Sustainable Development, Systems Thinking and Teaching for Sustainable Management

Zhu Song[1]   Davorin Kralj[2]

Department of Foreign Languages, Chongqing University of Science and Technology, Chongqing, 401331, China[1]
alisoncody@126.com
Art-K BusinessConsulting, Na gricu 47, 2000 Maribor [1]   Institut for Business Excellence, Novi trg 5, 7000 Novo mesto, SLOVENIA[2]
davorin.kralj@amis.net,

Abstract: Leading global corporation are embracing sustainable business development as a strategic framework for integrating their business enterprises, creating innovative solutions to the complex needs and requirements of the business environment, and thinking strategically about leading change. The theory on the basis of the practical experiences envisages sustainable development planning as a process of continuous improvement.The last three decades have witnessed a radical change in world and regional circumstances as well as in social and entrepreneurial ones. Consequently, following a holistic approach to competitiveness, it is of utmost importance to consider all the relevant factors of competitiveness. These factors could be subdivided into systemic thinking, production processes management, sustainable management and business /environmental excellence. Moreover, competitiveness is the basis for successful company performance as well as for a better quality of life. Modern trends requiring systems thinking and integrated system approach to sustainable management. Finally, innovation systems approaches emphasise the importance of institutional factors in influencing the rate and direction of innovation and sustainable development. The organization must provide an environment to "incubate" ideas which mature and translate through implementation into products or services.To be successful this must be viewed as a holistic approach that affects, and involves, everyone – employees, customers, suppliers, shareholders and society. Teaching for Sustainable Development Management can and should happen at various levels in the organization. Successful organizations have a teaching process working its way through all levels of the organization. The contribution focuses on teaching for Sustainable development management and on the issue of importance of environmental sustainable management.

Keywords - environment, system approach, systems thinking, sustainable management, sustainable development, teaching

I. INTRODUCTION

The world is today facing unique and daunting environmental challenges. These include climate change; an emerging global crisis in water availability and water pollution; record loss of biodiversity and long-term damage to ecosystems; pollution of the atmosphere; waste production and disposal; impacts of chemicals use and toxic substance disposal; damaged aquatic ecosystems; and deforestation and land degradation [23]. In recent years, increasing numbers of companies have adopted broad-based strategies and policies to manage the widening array of risks, and in some cases opportunities, presented by these environmental challenges. Companies that pursue such sustainable approaches can generate benefits from the following:

- cost savings through improved efficiencies;
- enhanced revenue as a result of related products, services, and technologies;
- building corporate and brand reputation;
- improving employee and community health;

helping to create sustainable societies and markets [1]. While more and more companies have embraced environmental sustainability as a management imperative, it is also clear that even more comprehensive strategies and actions will be required if business is to reach its full potential with respect to global and local environmental challenges[24]. The UN Global Compact's environment principles are derived from the Rio Declaration on Environment and Development. The three principles are:

- Business should support a precautionary approach to environmental challenges;
- Undertake initiatives to promote greater environmental responsibility, and;

Encourage the development and diffusion of environmentally friendly technologies [1].
Teaching the theory on the basis of the practical experiences envisages sustainable development planning as a process of continuous improvement.

In a world of constrained natural resources and pollution pressures, the business case for environmental stewardship grows stronger every day. Pressures on companies now come not only from screaming ecoradicals, but also from traditional "white-shoe" bankers and others asking tough-minded questions about environmental risk and liability [26]. OECD countries are collectively the biggest users of natural resources in the world and the environmental, economic and social consequences of the production and consumption of these resources and of related economic activities extend far beyond their borders. The issue of efficient management of natural resources has become part of sustainable development strategies and/or environmental plans of many OECD countries, and is supported with initiatives to promote waste prevention policies and integrated product policies. Reflecting country concerns, the OECD Environmental Strategy for the First Decade of the 21st Century includes two objectives closely related to the efficiency of resource management:

- Maintaining the integrity of ecosystems through the efficient management of natural resources
- Decoupling environmental pressure from economic growth

In addition, OECD work on material flows supports the implementation of the recommendation on material flows and resource productivity adopted by OECD Environment Ministers and the OECD Council in April 2004 as well as contributing to the organization's horizontal programme on sustainable development [25].

