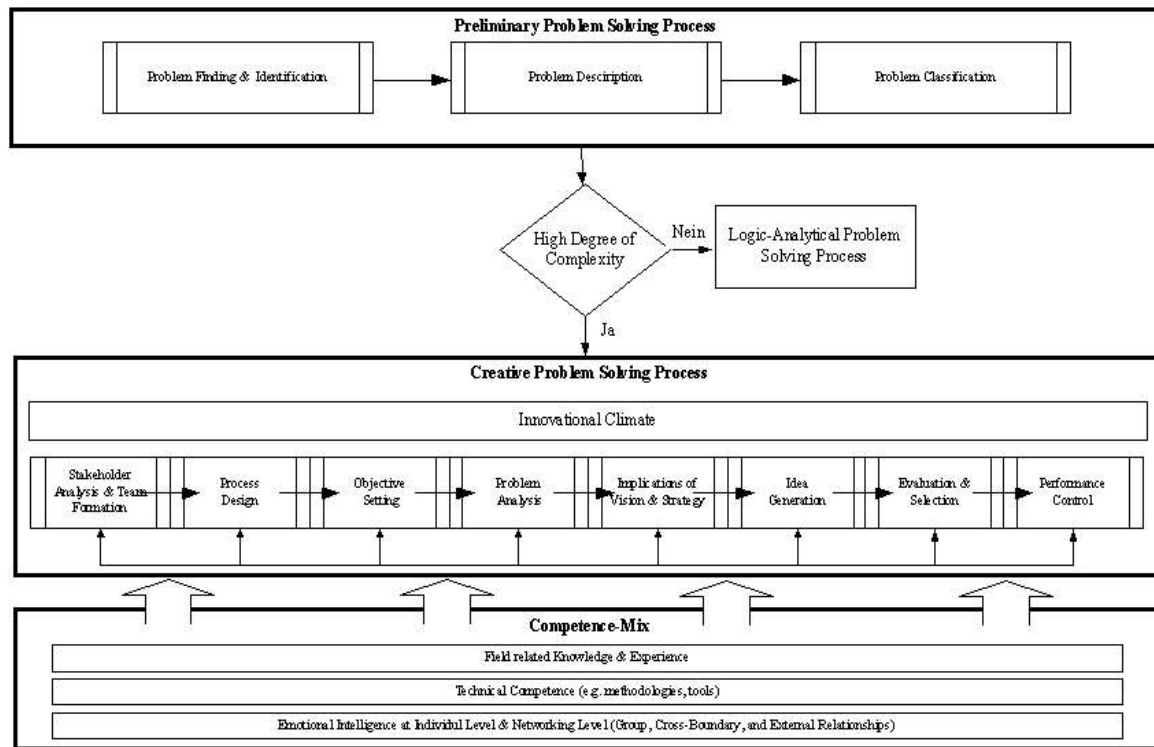
Embedded in the patterns of change, there is a wide variety of tasks or problems, which we have to deal with. In this context it helps to be aware of the kind of problem or task that is given, in order to know what kind of thinking or what combination of thinking best meets the requirements of the given problem. Similar to Probst and Gomez (1999) we distinguish between:

*Simple problems* with few influencing dimensions (= elements), little interaction between the elements and relatively stable patterns of interaction over time,

*Complicated problems* with many elements, strong interaction between the elements and relatively stable patterns over time, and

*Complex problems* with many elements, strong interaction between the elements and dynamically changing patterns over time.

Fig. 6.9.1: Dynamic Creativity Management



Simple problems are problems where standard solutions already exist. The problem solving process is predominated by logic and convergent thinking.

A first step in dealing with complicated problems is to try to divide the problem into sub-problems, which can be treated as simple problems. Once the pattern of interaction is understood, it will not change tremendously over time. Therefore, the recognition of this pattern might require a certain degree of creativity. However, the rest of the problem solving process will be based on logic and convergent thinking.

Complex problems (such as attaining sustainability) are typically problems for which no standard solutions are available and therefore new innovative steps have to be taken. Therefore, a creative problem solving process is required, in which divergent (lateral) thinking, circularity, holism and, consequently, systems thinking and logical-analytical considerations interact in a dynamic way.

#### 6.9.2.6 CREATIVE PROBLEM SOLVING = VERTICAL + LATERAL THINKING (CONVERGENT + DIVERGENT THINKING) = EI + IQ

Creative problem solving is not about making a decision between knowledge-based and emotion-based procedures: As Mulej states (1998), “both knowledge and emotions are to be included since they are interdependent, just as the left and right parts of the brain are interdependent.”

Creative problem solving is a prerequisite in the attempt to find solutions for complex problems. A big challenge for the future will be to move away from dualism towards a synergetic and symbiotic based paradigm. Dynamic creative problem solving requires both

knowledge and emotions, IQ and EI, convergent and divergent thinking, individual and group achievements, focused and holistic perspectives.

#### 6.9.2.7 CREATIVE PROBLEM SOLVING IN TEAMS

The given preconditions for the creative problem solving process are that the complexity of many problems is increasing continuously, and the available time resources are becoming increasingly scarce. This also raises the importance of teamwork, since a single individual can no longer handle the requirements concerning imperative competences to fulfill the given task, as well as the limited time resources.

Increasingly complex setting of tasks in connection with increasingly scarce time resources available for their accomplishment predominantly determine the creative problem solving processes in the industrial economic sector today. Thus, the answer increasingly lies in successful group and/or teamwork. Organizations such as enterprises are more than just a group of individually acting single participants. Close interaction within working groups and teams, departments, profit centers, business premises, enterprises and beyond the enterprise's own borders is very important as is a cooperating network of stakeholders.

Group achievement cannot be assumed to be the sum of individual achievements, rather it is determined by its own rules and needs different techniques for problem solving, and different forms of IQ and EI to provide for effective and innovative solutions towards sustainability.

#### 6.9.3 CONCLUSIONS

Sustainable development is ultimately a highly complex challenge that requires purposeful actions based on a dynamic system of objectives. As discussed in this chapter, pure logical-analytically based problem solving alone is not an appropriate approach, since it can provide for new developments in a limited way only.

Sustainability is itself a necessary innovation and requires creativity and innovation in combination with the paradigms of logic and determinism. It can be supported by dynamic creativity management, which is no alternative to traditional paradigms, but brings its best within synergetic interaction.

Systems analysis can offer additional support. Let us brief it now!

### 6.10 SYSTEMS ANALYSIS OF ECOLOGICAL MODERNIZATION<sup>377</sup>

#### 6.10.0 THE SELECTED PROBLEMS AND VIEWPOINT OF DEALING WITH THEM IN THE CHAPTER 6.10

System analysis is a broad research strategy that involves the use of **mathematical** techniques and concepts, but in a **systematic**, scientific manner to the solution of a complex problem. The complex problem is in our case the implementation of ecological modernization. We may identify seven steps in the application of system analysis to a practical problem.

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In our case we define the following **steps** of systems analysis:

- (i) Recognition of a complex problem - ecological modernization;
- (ii) Definition and a bounding of the extent of ecological modernization;
- (iii) Identification of goals and objectives - use of harmonized environmental policies;
- (iv) Generation of potential solution course - Use of Environmental Management System;
- (v) Acquisition of solution - Implementation of a new philosophy of winning along with executive support systems;
- (vi) Evaluation of results;
- (vii) Implementation of results.

Let us brief every one of them!

#### 6.10.1 RECOGNITION OF THE PROBLEM

Economic *growth* and environmental *protection* are often seen as mutually *antagonistic*. We apply a systems analysis approach to the concept of ecological modernization to propose the conditions for economic modernization and environmental protection, which result in a **synergetic effect**. Ecological modernization should promote the application of an environmental management system as a stimulus to industrial development (Gouldson, 1995).

#### 6.10.2 DEFINITION AND BOUNDING OF THE PROBLEM

At the Forum on Industry and the Environment in New Delhi, S. Paulus gave the following definition of ecological modernization: "Ecological modernization focuses on prevention, on innovation and structural change towards ecologically sound industrial development. It relies on clean technology, recycling, and renewable resources". To introduce such a concept into the economy, it is necessary to **coordinate various policy areas**, such as industrial, fiscal, energy, transport and environmental policies (Simonis, 1989).

#### 6.10.3 IDENTIFICATIONS OF GOALS

This contribution seeks to **examine the conditions** that allow micro-economic industrial competitiveness to be enhanced rather than impeded through the application of harmonized environmental policies as for instance Integrated Pollution Prevention and Control (IPPC), Environmental management system and Eco-Audit, and Quality Management regulations. In so doing, they will contribute to the academic, regulatory and managerial **knowledge base** that will facilitate a broader integration of economic development and environmental protection (Gouldson, 1995).

#### 6.10.4 HARMONIZED ENVIRONMENTAL POLICIES AND ENVIRONMENTAL MANAGEMENT SYSTEMS

We still face major environmental challenges nationally as well as regionally and globally. Much of the responsibility for finding solutions to environmental problems lies with the industrial countries, and a **binding international cooperation** is essential, if we are to achieve results. The depletion of the ozone layer, the risk of climate change, the generation of large amounts of hazardous waste, the global loss of biodiversity, are all results of our current production and consumption pattern. Furthermore, poverty leads to growing pressure on natural resources, and the present inequitable distribution of the world's common resources is

not acceptable. Taken together, these are some of the greatest challenges facing us as we approach the new century (Berntsen, 1995).

Although environmental policy in the industrialized world has started more than twenty years ago, instances of **outstanding environmental degradation** are likely to be more in evidence than abundant remarkable achievements in pollution reduction. But most of the reported improvements have been attained by additive end-of-pipe measures, not by fundamental change in technology, reduction in energy and material consumption, or eco-restructuring of the economy. The Research Unit for Environmental Policy at the Free University of Berlin tried to discover whether structural change in industry since 1973 had positively affected the environment. This approach should not be confused with a comprehensive evaluation of national environmental policies. The Unit calls attention to **some partial successes** (under otherwise unfavorable conditions) because a mosaic of partial achievements constitutes an overall picture of a viable environmental policy, or at least a panorama of empirically possible options that goes farther than the most successful existing national policy. Such case studies of harmonized environmental policies consist of the total sum of positive experiences in various countries and are useful at least as a point of reference (Jaenicke, Weidner, 1995).

Modern industrial society now provides **three potential levels of intervention**: traditional government, civil society and, between the two, the modern "cooperative state". The growth in the importance of this "third party", non-governmental actors, is to a certain extent a consequence of past governmental and civil society's intervention failures. The success stories of harmonized environmental policy partly reflect the political change that already has taken place. **Political modernization** has become an indispensable precondition for ecological modernization. Modernization is a process of reorganization or reconstruction (reformation, renovation) of the technical and scientific demands (request, requirement). It is required at all three levels.