One of the key reasons for the problems of today is the absence of an integral approach in planning or drafting development strategies. Sustainable development is in no case a neutral concept, since it intervenes on all fields of economic, environmental and social life. Leading global corporation are embracing sustainable business development as a strategic framework for integrating their business enterprises, creating innovative solutions to the complex needs and requirements of the business environment, and thinking strategically about leading change. The theory on the basis of the practical experiences envisages sustainable development planning as a process of continuous improvement. The successful green development and implementation of green innovation in an organizational system can produce a significant saving in the amount of business and environment resources and therefore a smaller environmental impact.

II. DIALECTIAL SYSTEMS APPROACH

Dialectics is based around three (or four) basic metaphysical concepts:
- Everything is transient and finite, existing in the medium of time (this idea is not accepted by some dialecticians).
- Everything is made out of opposing forces/opposing sides (contradictions).

- Gradual changes lead to turning points, where one force overcomes the other (quantitative change leads to qualitative change).
- Change moves in spirals (or helixes), not circles. (Sometimes referred to as "negation of the negation") [27].

Within this broad qualification, dialectics has a rich and varied history. It has been stated that the history of *dialectic* is identical to the extensive history of philosophy.. The basic idea is perhaps already present in Heraclitus of Ephesus, who held that all is in constant change, as a result of inner strife and opposition.Only fragments of his works and commentary remain, however[27].

The aim of the dialectical method is resolution of the disagreement through rational discussion,and ultimately the search for truth. One way to proceed — the Socratic method — is to show that a given hypothesis (with other admissions) leads to a contradiction; thus, forcing the withdrawal of the hypothesis as a candidate for truth (see also reductio ad absurdum). Another way of trying to resolve a disagreement is by denying some presupposition of both the contending thesis and antithesis; thereby moving to a third (syn)thesis or "sublation". However, the rejection of the participant's presuppositions can be resisted, which might generate a second-order controversy [27].

We are talking about human thinking style, here. Eduardo de Bono, the world famous author about creative thinking, said: "*Thinking is the most important human behavior.*" (2003) We are adding: "*Holistic and creative thinking is what we has had in mind – with full right*" [28]. This is what Systems Theory has been created for. Ludwig von Bertalanffy is the father of the General Systems Theory, the oldest one among systems theories, which are many now. He found some seven decades ago, that the human way of fighting our problems is also the cause of our problems [18]. Humankind has developed, millennia ago, the attitude that man is master over nature, rather than a part of nature and adapting to our natural environment. Since then, and especially in the 20th 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, by our own criteria. 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, but as individuals and groups. The whole is fragmented into parts, which may no longer be able to become a whole[28].

The Environmental revolution has been almost three decades in the making, and it has changed forever how companies do business. In the 1960s and 1970s, corporations were in a state of denial regarding their impact on the environment. Then a series of highly visible ecological problems created a groundswell of support for strict government regulation. In the United States, Lake Erie was dead. In Europe, the Rhine was on fire. In Japan, people were dying of mercury poisoning. Today many companies

have accepted their responsibility to do no harm to the environment. Products and production processes are becoming cleaner; and where such change is under way, the environment is on the mend. In the industrialized nations, more and more companies are "going green" as they realize that they can reduce pollution and increase profits simultaneously. [12]. The continual adaptation for enforcement of competitive ability of professional system dictates the stimulation of creativeness, intensity and novelty. Now business shows new context and new contrasts (table I) (Peters, 2003) [12].

WAS	IS
" Old Economy" Army	"New Economy" Army
Steep, bureaucratic, with lots of "brass"	Flat, decentralized, with little "brass"
Slow but sure	Fast and sure
Heavy and thus lethal	Light but no less lethal
Overwhelming force, difficult to maneuver	Precision munitions, able to "turn on a dime"
Biggest Guns in Town	Smartest Systems on Earth
Soldiers in massed formation, riding in tanks and towing heavy artillery	Units of five or ten "Army of One" soldiers, "armed" mostly with technology and capable of calling remotely upon an array of armaments
Firepower-intense	Information-intense
Hierarchical, with independent units that relate via top-down command-and-control operations	Network-centric, with interdependent groups that engage in ad-hoc operational planning
Lots of friction, low coordination especially with other armed services and with government agencies	Friction-free, open communication – both within units and across organizational divisions
Very "real"	Very "virtual"

Table 1: Contrasts between "Old and "New" Economy (Peters, 2003) [12].