The concept of **ecological modernization** has a short history in German and, to some extent, Dutch discussion about the institutional changes in Western industrialized countries aimed at overcoming the ecological crisis. The concept is used at two levels in this debate: First, ecological modernization is used as a *theoretical concept* for analyzing the development of central institutions in societies necessary to solve the fundamental problem of the ecological crisis. At this level it can be seen as an alternative to other concepts and analyses of the relationship between institutional developments in different domains and environments. Second, on a more practical level, ecological modernization is used as a *political program* to direct harmonized environmental policy. As such, it includes a strategy with more or less concrete measures to counter environmental problems. The political program of ecological modernization seems to fit rather well with the recent developments in environmental politics in some Western European countries. Like the concept of sustainable development, ecological modernization indicates the *possibility of overcoming the environmental crisis without leaving the path of modernization*. It can be interpreted as the ecological restructuring of the processes of production and consumption. Thus the central economic theme of the ecological switch will be the ecological modernization of production and consumption cycles by new and more intelligent technologies. From traditional end-of-pipe technologies, there is a shift toward technologies that establish **clean production processes**. Microelectronics, gene technology, alternative sources of energy and new materials are seen as new technologies for disconnecting economic development from relevant resource inputs, resource use, and emissions, and for monitoring processes of production and consumption for their effects on the environment. This must lead to the **ecologization of the economy**, that is, to physical

change in production and consumption processes and to the possibility of monitoring these processes. Second, the concept of ecological modernization includes *economizing ecology* by placing an economical value on the third force of production: nature. Nature and environmental resources should regain their place in economic process and decision-making (Jaenicke, Weidner, 1995; Simonis, 1989; Vezjak, Savsek, Stuhler, 1996).

A harmonized policy for ecological modernization must include *all sectors of society* and reach *across national borders*. It is essential to include environmental protection as a basis for development in all areas of society, and to provide regulatory mechanisms at the national and international levels to facilitate this. It is very important to include environmental considerations as a part of the overall, strategic decision-making process. We are therefore working together across institutional boundaries in the public sectors, with other sectors of society, with the business sector and in many international arenas. The general public has become far more aware of environmental issues, and environmental modernization plays a far more important role in government policy than a few years ago (Berntsen, 1995).

The International Standard **ISO 9000** specifies the quality system - model for quality assurance in design, development, production, installation, and servicing. International environmental management standards **ISO 14000** are intended to provide organizations with the elements of an effective environmental management system which can be integrated with other management requirements to assist organizations to achieve environmental and economic goals. It has been written so as to be applicable to all types and sizes of organizations and to accommodate diverse geographical, cultural, and social conditions (SIST ISO 9001; ISO/DIS, 1995).

#### 6.10.5 IMPLEMENTATION OF A NEW PHILOSOPHY OF WINNING ALONG WITH EXECUTIVE SUPPORT SYSTEMS

##### 6.10.5.1 A NEW PHILOSOPHY OF WINNING

In management we always try to develop better methods to arrive at what we consider the "best practice". With this practice we want to win, which is make money and make everybody happy *now*: customers, shareholders, staff, community, etc. To this end we have learned to deal with a number of institutions: market (financial and product), laws and regulations, people, media etc. Altogether we are dealing here with a *vast number of variables*, but under a very restricted set of assumptions. In ecology everything is different. There is no best practice, because the variables are immensely more numerous, and the assumptions are much more complicated. We do think of now but also of *then*. We know that we do affect the utility functions of millions of people all over the world as soon as we choose one alternative way of production or consumption over the other. Thus we are dealing with a *huge range of unknowns*. Raw materials and re-creation have prices attached to them as soon as they have their way into the market, but the nature as such and the natural environment do not. In fact we don't think that even those prices are efficient in any relevant meaning of the term. Thus, a conflict is inevitable.

This means that we do not believe in win strategy, i.e. not everybody can win at the same time. However, conflicts are there to be solved, and here we see new and promising avenues to the *solution of conflicts* between e.g. shareholders and stakeholders. These processes are characterized by:

- 1 There is no fundamental barrier against talking to each other.

- 1 Consciousness as far as environmental issues are concerned is still rising on a global scale.
- 1 International standards are being discussed and accepted by the international community. These standards are not merely financial or technical but also qualitative - including also the quality of our natural environment.

#### 6.10.5.2 *USE OF EXECUTIVE SUPPORT SYSTEMS*

The selected matrix can aid strategic management. Each type makes a particular contribution, and which type, or types, should be used by strategic planners – this should be a function of the objectives of the exercise and the data available. The **Directional policy matrix** is for instance based on: market, competitiveness, technological, economic, production, personnel, financial, governmental, supplier, geographical, and social factors (McNamee, 1984).

In regulated companies it is of strategic importance to use *executive support systems* (ESSs). J.H. Nord and G.D. Nord think that the executive support systems are computer-based systems that provide top managers with the capability to attain easy access to internal and external information, which is relevant for their strategic decision-making and other executive responsibilities (Nord, Nord, 1995). ESSs allow senior executives to:

- 1 Access information critical for understanding, and assessing situation quickly.
- 1 Electronically confront and communicate problems.
- 1 Report information as a combination of graphics, tables and text.
- 1 Make schedules, set agendas, and follow up on matters.
- 1 Applied "drill-down" capabilities (e.g. a report on daily corporate rates can be drilled down to find the daily sales in a region, or by product, or by salesperson).

In addition, ESSs offer statistical capabilities, as well as functionality for decision support, what-if analysis, and queries; they are easy to learn and to use.

ESSs are used by executives and their subordinates for a *wide variety of purposes*. These systems allow them, for example, to manipulate data for decision support, to stay abreast of daily activities, to communicate with others users of the systems. Hence, we can range the following purpose of the use of an ESS among the most important:

- 1 Decision-making
- 1 Scheduling
- 1 Electronic mail
- 1 Electronic briefing

Let us give a short presentation of particular possibilities of the use of an ESS. First, we mentioned the decision making whereby we think mainly of *strategic decision-making*. Since numerous factors influence strategic decision-making, managers must use technology to understand and assess situations in a timely manner. An executive support system typically allows the user to access to internal and external databases, therefore presenting a corporate as well as an industry perspective. Statistical analysis capabilities coupled with alternative presentation options provide for "what-if" analysis, with the results in a graphic or table format.

The second reason for managers to use ESS software is *scheduling or setting agendas*.

The *electronic mail* is also one of the most important purposes for the use of the ESS.

Forth, the *electronic briefing* component of an ESS allows managers to understand and assess situations quickly and to maintain a current perception at both the corporate and industry level. Many external databases are now available that provide a strategic advantage to those who have immediate access.

#### 6.10.6 EVALUATION OF RESULTS

On the base of information about a product we can evaluate it by economic, ecological, and technological parameters. The result of the evaluation should be the *attractiveness* of the product for a specific market and should be the starting point for further decisions about production, modification, or improvement. The convenience of a product for a market proceeds from the quantitative and qualitative valuations. Here, some characteristics of a product described by redefined parameters will be neglected, some more important ones will contribute to the final valuation and decision in chosen form (Vezjak, Savsek, Stuhler, 1996).

It is useful if the valuation procedure is made *step by step*. In this manner we can control the partial results, we can go back to the starting point, or we even can correct the values of the variables. In the case where the result is ambiguous, we can talk about the comparative advantages for a specific market share on the base of economic, ecological, technical or other conditions. The determination of attractiveness of a product for various markets from a methodological point of view will also vary *from case to case*. By processing the data of the product we can transfer its characteristics by scoring it, and we can emphasize those desired characteristics by choosing the parameters. Mathematically, the procedure is often defined by adding scores connected to ponders by multiplication. Graphical representations are not rare. The data about the products are in a non-aggregate database (Vezjak, Savsek, Stuhler, 1996).

In this contributions the following *economic parameters* are taken into account: price (with transport cost), market share, profitability, brand, life cycle assessment, design, and guarantee. The *ecological parameters* are: energy consumption, emissions, recycling possibilities, noise characteristics, reuse of packaging, and usage of non-renewable resources. The *technical parameters* are: energy efficiency, frequency of errors, technology of product, compatibility of product, spare parts, and service (Vezjak, Savsek, Stuhler, 1996). Some case studies for the "same" products of different companies and different products from the same companies have been tested with a quite satisfactory result. As an example a *model* is built and on a set of quantitative and qualitative data relevant to a specific case, an assessment of attractiveness of the product as a concrete measure of economic and ecological impact is performed. We applied Analytic Hierarchy Process (AP) approach introduced by Saaty. The results are presented along with discussion on suitability of the described decision making method for an advisory system applied to ecological modernization (Vezjak, Petkov, Stuhler, 1997).

#### 6.10.7 DISCUSSION AND CONCLUSION

Rather than perceiving industrial development as the source of environmental decline, ecological modernization seeks to harness the forces of entrepreneurship for environmental gain. Experience with existing regulations suggests that although they can impose significant costs on regulated companies, under certain conditions they instead can lead to significant benefits. As these *conditions determine* whether environmental regulations impede or enhance the competitiveness of regulated companies, they are central to the relationship between economic development and environmental protection in the future of the European Union. We seek to assess the conditions that allow micro-economic industrial competitiveness

to be enhanced through the applications of eco-audit regulations. This assessment is in a specific way of interest to any firm in EU member states or in the Central and Eastern European countries. By a quantitative and qualitative comparative analysis, the interaction between economic, environmental and technological variables is evaluated. An assessment for each particular case should be reached in order to analyze the environmental impact and the development of industrial competitiveness. The goal is to provide a ***practical approach*** to challenge in the innovative capacities with respect to environmental effectiveness and economic efficiency (Vezjak, Savsek, Stuhler, 1996).

Many disciplines are involved in the issues of the above theme. Their insights and results need integrative linkages. That means, the provision of ***transdisciplinary exchange*** of information and its ***integration*** into *new pattern of thinking*. They should mirror and anticipate the supra-functional interaction concerning the problem and conflict solving. That is on the basis of ***intellectual and psychic transformation***. Therefore it is necessary to begin with a *systems approach* to the thought processes of analysts, planners, decision makers and leaders.

Looking backwards, dealing with the present time and/or anticipating the future, and leading is composed of the following elements of thought. Knowing about the *organization of thinking* may help us avoid or minimize failures. Each of the different items has been engaged in the embedded and overall structure. From that the meaning of these items comes. It also applies to actions.

For speech as well as for problems and conflict solving we have ***mental plans***. Even "muddling through" follows a certain kind of plan, i.e. a *sequence of internal steps*. Usually all plans are related with *goals*. Therefore the next step of the mental plan is to choose or combine the means in such a way that the given *goals can efficiently be achieved*.

***Goal-directed*** problem and conflict solving determines the thought processes and the hierarchical organization of various subsidiary actions. For example, the sustainable development implies the *subsidiary goals* to promote biodiversity and to not neglect the carrying capacity of our eco-systems.

Complex problem and conflict solving puts high demands on the human capacity to develop hierarchical organizations of a mental plan. The ability to analyze the ***components*** and to determine their ***interdependence*** is the basis for *setting sub-goals*. Novices have more difficulties to chunk subcomponents hierarchically than masters do. Therefore we can say that the *priory knowledge* about the structure of such a hierarchical plan is helpful in developing a specific plan.

Even if chunking is not explained, its importance seems to be evident. Probably there are learned *neural programs*, which allow the actor successive actions. Masters may think in larger units. Usually that enables them as well to act more successfully, if the future has to be predicted and action plans for the fields have to be developed. If someone has enough information about the goals and sub-goals and the situation (*we call it the systems structure*), one can try to predict the future.

The next step to be followed is ***action planning***, if one knows about the internal structure and the tendencies, which have to be expected. By this we mean the preparation of courses of actions outside of the human mind. One very important aspect is ***which side effects*** the planned actions may have. More *obstacles* must be taken into account. Sometimes the problem or conflict solver *lacks some important information*. Sometimes there is an

*oversupply* of potential information. And last but not least, in many cases the action planning is difficult, because the outcomes are not certain, not deterministic, but have a certain *probability*, which is more or less known.

To work backward and to find *appropriate analogies* can be useful for problem solving. Working backwards proceeds from a given goal over the sub-goals down to the indicators necessary to lead the system's development. And as sometimes problems and conflicts have similar structures, it can be helpful to work with analogies. Therefore a new problem can be solved by analogy with a similar problem solved some time ago.

If the actor suddenly changes how he or she is viewing the problem or conflict (we call such an event a flash of insight or "aha effect"), there will be a ***restructuring of the action plan***. We call someone a creative problem and conflict solver who generates a solution, which is new and appropriate. Often that takes a long and intense time of preparation until suddenly the solution arrives.

***Monitoring*** is necessary for people/actors to learn about the effects of the *implemented action plan*. Time delays have to be taken into account between a certain action and its effects. *Self-monitoring* should not be forgotten as a very important tool of monitoring the actor's own *thinking and emotions*, which influence the *cognitive processes*. As soon as the *feeling of competence* is endangered by stress, fear of failure, lack of information, etc., there are additional demands on the actor. Such a situation can easily occur, if loosely structured problems and conflicts have to be solved. Knowledge about *heuristics* may help. With that we mean thumb rules and tricks and trial and error approaches.

Instead of summarizing the deductive and inductive reasoning and decision-making, a few sentences should be written about ***leadership***. It is seen as a reality, which exists "out there". It is an object separated from the scientist, just like problem and conflict solving. A contradictory paradigm is that what researchers, who work on leadership, see, is nothing more than the leadership reality that they themselves have created. The purpose of research in that field is to get a better understanding of leadership as a role and activity. Our special interest is on leadership related to planned changes of environmental situations. Subjective processes of interpretation and social processes are at work when researches are active. Therefore interplay of the two paradigms could lead to useful checks and balances.

The *training of leaders* as a topic of decision-making may be called an ill-structured problem. There is no common understanding of the ***concept of leadership***, no agreement on appropriate solutions of that dilemma, and a lack of consensus on ethical implications with respect to outcomes for leaders and followers and society.

The ***standards*** (ISO 9000ff, ISO 14000ff, EMAS etc.) will definitely help to structure the ongoing discussion and will certainly contribute to a civilized problem solving process. This is why we want to demonstrate some of the potential of these tools. Hopefully people whom we all consider as "creative" like designers, intellectuals, and top executives recognize the opportunity to join forces for a better world.

We shall continue to develop and reinforce the described approach in the years to come. This is the best way to ensure that we are acting in the interests of future generations.

## 6.11 AXIOMS FOR A MORE COMPREHENSIVE SYSTEMS APPROACH TO THE CLIMATE CHANGE SYSTEM<sup>378</sup>

### 6.11.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 6.11

In the foregoing two chapters my colleagues briefed a rather qualitative and a rather quantitative method. They are both usable and useful, but they can be even more so in a synergy. A reworked game theory provides a chance for it. This is what I am going to brief in this chapter.

#### 6.11.1 THE BASIC IDEA

John Nash: An economic....*bargain depends on the combination of the negotiators back-up alternatives and the potential benefits of striking a deal* (Nasar 1998, 90).

This contribution verbally articulates proposed axioms of sustainability, defined as the positive intersection of economic, social equity, and environmental realms (the Three Es), in terms of John Nash's contributions to game theory (c. 1948-1950). The axioms are intended to express the necessary and sufficient conditions of sustainability and, as such, are applicable to all institutions conducting sustainability negotiations, including the public and private sectors and the non-profit sector.

In particular, Nash's second axiom is restructured in accordance with the rules of energy flow and web dynamics of integral science (see Sally Goerner, 1999), as applied to the interaction of all three realms, so that game players must optimize *adaptability* and *stability* as well as Nash's *efficiency* dimension.

Since all of the proposed axioms express the interdependencies of the three realms under examination, the approach allows us to state that *none of the three realms of sustainability can be optimized without a negotiation process that permits the optimization of the others*, amounting to a restatement of Adam Smith's *Invisible Hand* principle as a simple new operational rule that is more consistent with current developments in the social and natural sciences. I anticipate that mathematical expression of the axioms will lead to further clarity in their statement as well as their optimally effective implementation.

#### 6.11.2 METHODS

The axiomatic method in mathematics and logic is one of three main approaches to design research indicated in the chart (See: Fig. 6.11.1), taken from Gero (2000, ix).

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Fig. 6.11.1: Methods for Design Research

|                                                                                                                                                                         |                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| As an empirical endeavor in which experiments are designed and executed in order to test hypotheses, as in cognitive science                                            | •Empirical Approach      |
| By positing axioms and deriving consequences from them, as in mathematics and logic                                                                                     | •Axiomatic Approach      |
| By conjecturing design processes and constructing computational models of those processes so that the behaviors of the resulting computational systems can be examined. | • Computational Approach |

Mathematical axioms may inform and be informed by both the empirical and computational approaches also shown in the chart, since the three categories are interdependent and therefore interactive.

### 6.11.3 SUSTAINABILITY AND GAME THEORY

Sustainability is often simply defined in terms of a positive, interactive intersection of economic, social equity, and environmental realms (the three Es), requiring that we focus our attention on the institutions that negotiate outcomes for those three realms, in the interest of successful implementation of the concept. Game theory, in turn, presents itself as a tool useful for analysis of the negotiations. I suggest that the achievement of sustainability is based on the five axioms (conditions) and two related additional considerations presented below, derived from John Nash's game theory.

### 6.11.4 NASH'S GAME THEORY

My proposed axioms derive sequentially from the key axioms that are common to John Nash's papers entitled *The Bargaining Problem* (c. 1948), which led to his dissertation on non-cooperative games that won a Nobel Prize in economics (1994), and *Two-Person Cooperative Games* (1950). Both of the papers cited have been republished in Kuhn and Nasar (2002, 37-46 and 99-114, respectively). Nash's sixth and seventh axioms (Kuhn and Nasar, 11-113) are not included here because they treat of the special case where only one, or neither of the players, can actually gain by cooperation.

Nash's first paper deals with a two-person bargaining situation

- in which there is opportunity to collaborate for mutual benefit, and
- in which no action taken by one of the players without the consent of the other can affect the benefit of the other.

The second paper broadens the analysis to include situations in which threats can play a role. Nash's key idea, informing both papers, was that the bargain depends on the combination of the players' back-up alternatives and the potential benefits of striking a deal.

Nash's five key axioms can be summarized in verbal format as follows:

1. Each game has a *unique* solution.
2. The players should cooperate with optimal *efficiency*.

3. The utilities of the different players are *non-comparable*.
4. Players may be regarded as *symmetrical* except in terms of their utilities and strategies.
5. Negotiations are understood to be *restricted* to a narrow range of alternative deals.

#### 6.11.5 PROPOSED COUNTERPART AXIOMS OF SUSTAINABILITY

My restatement of these axioms follows the same order, as listed below. Like the original axioms, they are interdependent. I anticipate the axioms ultimately can be expressed mathematically in the interest of greater clarity and optimally effective implementation.

1. There is a set of utility functions, expressible either in money or energy, that describes a sustainable outcome of negotiations between sets of players representing the three realms of economic benefit, social equity benefit, and environmental benefit (the latter could be expressed alternatively in terms of stocks and flows of resources, as suggested by Kenneth Boulding, 1966, 10). This axiom is analogous to Nash's first axiom that states the game has a unique solution.
2. The rules of energy flow and web dynamics in *integral science*, as promulgated by Goerner (1999), are common to all three realms and their interaction (please note that integral science will be characterized briefly in following sections). Thus, the three Es may be thought of as interrelated by fractal relationships that allow for energy transfer among the different scales of the three realms. Accordingly, the players must optimize *adaptability* and *stability* as well as *efficiency* dimensions included in their bargaining positions (see Anthony 1978, IV 1-12; Ulanowicz 1997, 73-103; Ulanowicz 1986, 102-166). This axiom is analogous to Nash's second axiom except that efficiency is not the sole dimension to be optimized, as in the original axiom.
3. Each set of actors wishes to optimize its own long-term utility function in any ultimate bargain, but cannot do so unless the other sets of actors can also optimize theirs, thus requiring a collaborative solution. An umpire may be necessary to require bargaining and enforce initial short-term agreements among the three realms, but in the long term mutual benefits will guarantee the necessary agreements (see Hawken, Lovins, and Lovins, 1999, 320-322). This axiom is similar to Nash's third axiom, which states the principle of non-comparability of utilities.
4. *The only significant differences among the players are those included in the mathematical description of the game, including their different sets of strategies and utility functions.* This axiom is identical to Nash's verbal expression of his fourth axiom, known as the *symmetry* axiom (Kuhn and Nasar, 111).
5. *Negotiations are understood to be restricted to a narrow range of alternative deals.* Again, this axiom is identical to Nash's verbal expression of his fifth axiom (op. cit., 112).

***Additional considerations*** related to my reformulation of the axioms include the following:

1. All three sets of actors must include representatives of the private sector, the public sector, and the non-profit or NGO sector in the interest of *inclusivity*, consistent with the rules of energy flow and web dynamics cited above.

2. The axioms apply across different cultural conditions, but the achievement of sustainability will require culturally different networking/social learning/bargaining processes. This consideration is also consistent with the rules of energy flow and web dynamics, relating to the unique intricacy of local social organization.

#### 6.11.6 INTEGRAL SCIENCE AND THE S-CURVES OF SUSTAINABILITY

Based on Goerner (1999), the rules of energy flow and web dynamics are common to the three Es and their interaction. This means that each of the three E's may be conceptualized as having its own composite S-Curve (see Fig. 6.11.2), and that the three S-Curves are mutually interactive.