… 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*.., that we must begin protecting the individual and cultural identity of others. He advocated a new global morality: »an ethos, 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 from: Elohim, 1999) [28].
Let us quote from Bertalanffy's Foreword (Bertalanffy, 1979, VII): »... What may be obscured in these developments – important as they are – is the fact that systems theory is a broad view which far transcends technological problems and demands, a reorientation that has become necessary in science in general and in the gamut of disciplines from physics and biology to the behavioral

and social sciences and to philosophy. It is operative, with varying degrees of success and exactitude, in various realms, and heralds a new world view of considerable impact. The student in »systems science« receives a technical training which makes systems theory – originally intended to overcome current overspecialization – into another hundreds of academic specialties. ...« [28].
The development of specialization caused humans to forget about contexts of their own life, action, specialty, views, opinions, and experiences. Is it not interesting, that systems theory, as a theory of considering the wholes, has surfaced briefly after a few decades in the 20th 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? [28].

The above logic of DST (Dialectical Systems Theory) may be easy to follow and apply because it is plain natural thinking. It has had a decisive influence. In addition, DST considers another critical situation: *making* the starting points is one affair, and the *implementation* of them is another. There are two reasons for this, at least:
(1) In *later steps* of the process when one must concentrate on *details*, the large image steps back or out of sight completely.
(2) Later steps are frequently done by other persons who are *specialists* for one or another kind of necessary details.

Thus, it makes sense to remind them of the original starting points by guidelines concerning their implementation [28].

To do this, the following question needs to be addressed, according to our experience:
1. After the division of labor among specialists has taken place, are we still taking care of the entire entity under consideration and/or control holistically rather than one-sidedly?
2. Can specialists be requisitely holistic, if they are not open to each other enough in their daily work life rather than isolated?
3. When the daily work life on implementation of the starting points prevails, do we sufficiently consider life dynamics rather than static, un-changeability, lack of adaptability of thinking, working and behavior? Does this include mutual adaptation of specialists working together?
4. If we are trying to be holistic, open and adaptable in terms of the three questions above, do these attributes cover only contacts with persons of the same profession, emotions, concepts, views, or do they involve interdisciplinarity?
5. If we are trying to be holistic and do our best in terms

of all four questions above, may we therefore expect a deterministic reliability of our ideas and actions in our daily lives, or should we rather expect some risk, probability rather than full reliability?[1]

6. In order to meet requirement in terms of all five questions, 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. 2, 3 and 4 is a good solution. How is it practiced, if at all?

7. When using materialistic dialectics, interdependences may tend to hide the necessity of 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. How is it practiced, if at all?

8. When the entire work to be done is attended by specialists and hence in partial lots, single outcomes might be both partial and many, normally. A generalization may be needed to come to shared outcomes and to an acceptable amount instead of a too big one. Is the generalization done in a way allowing for realism of the out-coming information?

9. When the generalization is being taken care of, and/or new task distribution is under way, there is a chance for 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?

10. Traditionally, one has tried to prevent too much one-sidedness 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? [28].

II. SUSTAINABLE MANAGEMENT

The overall goals of sustainable development are to meet human needs and improve quality of life; to live within the earth's ecological carrying capacity and maintain or enhance its natural capital; and to protect future generations from reduced quality of life [8]. In the area of sustainable management we suggest the following short-term and long-term measures with a view of improving operations in the studied enterprises:

- Management should incorporate sustainable environmental management in an enterprise's operations as part of current practices.

- It is necessary to establish or determine the most suitable and optimal size of particular sustainable environmental indicators and indicating devices (environmental management indicating devices) in terms of an enterprise's activity and size.

- Time schedule for monitoring sustainable environmental indicators and indicating devices (environmental management indicating devices) needs to be adapted to an enterprise's operations and size as well as to its environmental impacts, considering environmental legislation.

- It is necessary to incessantly develop suitable sustainable environmental values, knowledge and skills with all employees concerning their functions.

It is essential for the real effectiveness of environmental management to have appropriate leadership and keep well-regulated interpersonal relations in an enterprise. Congenial and stimulating atmosphere, promoting relaxed free and unimpeded activities, work satisfaction and satisfaction with co-operation with others, are all elements distinguishing excellent performance. When implementing changes, employees should be motivated adequately. There was quite a strong resistance from employees to implementing working groups at the very beginning of this process, which also resulted from the fact that we were unable to present them the sense and benefits of this process, moreover, we were unable to motivate them by the positive aspects of teamwork.