The evolution of each S-Curve depends on optimization of *adaptability* and *stability* as well as *efficiency* (Anthony 1978, Ulanowicz 1997, 1986).

Fractal relationships among the three Es (self-similarities in structure, collaboration, and learning) allow for energy transfer across their different scales.

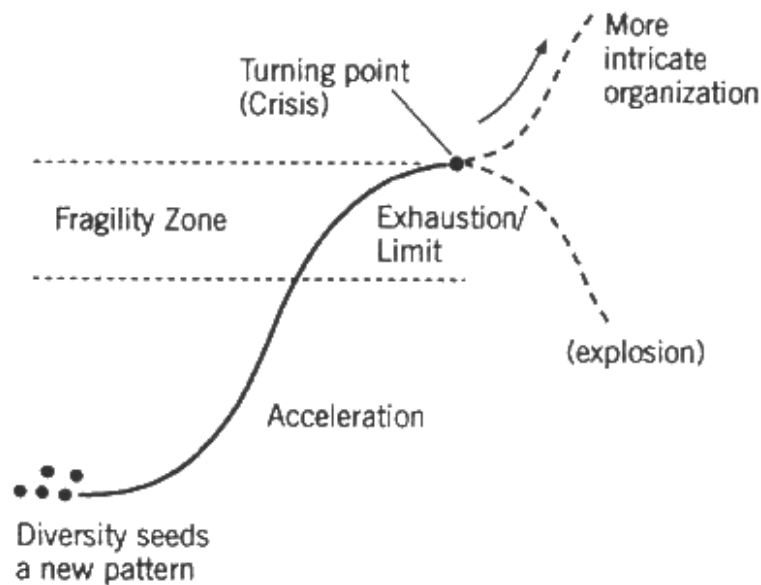
#### 6.11.7. CONCLUSIONS

Integral science imposes intelligence requirements for design that include considerations of structure, collaboration, and intelligence (social learning). These requirements are far more comprehensive and interactive than in reductionist approaches to design that are typically used. Goerner's "Braid" figure (see Fig. 6.11.3) provides a graphic interpretation of the evolutionary processes we are concerned with.

The axiomatic Nash game theory approach emphasizes the necessity of *collaborative* optimization of designs that, in turn, can help inform both empirical and computational approaches to design research. This finding is consistent with integral science as indicated above.

I have proposed couching the matter of sustainability in the context of game theory because, as mentioned by Nasar (1998, 375), *the latest generation of (economic) texts used in top graduate schools all recast the basic theories of firms and the consumer, the foundation of economics, in terms of strategic games.*

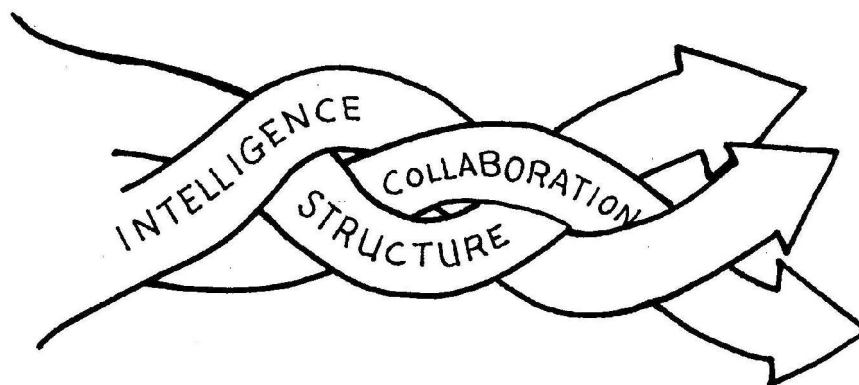
Fig. 6.11.2: The S-Curve



Smith's *Invisible Hand* metaphor (as misunderstood by many, which was demonstrated earlier in this book) is no longer as dominant because economic players must all take account of the actions of others, and pursue their own best strategies in the context of this interdependence.

The game theory approach allows us state that *none of the three contingent realms of sustainability can be optimized without a negotiation process that permits the optimization of the others*, amounting to a restatement of the *Invisible Hand* principle as a simple new operational rule that is consistent with current developments in the social and natural sciences.

Fig. 6.11.3: The "Braid"



## 6.12 SYNERGETIC CONCLUSIONS FROM THE CHAPTER 6

Eleven rather different contributions are making the Ch. 6. Their authors are invited co-authors of the three authors of the book. They are supposed to provide an idea how *interdependence of mutually complementary measures*, which belong to different fields of science and are topics of different specialists, in terms of their education and jobs, can lead to a synergy making a systemic result.

After the foregoing chapters have tried to provide insights in the reality of the current climate change and its (likely) factors and consequences, as well as in the capacities of systems thinking and systems theory, including their informal application, the Ch. 6 is trying to help the reader become an opinion maker and change agent. A new approach to the climate change, i.e. the one based on systems thinking rather than a biased and one-sided one, is a novelty, which is supposed to become an innovation. A book can hardly achieve this goal. If it contains no rather practical (framework) instruction, it can produce interest, ethics, and values, but hardly any action.

As a matter of ethics, we first addressed (in Ch. 6.1) the need for holistic / systemic / systems thinking to become an innovation covering at least the most influential persons and organizations in the role of the new general / prevailing culture. This is no easy goal to attain, the reminders in Ch. 6.2 let us see, but it can be done. Individuals and organizations finding a change agent or somebody else creditworthy and trustworthy (including innovation and sustainability) will be easier to influence and persuade; this is the essence of the Ch. 6.3. Organizations using methods with which they can design environment friendly products, can capitalize on their new knowledge and creditworthiness more easily than their competitors; they may receive help in Ch. 6.4. Most managers have not had much education on such aspects of life, and hence they may care for reading a chapter about values such as Ch. 6.5. But experience teaches us that the biggest impact over the managers' values comes from taxes: if they favor care for climate change and other parts of sustainable development as a system / whole / entity, managers are likely to follow; that's why we have Ch. 6.6. Though, there is also experience that managers take an action themselves, especially if methods are available; this is what Ch. 6.7 is all about. Ch. 6.8, on the other hand, let us see that we humans do not make the only impact about our own climate, but we are anyway becoming able to work against some forces from outside the Earth. We can have more chance to succeed if we use more holistic methods, be it on the Earth, locally or globally, or even against some forces from out there. This kind of efforts is gaining support in Ch. 6.9, 6.10, and 6.11.

None of the commented chapters is self-sufficient; they are all interdependent and interactive, if used properly, i.e. not too one-sidedly, but in terms of the law of the requisite holism. For this book to meet this requirement, we will add Ch. 7 to address political issues, after we have dealt with the professional ones in Ch. 6. Both of them are complementary, interdependent, and interactive, too.

## ***7. IMPLEMENTATION OF THE HOLISTIC THINKING ABOUT THE CLIMATE CHANGE SYSTEM – PART 2, A POTENTIAL DIALECTICAL SYSTEM OF POLITICAL INTEREST MEASURES***

### **7.0 THE SELECTED PROBLEM AND VIEWPOINTS OF DEALING WITH IT IN THE CHAPTER 7**

The climate change system operates under preconditions given by the dynamic evolvement of physics, geography, and biology of the Earth and its environment. The humans, with their life practice over the last 300 years of industrial and post-industrial civilization, have been proving their ability to influence constructively and destructively their natural environment, and are going beyond the border of a sustainable life and its long-term influence on the biosphere of the planet Earth. Our findings exposed in this book so far demonstrate that the human impacts on the planet Earth's biosphere system are both individual and organizational, and their consequences are individual, local, organizational, regional, national, international, continental, global, and perhaps even universal. Therefore the selected problem is how to attain a better and more systemic long-term responsibility of humans. The selected viewpoint considers the potential political measures toward this responsibility.

### **7.1 THE CURRENT NEED FOR A GLOBAL AND LONG-TERM RESPONSIBILITY<sup>379</sup>**

The climate change system as an integral part of the Earth biosphere is not its creator, but its provider and guardian of the living conditions. Humans have to find a new path towards sustainability or sustainable future, which will make mutual relationship of this civilization and the planet Earth in the newly evolved conditions.

Knowledge, sciences, research and applied research, society, and all governing, economic, national, international institutions/subjects, etc. need to accept a broader view at the given evolvments in our biosphere, and to respond adequately to their new challenges.

The present pollution on the global scale (nuclear technologies, CFCs and alike substances, pesticides, genetic modifications, hormones-like substances from our civilization's synthetic chemical production, technologies impact – explosive engines and others, transport equipment, war equipments, PCBs with impact on gene structure, etc.) reflects samples of our civilization's short-term thinking and action. What we need for our sustainable future is our long-term responsibility for our civilization's impact within the biosphere.

Here we have to distinguish the impacts of the ruler of our civilization – profit motive – from the understanding of it and the actual damages done by by-products caused by the lack of knowledge and holism. In many cases of global pollution the profit motive of our civilization was the main reason for large pollution – PCBs, CFCs, pesticides, etc.– which were and are produced, promoted, and marketed as improvements, but have resulted in damages within our own living space or environment. Global warming, ozone band destruction are cases - please see the Drawing No. 14; 15; 16; 17; 18; and 19 in Atlas at the end of the book – of a lack of any responsibility, and long-term responsibility of our civilization. Cases include the population's explosive reproduction, and pollution of the atmosphere.

We need research and understanding aimed at long-term responsibility of our civilization in order to stop the irresponsible behavior of the present rulers, the humans and our civilization's

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products such as the one-sided profit system, which causes a failure of understanding of the long-term responsibility, and hence causes irresponsibility.

## **7.2 WORLD GOVERNANCE – WORLD PARLIAMENT, WORLD GOVERNMENT AND CLIMATE CHANGE<sup>380</sup>**

The present status of the biosphere, nature, space and the environment, as well as the scientific and research knowledge at the disposal of humankind and our social system are driving our civilization in a dead alley. Individual, regional, national and international interests do not permit humankind to take a new approach to survival by their social, financial, political, and bureaucratic pressures, war philosophy, and lack of tolerance between people.

We, the people of the Earth, have to recognize the need for action towards the establishment of a world constitution, a world parliament, and a world government as a possibility for our survival, with responsibility to co-ordinate social issues, and to harmonize the needs of the entire humankind, and the nature, space, and environment capabilities, needs, and possibilities.

The present practice on the Earth such as

- the destruction of nearly all waters with synthetic chemicals, bio and air (rain-induced) pollution,
- the destruction of air by the land, sea, and air traffic,
- the destruction by the results of war actions,
- the destruction of the ozone layer,
- destruction of the soil fertility by the agriculture practice, including producing deserts,
- global warming, and of course
- the explosive reproduction of humankind,

cannot be dealt with by simply taking national interests into account and meet them in mutual isolation. They should be a major responsibility of the world government.

The climate change system, which is responsible for living conditions within the biosphere, needs special scientific research, and world governing action. Nature, space, and environment protection, which should take care of the biosphere, need special scientific research and world governing action, too. Both groups of topics are too global systems and reacting to the human one-sidedness by causing global entropy tendencies, which require a global level of the requisite holism in humankind's dealing with them.

The necessary scientific and applied research to cope with the above issues cannot be provided on the basis of our civilization's current scientific and research capacities, due to the engagement of scientists with war and the demands of bureaucracy. Therefore, a new approach is needed for a redirection of scientific work towards the needed knowledge and values capable of saving the nature, science, and the environment including the climate change.

Scientific work, as a basic source of knowledge, needs special co-ordination at worldwide level and should be an integral part of the world governance.

An integral part of nature is the system of climate change. From the system theory point of view, and from macro system thinking, we may say again that there are macro systems and micro systems. Macro systems are the cosmos, the solar system, the planet Earth, the biosphere, and climate change etc. Micro systems are individual creatures, aircraft, automobiles, countries,

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national governments etc. An essential share of their mutual impacts is subject to the self-regulation processes, but preconditions for these processes to work well enough have been largely destroyed over the last centuries, especially the last decades. They need a new support.

To be able to understand the need for world governance, humans should understand the systems within which we exist, and systems we consist of and that we create. It is important due to the known fact that any system in nature will remain as it is, as long as all systems and relations within it are in a similar mode. Together they make a living system that is trying to be a viable system. If and when any major or minor part of the system moves, changes, the whole system will commence to move, change. It is not possible to predict in which direction the system will move, change. This is what is happening with the climate change system.

The climate change system, due to the triggering effect of humankind's impact on the biosphere – depletion of the ozone layer, global warming, deforestation, desertification, erosion, input of synthetic chemical substances, consumption of fossil fuels, etc. – commences to respond in the way a living and viable system does. This means living conditions within the biosphere are changing. One important aspect of it says:

if the mean land mass temperature changes by one Celsius centigrade within 12 months,  
the change will force extinction of up to 90 % of known plants.

Important is how and what will be the evolution of two major sub systems – firstly, the Earth land mass - configuration changes due to a rise in land mass temperature, and secondly - sea waters - change in terms of salinity, currents, ability for CO<sub>2</sub> carbon dioxide storing, expansion due to rise of average temperature, and possible impact on bio systems: eutrophication, phytoplankton, and other life forms.

The climate change system is becoming unstable due to global warming and ozone layer depletion that result from other changes and their synergies.

Scientifically it is possible to correct global warming by fostering phytoplankton reproduction, and the resulting consumption of CO<sub>2</sub> carbon dioxide, which may decrease global warming. But if it is used without scientific control, it may produce another Ice Age and result in the end of our civilization. So we are at this point, as the ancient Romans and Greeks would say, between Scylla and Charybdis, which were two rocky islands on the sea route from Greece to Rome where many ships sunk. Decisions of such weight should not be left to national governments or the UN, since they do not recognize the importance of the issue and define their level of the requisite holism on a too narrow basis.

The climate change system ultimately would change living conditions within the biosphere and geography of the Earth so much that our civilization will end. Therefore we issue the following

## **RECOMMENDATIONS:**

*One planet, one government* is our first recommendation. Of course The Planet Earth Constitution is first and The Planet Earth Parliament and Government follow in line, after ratification of The Planet Earth Constitution.

Secondly we recommend a new approach to the *social order*, which has to reflect the present experience, and the establishment of a *new contract for humankind* living on the planet Earth. The goal is to prevent explosion of humankind reproduction, enforce ethics and tolerance amongst peoples of the Earth, enforce (a globally holistic!) law and order, and with skilful

governing allow the coming generations to live on the planet Earth.

Thirdly we recommend *redirections of scientific work* from war armaments, too narrowly market-oriented and synthetic chemicals technologies, etc., to discovering viable global systems of nature, space, the environment and cosmos, as essential elements of knowledge needed for survival.<sup>381</sup>

This book could be a basis for such a world government to work. How good are our chances?

### 7.3 FEASIBILITY OF GOVERNANCE OF THE GLOBAL ECONOMY<sup>382, 383</sup>

#### 7.3.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 7.3

The world is facing an *historic dilemma*. We now have a global economy, but we do not have global institutions to regulate the global economy. However, we do have *two “global political parties”* that are proposing programs and seeking to implement them. One party consists of economists, government representatives, and officials inside global economic institutions such as the World Bank, the International Monetary Fund, and the World Trade Organization (WTO). The other party includes the people who protested at the WTO meeting in Seattle, authors of books questioning the benefits of globalization for the poor, and leaders of efforts to achieve voluntary compliance with progressive labor and environmental standards. The proposals and strategies of these two “parties” can be thought of as a regulatory system for the global economy in the absence of a more organized federal system.

#### 7.3.1 WHY WE NOW HAVE A GLOBAL ECONOMY

In the 1990s the world economy was transformed by the *collapse of the Soviet Union/bloc and Yugoslavia*. Almost overnight, the competition between two competing economic models ended, and nations around the world looked for ways to adapt to the new era of markets and globalization.

*New communication and transportation technologies* have created the ability to move capital, goods, and information rapidly and easily around the world. And organizations have adapted to these new abilities by creating flexible organizational structures. By not building factories but rather by contracting for the manufacture of products, companies are able to easily move the production of goods from one country to another to take advantage of lower cost labor or more favorable government regulation. Indeed some companies go so far as to contract for the design and marketing of goods as well as the production of goods. This

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<sup>381</sup> The scientists who contributed to this chapter by their work or ideas are as follows: Dr. Rashmi Mayur, Mumbai, India; the late Prof. Dr. Dr. Helmut Metzner, Tuebingen, Germany; Prof. Dr. George Pethes, Budapest, Hungary; Prof. Dr. Slavko Kulic, Zagreb, Croatia; Prof. Dr. Marjan Vezjak, Vrhnika, Slovenia; Dr. Elmar A. Stuhler, Freising, Germany; Richard Bartak, CSM, Prague, Czech Republic; Prof. Dr. Micheal O Suilleabhain, Cork, Ireland; Dr. Marion Hersh, Glasgow, Scotland; Dr. Glen Martin, USA; Prof. Dr. Nina Dorofejeva, Ukraine; Prof. Philip Isely, Lakewood, USA; Yogi Shanti Swaroop, India; Prof. Dr. Elohim Jimenez Lopez, Mexico, and Mautendorf, Austria; and many others past and present members of the SEM Institute for Climate Change.

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<sup>383</sup> *Acknowledgement: This contribution is largely based on a Salzburg Seminar on Global Economic Institutions that occurred in Salzburg, Austria, April 17-24, 2002. I am grateful to the faculty and students of this seminar for providing the raw material for this report and to the staff of the Salzburg Seminars for arranging the event.*

arrangement allows them to hire local firms that know better the desires of consumers in their countries.

New communication technologies, increased **standardization of accounting** practices and **new financial markets** have made it easier for capital to move rapidly from country to country. Capital now flows easily across national borders seeking the highest return on investment.

As a result of the triumph of **market-oriented economic theories** over theories advocating government ownership or control, there is now widespread political support for privatization, competition, and agreements to lower trade barriers (Yergin and Stanislaw, 2002). If markets are good, then trade across national boundaries is also good. Lowering tariff barriers allows producers to sell their goods in other countries. Increased trade creates more competition and leads to higher quality goods and lower prices for consumers.

However, the people who demonstrated against the World Trade Organization in Seattle and elsewhere are concerned about what has been called “**the race to the bottom**” (Tonelson, 2000). Countries seek foreign investment to provide jobs and tax revenue. But countries often find themselves competing for foreign investments with other countries that have less restrictive labor and environmental standards. Businessmen, not surprisingly, often choose to move their operations to countries with less restrictive policies. The fear of the protesters is that there will be a worldwide lowering of labor and environmental standards. They feel that a global economy guided primarily by a desire to lower trade barriers will create incentives for countries to place their people and their environment at risk by removing or weakening regulations.

This problem is not new. Earlier in the U.S. some states passed more restrictive environmental laws than other states. Businesses responded by moving to states with less restrictive laws. The solution was to pass federal environmental protection laws in order to create a “**level playing field.**”

Today we are facing a similar problem in the global economy. Economic activity has grown more rapidly than regulatory institutions. But to what organization can people appeal to establish global labor or environmental standards? And what organization would have the means to enforce the standards? The IMF and World Bank are global economic institutions, so they become the focus of attention, even though their missions are not to set and enforce global standards for labor, the environment or consumer protection.

If we were to apply the experience within the U.S. to the world level, we could assume that an appropriate strategy would be to pass legislation to **establish regulatory institutions** and have them enforce the laws. But at the global level it is not clear what institutions would perform these functions. The UN in its present form is unlikely to be able to accomplish these tasks. Perhaps in the long run global standards will be devised and enforced in somewhat the same way that the European Union is creating common standards. But that time seems to be many years in the future (Zedillo Report, 2002).

### 7.3.2 ELEMENTS OF A FEDERAL SYSTEM

If we assume that **global institutions** may eventually evolve in the direction of a regulated international market economy, what institutions would have to be in place in order to serve the regulatory function, if we use current nation-states as models? There should be a widely

respected, representative legislature; an effective executive branch, including police to enforce the laws; an uncorrupted court system to try cases and resolve disputes; belief in and respect for the rule of law; and widespread voluntary compliance so that enforcement is not an unbearable burden. Not only do these elements not exist at the global level, they exist in only a few countries.

Currently the United Nations is not designed to be a world government, and there is little interest around the world in its becoming a world government. **Nationalism and national sovereignty** are still much too important. Many people believe that the decisions a world government would make would not be in their interests. Currently labor, consumers, and the environment are protected, if at all, by laws within countries. Whether global regulations are desirable or not, they are not currently possible.

One approach to improving the global economy is simply **to reform existing global economic institutions**. This would require the people in the global economic institutions to work with nation-state leaders -- a continuation of the current process. An alternative approach is to create a **new system to propose and implement reforms**. This approach would create a structure or procedures that would generate a continuing series of reforms in the future.

Consider the US political system as a model. There are basically **two political parties** – the Democrats and the Republicans. These political parties assemble coalitions, compete in elections, pass legislation, lobby to enforce laws through executive orders, and bring cases for interpretation by the courts.

Another element of the US domestic political system is **think tanks** or policy research organizations. Frequently people go back and forth between high government positions and think tanks, depending on which party won the last election. This rotation of people gives former government officials the opportunity to reflect on what worked and what did not and to design the next set of reforms that they will seek to implement when next they hold a government position.