In such an organization, a high level of trust and honesty in the communication between the management and other employees, within the management, between teams and even between the organization and its customers and other companies is achieved. Employees can ask questions and get honest and helpful answers. Information exchange is effective when the system and communication network make it possible to the management and to all the employees to get the right information when they need it, to exchange their points of view, personal goals when discussing the goals of the company as well as to check their ideas, and learn from each other[14]. Good managers help people find out what is important about their work and in what way the work of each employee contributes to achieving the vision of the company. Employees are interested in learning whether their work, and in what way, influences common goals. Employees ask themselves why changes are required for themselves and why for the company. Managers, who speak in favour of changes, have to act in compliance with their words, spoken in public, formally or non-formally. Their actions have to support the "story of the company", they also have to be good communicators, they have to know how to present their "story of the company" in a convincing way [14]. In the early stages of introducing a learning organization in the company, such credibility is of great significance.

Learning organizations are, thus, (and have to be) infused with communication directed to goals; in organizations where the level of communication is not adequate, the problem is evident, management and other employees alike are aware of it. A step forward will only be possible when the management will, in view of their power and influence,

assume responsibility for establishing the environment encouraging open two-way communication directed to the goals of the organization. [14]. This will result in the awareness of their own directions into the future and into better market positions. Another step toward improvement is connected with the awareness of the management as well as of other employees that even if people communicate all the time, this does not mean that they know how to communicate. If that were the case, there were not so many misunderstandings, mistakes and conflicts [14].

Development of Environmental Management System is constantly improving. New environment issues dictate the redefining of The interest of customers, users, developers and others in the environmental aspects and impacts of products is increasing [11]. Because of this, EMS needs Environmental Indicators. The development (ISO 14062 discusses making improvements to environmental impact goals [10]) of indicators is a dynamic process that is constantly subject to updating and improvement [7]. Long-term orientation of the organization depends on:

- the organization culture,
- management philosophy,
- long-term and enduring choice of resources (capital, work, knowledge).

Environmental education supports organizations knowledge. Environmental education began in the early 1960s as a response to concern about environmental degradation and focussed on creating public awareness (Gough, 1997) [9].

III. WHAT TO TEACH

Life Cycle Analysis: Life Cycle Analysis is essentially a method of considering the entire environmental impact, energy and resource usage of a material or product. It is often known as a 'cradle-to-grave' analysis and can encompass the entire lifetime from extraction to end-of-life disposal. Life cycle analysis can be an extremely effective way of linking many different aspects of the environmental impacts of materials usage. The scope of a life cycle analysis can be adjusted to suit a particular case. For instance it could cover the environmental impact of the global aluminium industry or simply that of one single plastic injection moulding machine. In order to gain most learning benefit from this area, students would be expected to have a good grasp of the necessary underlying technical areas, which could be quite complex and so this ideally suits more advanced degree students. The most conventional way of approaching a life cycle analysis is to follow a particular material or product through its lifetime. Therefore the first consideration would be the impact of materials extraction, and then production and manufacture, product use and finally end-of-life considerations. This approach is followed below. Various aspects, such as energy usage, economic and legislative issues occur throughout the cycle.

Materials Extraction and Resource Implications: The environmental impact of raw materials extraction and processing together with global resource issues provides a good place to start consideration of environmental aspects of materials. Indeed taking this approach can provide a more interesting way of dealing with subjects such as extraction metallurgy that can otherwise come across as very dry factual subjects. This can be taken at quite a basic level covering materials abundance and the energy required for extraction, up to a detailed consideration of environmental impacts of extraction processes. For example, the production of aluminium requires large amounts of energy and produces a significant contribution to overall greenhouse gas emission. By comparing energy usage for extraction of new aluminium compared to recycling of used aluminium, students will see the large benefit to recycling in this case.

Environmental Impacts of Processing: This area often overlaps with the above, and again can provide an interesting slant to the teaching of materials processing. Topics that would come under this subject area include the specific environmental problems associated with processing of metals, polymers, ceramics, composites etc, and how these problems can be overcome.

Design for Sustainability: This area takes the conventional subjects of materials and process selection and product design and adds the sustainability criterion. It will therefore cover issues such as design for successful recycling, waste minimisation, energy efficiency and increased lifetime.

Economic, Social and Legislative Issues: Although this subject area takes things outside the normal realm of a Materials specialist, there are many important aspects that have a significant influence on the more technical issues. For example, materials selection within the automotive industry is now heavily influenced by 'end-of-life vehicle' and 'hazardous material' regulations.