Until very recently the thinking about how to manage the global economy has been the province of economists. Economists designed the World Bank and the International Monetary Fund (IMF) in the closing days of World War II. The Cold War was a contest between two economic doctrines. With the end of the Cold War there was a brief period of general agreement on desirable macro-economic policies. John Williamson (2000) coined the term “Washington Consensus” in 1990 to refer to the policies that people in Washington felt governments in Latin America should follow in order to promote their development. The elements of the **Washington Consensus** were fiscal discipline; public funds spent on health, education and infrastructure; lower marginal tax rates and a broadened tax base; interest rate or financial liberalization; a competitive exchange rate; trade liberalization; liberalization of inflows of foreign direct investment; privatization; deregulation to abolish barriers to entry and exit, and secure property rights.

### 7.3.3 GLOBAL POLITICAL PARTIES

However, the protests at the meeting of the World Trade Organization in Seattle served notice that the “**consensus**” was **far from universal**. The protestors expressed the view that global economic institutions were serving the interests of the rich much more than the poor. Consequently, it is now possible to identify two very diverse groups that can be thought of as two “global political parties.” One group consists of the people inside the meetings of the

World Bank, the IMF and the World Trade Organization (WTO). The other group includes the activists protesting in the streets outside these meetings. Table 7.3.1 describes the assumptions underlying the positions of these two “global political parties” (Umpleby and Medvedeva, 2002). The left column is unified by economic theory and is able to command large resources by virtue of being in control of large organizations such as the World Bank and the IMF. The people described in the right column have been able to organize protests and to produce a number of “anti-globalization” books but are much more diverse and command few resources. Whereas the “economists” are based in global economic institutions and policy research organizations, the “activists” are based in grass-roots community organizations and perhaps some universities.

Like most political parties, the two global political parties have very *diverse memberships*. The “economists” include some people who emphasize privatization, competition, and trade as a general solution to nearly all problems. But this “party” also includes people who believe that poverty reduction requires some government programs. The “activists” are even more diverse. This “party” includes conservatives who want to stop globalization and modernization or at least keep it out of their country. However, progressives within this “party” want to help their countries adopt widely accepted macro-economic policies in order to prevent problems such as those Argentina is now facing.

### 7.3.4 ENFORCING POLICIES

In addition to formulating policies, political parties also need means to *implement* them. In a democratic country, the usual means is through passing laws in the legislature. In the case of the global political parties, the “economists” have access to government leaders. They assume that the way to make changes is to work with government representatives. Some of the reforms contemplated by the “economists” can be found in the Zedillo Report, which was prepared for the United Nations conference on Financing for Development, held in Monterrey, Mexico, in March 2002. As an example the Zedillo report suggests a Global Environmental Organization and an International Tax Organization.

Most of the “economists” come from democratic, developed countries, so they assume that citizens achieve their goals by working through their *governments*. However, the “activists” employ *different means* to achieve their goals. Often they feel alienated from their governments, which are in some cases unresponsive and corrupt. The activists feel solidarity with citizens in other countries who have similar problems. Consequently they usually work through institutions of civil society and international non-governmental organizations.

In the absence of a legislature or enforcement agencies, it is nevertheless possible for people to act to provide some regulation of the global economy. There are already many examples of *voluntary compliance* with recommended standards and voluntary participation in enforcement actions. Perhaps the best example is voluntary compliance with the four principles advocated by the International Labor Organization – the right to collective bargaining, no forced labor, no child labor, and no job discrimination (Tapiola, 2001). There is increasing cooperation on issues involving food, drugs, and consumer products in order to protect consumers. Institutions of *civil society* are growing, networking, and becoming more effective. Examples of international cooperation on adhering to safe standards sometimes involve international governmental organizations and sometimes involve only non-governmental organizations. Through the press, associations and the internet people in different countries are continually learning from each other and imitating effective practices. Another effort is a growing democracy movement aimed at improving the ability of countries

around the world to regulate their affairs according to the wishes of the local population (Democracy Coalition, 2002).

Consequently, the “activists” are increasingly employing a voluntary strategy to achieve their goals. The most well-organized example is the **Global Compact** being promoted by UN Secretary General Kofi Annan (1999). The Global Compact includes the four principles from the International Labor Organization, four environmental principles, and three principles on human rights from the United Nations Declaration on Human Rights. Corporations are urged to sign the Global Compact and then report each year by describing one example of what the corporation has done to advance the principles of the Global Compact. These statements are made available via the internet. There is also a role for universities in writing case studies. An academic network has been established to support the Global Compact Learning Forum. The first progress report on the Global Compact was released in July 2002. The Global Compact can be thought of as a voluntary approach to regulating the global economy.

Is a voluntary system adequate to achieve regulation of the global economy? I addressed this issue in an earlier paper (Umpleby, 1990). The question is whether those who aspire to be “regulators” have the power to bring about the desired behavior on the part of “those being regulated.” In a voluntary system there is not the threat of litigation, fine, or imprisonment. A police and court system are not available. However, **persistent internal education and lobbying** can sometimes win converts. The possibility of public embarrassment, ridicule, or condemnation may be persuasive. And laws that reflect international standards can be passed by country legislatures. A voluntary movement does not have the resources and expertise of a governmental agency, but a lack of technical expertise can be dealt with by making demands that are simple and observable. In a market economy “**good will**” is valuable. Respected companies attract a larger pool of job applicants. They retain employees longer, so have lower training costs. They find it easier to attract and retain customers and suppliers. Hence, respected companies can be expected to have more capable employees with higher morale, more loyal customers and better relations with suppliers. These features translate into profitability and longevity. Over time an economy will probably be populated by an increasing number of companies that are respected for their compliance with standards such as the Global Compact and a decreasing number of companies that choose not to pay attention.

*Table 7.3.1: Two Global Political Parties*

| <b>ECONOMISTS</b>                                                                                                                      | <b>ACTIVISTS</b>                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Based on economics                                                                                                                     | Based on sociology, political science, cultural anthropology, management, and political economy                                               |
| Emphasis is on facilitating business, trade, and capital flows                                                                         | Emphasis is on education, participation, democracy, human development, and local control over changes in norms and values                     |
| Aim is to spread Western business methods worldwide (often perceived as Americanization)                                               | Aim is to adapt business methods to local values (in order to maintain and enrich cultural diversity)                                         |
| Unifying theme is spread of material culture and civilization                                                                          | Unifying theme is the right of people to preserve and enhance their societies as they choose                                                  |
| Theoretical                                                                                                                            | Experiential                                                                                                                                  |
| Technocratic methods                                                                                                                   | Humanistic methods                                                                                                                            |
| Economic rationality                                                                                                                   | Socio-economic rationality                                                                                                                    |
| Goal is perpetual economic growth                                                                                                      | Goal is sustainable development                                                                                                               |
| Intent is to create an interconnected, trading world                                                                                   | Intent is local autonomy and self-reliance – population stabilization, environmental sustainability, democratic government, human rights, etc |
| Belief that fewer trade restrictions will increase freedom, provide jobs, lead to cheaper products, and make foreign investment easier | Belief that local autonomy, participation, democracy, and transparency will aid social capital development                                    |
| Find best combination of policies (for any country)                                                                                    | Work on issues of greatest local interest (within the context of policies described in the Washington Consensus)                              |
| World standards                                                                                                                        | Regional banks and trading rules with cultural and institutional differences                                                                  |
| Assumes humans are rational actors, reason similarly, and will make similar choices                                                    | Assumes people are led by different cultures to seek different values                                                                         |

|                                                             |                                                                                                                        |
|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Assumes that every country wants development and prosperity | Recognizes that some within countries, prefer tradition and stability to countries, or groups change and modernization |
|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|

### 7.3.5 CONCLUSION

**Current challenges** in the development of the global economy are more equitable distribution of wealth; fair labor standards; environmental protection; reduced corruption; basic social services such as health, education, housing, clean water and food; gender equality; and civil liberties. Much has been done, and much more can be done through **voluntary organizations** and **voluntary compliance** with recommended standards. Reform of current international organizations and creation of additional international organizations by the “economists” will no doubt occur, but “activists” are also working to achieve voluntary compliance with widely accepted standards.

Every organization – corporation, government agency, university, hospital, non-governmental organization – could have a group of employees working within the organization to achieve compliance with recommended standards. These **internal lobbies**, **networked** together and to non-governmental organizations, would increase the influence of civil society organizations working for positive social change. They could work to influence the mission, vision, and values of their organizations and the voluntary activities of employees.

Current international financial institutions (IFI) deal with governments and government representatives (Figueres, 2000). But many of the problems that the IMF struggles with are rooted in the **political culture**. A grass-roots movement within a country to encourage responsible economic policies might be very helpful in constructing a long-term solution to problems such as the decline of the Argentine economy. Hence, a combination of reform proposals and strategies from the two “global political parties” may be the best way to regulate the global economy at the present time.

On the other hand, most governments depend a lot on the businesspersons, especially the most influential companies. World governance may need their support as well. What have they to say, and what have they said and done so far? Let us finish the book by addressing this issue!

## 7.4 THE DEVELOPMENT OF THE IDEA OF SUSTAINABLE DEVELOPMENT - A SUMMARY ON THE SUPPORT TO IT FROM SOME BUSINESS VIEWPOINTS<sup>384</sup>

### 7.4.0 THE SELECTED PROBLEM AND VIEWPOINT OF DEALING WITH IT IN THE CHAPTER 7.4

The UNO actions and the above ideas about the need and chances for a world governance to show up do make sense, obviously, but seem to have a little chance to prosper before the **public opinion makers** innovate their own views and diffuse them among many other. How much has actually been done on this topic so far?

#### 7.4.1 THE EVOLVEMENT OF THE IDEA OF SUSTAINABILITY – A SUMMARY

The problem/threat to our civilization from the climate change system may be considered the visible top of the iceberg called danger to be solved by the sustainable development.

The **sustainable development** (a better term such as sustainability and sustainable future could be applied) belongs to the most important achievements of the humankind’s mental development. It results from a longer and broader mental process with which the professional

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<sup>384</sup> Vojko Potocan and Matjaz Mulej

public has been trying, over half a century after WWII, to rethink and redesign the starting points for the humankind to act and behave less destructively (e.g. Reports by the Club of Rome, of the Club of Paris, Actions by UN, Our Common Future etc. by a many politicians, professionals, formal and informal organizations and associations.). They can be said to use quite a lot of informal systems thinking.

A more *holistic understanding of needs and requirements* (e.g. economic, environmental, social) (but all of them from social sciences point of view) of the future development is largely encouraged by:

- A *modernization of the understanding* of the world and the role of humans in it. It enabled the cognition that equal opportunities for the current and the future generations to live must be assured.
- A *change in the conditions* of the economic activity and life of humankind. It enabled the cognition that the future development (sustainable future) must holistically consider all the important economic, social, and environmental objectives and their synergies.

The future existence and quality of life of the humankind will crucially depend on the *selection of the basic concept of the future development* (sustainable future). This concept has therefore to be studied from at least two crucial systems of viewpoints:

- The *professional* one includes a holistic definition of the basic attributes of the sustainable development (sustainable future), both in terms of contents and of methodology
- The *political* one includes the interests to be defined and worked out concerning the basic starting points (long term policy) and assuring the preconditions for the concept of sustainable development (sustainable future) to be implemented everywhere.

UNO has been a central political body to sponsor the professional discussion about the sustainable development (sustainable future) since 1970, and they also work on the necessary political harmonization of the dealing with the sustainable development<sup>385</sup>. The UNO commissions and boards have, in 1980-1987 conceptualized and formulated the basic starting points of the sustainable development.

In 1987, The World Commission on Environment and Development chaired by the Prime Minister of Norway, Mrs Gro Harlem Brundtland (“The Brundtland’s Commission”), published a report “Our Common Future”, which brought the concept of sustainable development onto the international agenda (WCED, 1988)<sup>386</sup>.

The sustainable development is denoted also with the term sustainability<sup>387</sup>. Some people think the word “development” has become associated with “developers”<sup>388</sup>, who do think of their partial development surviving in a longer term, and therefore prefer to talk about “sustainability”

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<sup>385</sup> Literature mentions other terms too, such as concerted development (Ib 3, 2001).

<sup>386</sup> »Our Common Future« also provided the most commonly used definition of sustainable development

<sup>387</sup> This wording may cause a lack of clarity of contents. Sustainability may mean durability (like in French), or long-lasting or long-term without consideration of the social and natural environment or holism. Such a meaning cannot be put equal to the sustainable development in terms of UNO Rio Declaration or this book.

<sup>388</sup> It may denote the city developers, or the technological developers, as well as the economy and society developers. Their decisions are based on criteria for investment and business that are usually local/organizational rather than global. The opposition between the global (or broader) and local (or narrower) criteria of decision making may cause a number of difficulties such as: unforeseen global consequences, fictitiously systemic thinking, and »cooperation« of specialists lacking a sufficient interdisciplinary knowledge and will to interdisciplinary cooperate toward a synergy.

instead. Other avoids this problem and just talk about specific improvement projects in terms that people are more used to. In this book:

- The term sustainable development denotes the idea (and the concept supporting its implementation) of development, acting, and behavior that are based on holism rather than one-sidedness.
- Sustainability denotes the attribute (or capability) of every entity in the objective reality that it accepts, implements, and applies the concept of the sustainable development in its own action.

Numerous *definitions* of sustainable development are known, but they mutually differ in terms of their applied concepts, approaches and goals<sup>389</sup>. We have selected two rather “general” definitions that are most frequently mentioned both in theory in practice<sup>390</sup>:

- "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (p. 43).
- "...sustainable development is not a fixed state of harmony, but rather a process of change in which the exploitation of resources, the direction of investment, the orientation of technological development, and institutional change are made consistent with future so well as present needs" (p. 9).

The sustainable development (its starting points and policies) and its economic attributes are basically defined in the following *documents*: Rio Declaration, Agenda 21 and Local Agenda 21. Principles of basic definition have been incorporated in the Rio Declaration, adopted by the United Nations Conference on Environment and Development (UNCED), meeting in Rio de Janeiro 3 to 14 June 1992. In Rio a majority of the 178 participating countries signed 5 documents, which indicated actions and guidelines that were required for the world society in order to lead the development in a sustainable direction. The Rio Declaration on Environment and Development sets out 27 principles supporting sustainable development.

The Declaration identified “a healthy and productive life in harmony with nature” as a basic right for all humans. It also stated, that “in order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.” It identified the eradication of poverty as an indispensable requirement for sustainable development, “in order to decrease the disparities in standards of living.”

It required that “the developed countries acknowledge the responsibility they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command”. Sustainable development is directly linked to the elimination of unsustainable patterns of production and consumption. It is dependent on states strengthening their capacity building by exchanging scientific and technological knowledge, and by enhancing the development and diffusion of new technologies.

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<sup>389</sup>Literature mentions a number of definitions of the sustainable development that can be generally put in two groups. The first group tries to define the sustainable development as holistically as possible. The second group includes definitions exposing rather single aspects of it. (E.g. Development which improves quality of people’s life, within the carrying capacity of the Earth’s life support Systems - United Nations Environment Programme and Sustainable development is living on the Earth’s income rather than eroding its capital - British Government White Paper, “This Common Inheritance”, 1990).

<sup>390</sup> Both are from Report: “Our Common Future” (WCED, 1988).

The Rio Summit also identified “**Three Pillars of Sustainable Development**. 1) Social progress (Equity, Social Cohesion, Social mobility, Participation, Cultural identity), 2) Economic growth (Growth, Efficiency, Stability), and 3) Environmental protection (Healthy environment for humans, Rational use of renewable natural resources, Conservation of non-renewable natural resources, Participation, Cultural identity). But it failed to tackle the question at the heart of the Sustainable Development debate: how can economic growth be sustainable? It said that: “States should cooperate to promote a supportive and open international economic system that would lead to economic growth and sustainable development in all countries, to better address the problems of environmental degradation.”

The **Rio Declaration** presents a *holistic idea* of the strategy of the sustainable development on the global/planet-wide level of action and existence. The central area of the global activity is the economic activity. It can be denoted as the macro economic level. What about the macro economic level, the Rio Declaration offers a vision and a concept of the future economic development that acts from a position of equal value of all important goals of action (economic, social, and environmental) and it tries to foresee and assure the realization of a “**suitable economic growth**” considering the needs and requirements of the world as a whole.

The Summit also accepted a document called **Agenda 21**, the action plan for the realization of a Rio Declaration on Environment and Development. Agenda 21 provides a comprehensive strategy for implementing sustainable development on a global scale. The Summit also recommended that all countries should produce national sustainable development strategies. The original document is 500 pages in 40 chapters long, covering social, economic and environmental issues. Because of that, Agenda is bringing together environmental, social and economic issues, to secure a new development, conceived more holistically.

Agenda 21 encourages people, governments and nations to work together toward a global partnership for achieving sustainability. The **interconnectedness** between countries, and the effect one country’s activities may have on another is recognized – encouraging an atmosphere of mutual respect. The responsibility for sustainable development lies with each individual, and all individuals inhabit one world.

An important novelty is also The Agenda 21 with its explicit recognition of the roles of “**major groups**” (or special groups) such as: non-governmental organization, women, trade unions, children and young people, the scientific community, business and industry. UN conferences since 1992 have increasingly built inputs from such groups into their programs, in contrast to the earlier practice of excluding all save national governments and a few favored “observer” organizations.

Agenda 21 presents a holistic idea of the strategy of sustainable development for single level, areas, and/or viewpoints of the societal sustainable development, i.e. the *societal* environment level of sustainable development. Now, the economic viewpoint is the economic activity on the mezzo / *organizational* level of economics. It contains so many different organizations – local and less local businesses, local and less local communities, interests, humans etc., that it is very tough to deal with in terms of both contents and methodology.

Agenda 21, on the basis of the macro economic ideas about development as defined in the Rio Declaration, formulates a set (perhaps a system) of mutually linked and interdependent strategies and policies. They deal with activities on single specific levels, areas, and viewpoints of the social development.

Chapter 28 of the Agenda 21 describes the important role *local and regional governments* have in the process towards implementations of a sustainable development. This chapter is today commonly known as “*Local Agenda 21*”. Local Agenda 21 is the action plan for a sustainable development of a municipality, set up by local authorities, together with the local stakeholders and citizens. The mandate for setting up a Local agenda 21 was given to local communities worldwide at the Rio Summit 1992.

The International Council for Local Environmental Initiatives (ICLEI), acting on behalf of municipalities, had brought in this mandate, which was incorporated into chapter 28 of Agenda 21 (Agenda 21, 28.3):

Each Local Authority should enter into a dialogue with its citizens, local organizations and local enterprises and adopt “a Local Agenda 21”. Through *consultation and consensus* building, local authorities would learn from citizens and from local, civic, community, business and industrial organization, and acquire the information needed for formulating the best strategies. The process of consultation would increase household awareness of sustainable development issues. Local authority programs, policies, laws and regulations to achieve Agenda 21 objectives would be assessed and modified, based on local programs adopted. Strategies could also be used in supporting proposals for local, regional and international funding.

The Local Agenda 21 presents a holistic idea of the sustainable development addressing the needs of acting of individuals, human groups and organizations on the local level. It can be denoted, in economic terms, as: 1) Corporate level of Sustainable Development or 2) Business level of Sustainable Development and/or Business Sustainable Development – following the definition by the World Business Council for Sustainable development – WBCSD, or the forum Business Action for Sustainable Development – BASD.

The cited documents present a unified professional and political basis for humankind to formulate and make a holistic sustainable development happen. Still, the results differ from the possible and expected ones. The issue surfaces: what should one do?

Different approaches may be used, based on a normative approach, in one extreme, and an interest approach. One can think of a “global government”, as Ch. 7.2 and 7.3 of this book discuss, or of the international business and other groups such as the one mentioned a few lines ago. Reality may require their combination, or at least a combination of the role of UNO as a kind of the world government, and business associations and nongovernmental organizations. They may provide for a global version of the requisite holism, the national and local bodies, on the other hand, may provide for the more local versions of it.

How do business react to these initiatives?

#### 7.4.2 SUSTAINABLE DEVELOPMENT (SUSTAINABLE FUTURE) AND THE INTERESTS OF BUSINESS COMMUNITY

The summarized picture of the normative reality says that more needs to be done in terms of the interest reality. Two sources, at least, can be exposed from this viewpoint: Business Strategy for Sustainable Development: Leadership and Accountability for the 90s (International Institute for Sustainable Development and Deloitte & Touche, Winnipeg, Canada, 1992) and The Cornerstone of Development: Integration Environmental, Social, and Economic Policies (IDRC, Ottawa, Canada and Lewis Publishers, Boca Raton, 1998).

**The basic cognitions of Business strategies for sustainable development (sustainable future) are:**

**A business definition of sustainable development - SD (sustainable future):** for the business enterprise, sustainable development means adopting strategies and activities that meet the needs of enterprise and its stakeholders today well protecting, sustaining and enhancing the human and natural resources that will be needed in the future. The definition recognizes that the economic development must meet the needs of a business enterprise and its stakeholders. The latter include shareholders, lenders, customers, employees, suppliers and communities who are affected by the organization's activities. It also highlights business's dependence on human and natural resources, in addition to physical and financial capital. It emphasizes that economic activities must not irreparably degrade or destroy these natural and human resources. This definition is intended to help business directors apply the concept of SD to their own organizations. However, it is important to emphasize that SD cannot be achieved by single enterprise (or, for that matter, by entire business community) in isolation. SD is a pervasive philosophy to which every participant in the global economy (including consumers and government) must subscribe.

**The concept of SD needs to be incorporated into the policies and processes of a business** if it is to follow SD principles. This does not mean that new management methods need to be invented. Rather, it requires a new cultural orientation and extensive refinements to systems, practices and procedures. The two main areas of the management system to be changed are those concerned with: 1) a greater accountability to non-traditional stakeholders, and 2) continuous improvement of reporting practices. Developing an effective management framework for SD requires addressing both decision-making and governance. The concept of sustainable development must be integrated both into business planning and into management and information and control systems. Senior management must provide reports that measure performance against these strategies. Governance is increasingly important because of the growing accountability of the corporation and its senior management. Information and reporting systems must support this need. Decision-making at all levels must become more responsive to issues arising from SD.

**Seven steps are required for making an enterprise according to SD principles.** These are: perform a stakeholders analysis, set SD policies and objectives, design and execute an implementation plan, develop a supportive corporate culture, develop measures and standards of performance, prepare reports, and enhance internal monitoring processes.

The basic cognitions of The Cornerstone of Development: Integration Environmental, Social, and Economic Policies are (here we wish to introduce to you only a part of this book, especially part 1, 2, and 2):

**In parts 1 and 2, Robinson and Tinker set out a framework for understanding the integration of environment, social, and economics policies.** They suggest that defining the ecological system as the primary system can be seen as imposing a particular, elitist view about environmental issues and blocking progress of human development, particularly in the South. On the other hand, defining the socio-economic system as the primary system can be seen as providing “a veneer of environmental respectability for that what is real continuing, non-sustainable economic growth.” Robinson and Tinker argue that to escape from this deadlock, we need to forge imaginative new approaches that recognize and integrate ecological, social, and economic conditions and goals.

For that reason, Robinson and Thinker (and Holtz in part 11) pointed out that these three imperatives are interconnected and mutually reinforcing, with direct and indirect impacts on each other, such that any attempt to address one system/entity in isolation not only runs the risk of intensifying problems in the other systems, but also may give rise to feedback effects from the other systems/entities, which may overwhelm the effects of the first intervention.

While business enterprises had previously focused their concerns and activities largely, or completely, on competitiveness and the creation of material wealth (measured by various indicators of profitability), in the future the enterprises will need to adopt broader and more balanced focus to include concerns for habitability (measured by various indicators of eco-efficiency), community (measured by various indicators of quality of life), and legitimacy (measured by indicators of corporate reputation, corporate social responsibility, and ethical investment).

But, the evidence demonstrates, that unethical practices undermine significantly the efficacy and viability of the overall development process. Such considerations highlight the need to extend the SD analytical framework to include explicitly an ethical dimension focusing on the value system. Thus, an extended sustainable development framework incorporates four principal dimension and associated imperatives: a) the economic imperative, that is, business activities must be economically profitable, b) the ecological imperative, that is, the activities must also be ecologically friendly and not damaging the environment, c) the social imperative, that is, in addition to individual or private gain, the activities must also promote community and social well-being, and d) the ethical imperative.

On the mezzo level of economic activities there are many different organizations trying to more or less holistically define the starting points, basic attributes, and results of the sustainable development of the business systems. All of them can hardly be presented. The most frequently mentioned ones include board and commissions of different professional associations, of formal institutional organizations of the government and public administration, of the business associations, and of the interest associations on different levels of activity (local, regional, national, international).

I may be worth to mention especially the Business Action for Sustainable Development (BASD). Different conferences showed that business is feeling the heat from groups campaigning for binding international rules on corporate activities. In defence of “voluntary action” and Self-regulation” the BASD is fine-tuning tools developed by corporate lobby groups in recent years. Handpicked, isolated examples of environment and social initiatives by BASD member corporations will be marketed as a “proof” of corporate commitment to sustainable development. This piecemeal approach will be coupled with a divide-and-rule strategy: a new conciliatory tone, combined with dialogue and “partnership” with the “responsible” NGOs, while discrediting the critics of corporate globalization. BASD speaks

about (see: Industry's Rio + 10 Strategy: Banking on Feelgood PR (Corporate Europe Observer; Issue 10, December, 2001): Legacy of Sustainability, Marketing "Corporate Citizenship", Concept of Divide-and-rule, Rules with Teeth or Self-Regulation, and Examples of Best and Worst Practice by BASD Member Corporation.

But making the vision of BASD happen is a shared responsibility of governments, business and civil society. They need to work together to determine what rules are best for business and what rules are best left to the other sectors. BASD starting points for discussing the sustainable development are:

- Business has responsibility to innovate, to market safe and sustainable products and services and it must adopt high ethical standards.
- Governments have the responsibility to work with all actors of society to set priorities. They must establish market framework conditions that promote environmental, social and economic sustainability.
- NGOs and citizen initiatives must provide sound advice to consumers and promote and support shifts in demand.
- Consumer and citizens are responsible for using the information available in the market to make choices that meet their needs and aspirations sustainably.

Some important points of working of BASD are:

- It has developed a vision document, "The business case for sustainable development" (Paris, 2001),
- It is compiling a Workbook with best performance stories from BASD members, and key findings from its work program,
- Its document "Marketscape: Facts and Trends" will provide what it sees as the essential trends and facts among the myriad of statistics available today.

A very interesting one is also "The World Council for Sustainable Development" (WBCSD). WBCSD is a coalition of 160 international companies united by a shared commitment to sustainable development via the three pillars of economic growth, ecological balance and social progress. Its members are drawn from more than 30 countries and 20 major industrial sectors. It also benefits from a Global Network of 35 national and regional business council and partner organization involving some 1000 businesses leaders globally. Mission: to provide business leadership as a catalyst for change toward SD, and to promote to role of eco-efficiency, innovation and corporate social responsibility. Aims: Its objectives and strategic directions, based on this dedication, include:

- Business leadership to be the leading business advocate on issues connected with SD.
- Policy Development to participate in policy development in order to create a framework that allows business to contribute effectively to SD.
- Best Practices to demonstrate business progress in environment and resource management and corporate social responsibility and to share leading edge practices among its members.
- Global outreach to contribute to a sustainable future for developing nations and nations in transitions.

WBCSD presented its vision of the relationship between companies and the goal of sustainable human progress in different documents, like:

- Changing Course (Rio, 1992). In this book WBCSD offered a business view of sustainable development and set out to spread the sustainable concept among business.

- Tomorrows Markets: Global Trends and Their Implications for Business, a succinct collection of statistics that will drive global business for decades to come.
- Walking the talks: The business Case for Sustainable development. A book explaining why smart companies pursue sustainable development and how they go about it.
- Statement for 2002 World Summit on Sustainable Development in Johannesburg (see: website: <http://www.wbcsd.org>).

This is important, because it demonstrates that there are also quite important businesses, which support holistic / systemic thinking about the current life and sustainable future of humankind. This book is trying to present a contribution in the same direction.

### 7.4.3 INCORPORATION OF SUSTAINABLE DEVELOPMENT IN THE SOCIETAL REQUIREMENT CONCERNING THE IDEAL BUSINESS SYSTEM

Back in 1990 we could find a very instructive table demonstrating the development of the requirements concerning the ideal enterprise over the last four decades (Bolwijn, Kumpe, 1990). With findings in this book we can now complement that insight (See Table 7.4.1).

The problems we see from the Table 7.4.1 lie first of all in the speed of change: previous generation had time periods of two generations (about 70 years) to adapt their cultures to new conditions of life, the current generations have only a single decade for a comparable process. This applies especially to the people making the 80 % of humankind with a poor tradition of the industrialization and (political) democratization (not to speak of other contents of democratization), not to speak about the globalization (which does not mean equal access to everything for all, only, but also a neo-colonization process to the benefit of the most innovative and entrepreneurial persons, organizations, countries, international associations).

In this respect, too, a total environmental quality requires a total mental quality. Systems thinking, which includes a broadest definition of the requisite level of holism, with the most influential persons, organizations, etc., first of all, is a prerequisite for a suitable mental quality resulting, hopefully, in a suitable environmental quality. As a consequence, the climate change system might have a chance to be requisitely stable and to allow humankind to succeed in preventing its pending and dangerous global tragedy of the commons from happening in reality.

## 7.5 SOME FINAL THOUGHTS

The research resulting in this book has taken many years and many persons who also have used many references before finalizing their thoughts in the form of the book. Many of them have been tried in conferences, and reworked before receiving the formulation in the book.

As a summary, we can see that

There are crucial needs,  
And there are promising seeds.  
There is more work on bits  
Than on the World-saving hits.

***Table 7.4.1: From an efficient to a sustainable business system<sup>391</sup>***

<sup>391</sup> The sign X denotes interdependence. The original table did not contain X, but +. To us, the sign + denotes that interdependencies are not considered, because the elements are only summing up. Our experience demonstrated the

| DECADE | MARKET & SOCIAL REQUIREMENTS                                                                                     | BUSINESS SYSTEM'S WAYS TO MEET REQUIREMENTS                                                            | TYPE OF BS     |
|--------|------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------|
| 1960   | Suitable price (as judged by customers)                                                                          | Internal efficiency, i.e. cost management                                                              | Efficient BS   |
| 1970   | Suitable price X quality (as judged by customers)                                                                | Efficiency X technical & commercial quality management                                                 | Quality BS     |
| 1980   | Suitable price X quality X range (as judged by customers)                                                        | Efficiency X, technical & commercial quality X flexibility management                                  | Flexible BS    |
| 1990   | Suitable price X quality X range X uniqueness (as judged by customers)                                           | Efficiency, technical & commercial quality X flexibility X innovativeness management                   | Innovative BS  |
| 2000   | Suitable price X quality X range X uniqueness X contribution to sustainable development (as judged by customers) | Efficiency X technical & commercial quality X flexibility X innovativeness X sustainability management | Sustainable BS |

Parts still matter more than wholes,  
Daily thinking is still facing holes.  
They cause rather clear oversights,  
Than requisitely holistic insights.

There still are people, opinion masters,  
Teaching us to be the nature masters.  
How dare they, on whose behalf?  
They are not holistic enough!

We humans certainly cannot stop being specialists, but we can learn to co-operate in order to become multidisciplinary, interdisciplinary, transdisciplinary, and supradisciplinary – in broadly composed teams, professional and political. Understanding that we must be mutually different to be mutually complementary, interdependent and interactive, and using the values and methods of creative co-operation and trustworthiness – this is the common denominator.

The dangerous changes in the climate change system keep resulting and threatening our own civilization, as long as we humans keep prevailing one-sidedness to creative interdisciplinary co-operation and to behaving as sustainable business systems (and we all are business systems also individually, not only as organizations, which we mostly form to more easily meet our interests, requirements and needs, very often in terms of business systems, too).

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summing up to be an oversimplification.

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