Use of Sustainable Materials: The design, production and use of 'sustainable materials' are at the heart of this subject, and yet the definition of such a material is hard to specify. It could easily be argued that steel is a very sustainable material; it is abundant, takes relatively little energy to extract and is easy to recycle, however people living near a steelworks would argue against this. It is probably sensible to define such materials as those that have distinct differences that achieve environmental benefit compared to conventional materials. With this definition, the list would include:

1. Materials of a significantly plant-based nature, including wood, natural fibre composites, natural polymers.

2. Materials produced using a large proportion of waste material, including recycled polymers, composites made from waste mineral powders, and arguably also much steel and aluminium.

Materials for Green Energy: The most exciting developments in Materials Science are in the realm of functional materials, and many of these serve an environmentally-beneficial purpose, particularly in the production of green energy. These include:

- Solar-cell materials

- Fuel-cell technology

- Catalytic pollution control

End-of-Life Issues: The treatment of materials at the end of their lifetime is a significant subject area and encompasses aspects such as recycling techniques and materials limitations, biodegradabilty and composting, chemical recovery and energy recovery [2]. It is now time to stop just talking and try a little pratice instead [3].

IV. BASIC KNOWLEDGE

For students to gain maximum learning outcomes from this area, there is a requirement for a certain amount of basic knowledge. This includes:

- Details of environmental legislation and economic factors

- Processing methods

- Materials composition, structure and behaviour

- Details of environmental impacts (eg the detailed chemical mechanism by which CFC's deplete the ozone layer) [2].

The methods by which students obtain this information can vary, depending on the level of initiative expected from the students. It could be presented via conventional lectures, with supporting multi-media material. If students are given more time and responsibility for their learning, they could be required to undertake a literature/information survey, however with this method it is quite common for important information to be missed or not understood.

The area of environmental materials presents an exceptionally good opportunity for other teaching and learning methods that are much more suited to the quite subjective and rapidly changing nature of the subject such as:

- Group discussion

- Self-directed information review

- Market research

- Case-study work [2].

One example of where group discussion has proved to be an effective learning tool is the consideration of new environmental legislation. Once students have become familiar with regulations dealing with packaging, automotive and electrical sectors, they could be asked to consider what should be in legislation aimed at other sectors, for example construction and agriculture.Self-directed information reviews are used most effectively to gather factual information and details of new materials/ technologies being used to address environmental concerns. An example might be for students to collect information on how the major automotive companies are planning to deal with forthcoming end-of-life vehicle regulations [2].

Market research is an interesting way for students to gain information on more subjective issues such as public perceptions, marketability of products and so on. In project work, there is scope for students to undertake surveys via questionnaires or door to door surveys. Case studies can be used to bring many important aspects together. For instance, an interesting case study might be to consider the environmental impact of PVC use. In order to do this effectively, students would need to have access to factual information on PVC production methods, additive technology including plasticiser chemistry, recycling methods, dioxin chemistry and the associated health risks. With this information, students could then consider the more subjective issues of the overall environmental risks posed by PVC, the optimum disposal routes and the benefits of long outdoor lifetimes when replacing other materials that require paint or preservative treatments. The significant learning objective in such a case would be the consideration of the full lifetime environmental impact in order to make reasoned comparisons with alternative materials. For students to be able to do this, a distinction must be made between the factual information presented, about which there is little argument and the subjective issues, where students should be encouraged to take a range of standpoints and argue their advantages/disadvantages [2].

The common threads that run through the contents of the text books should:

- Help enhance student's relationship with nature and promote appreciation of nature amongst them.

- Focus on the interconnectivity between society and environment - highlighting environment as a people's issue.

- Provide a historical perspective as well as address the contemporary reality to provide a holistic picture. Include threats to environment and methods of conservation – How to care for and protect the environment – indigenous methods, wisdom of common people / communities

- Empower students to become citizens who are aware of their rights to question environmental trends, to participate in deliberations and to act responsible. Do not project students and communities as the "polluters", responsible for environmental degradation. Do not talk them down but affirm some of their practices and concerns.

- Help questioning of development paradigms, lifestyles and consumption patterns leading to understanding of sustainable development as a paradigm, based on these principle of reduction, reuse and recycle

- Include equity issues related to environment and development; environment and social conflict based on gender, class, ethnicity, rural/urban; issues of access and control over resources and unequal distribution of

resources; and common shared resources versus privatization.

• Inculcate gender sensitivity and understanding of women's relationship with nature

• Present environmental challenges as a concomitant of urbanization. The content should be state-centric and focus on environmental resources and issues related to that place, including comparisons and contrasts with other regions.

• Encourage critical thinking on environmental concerns. Attempt to explain them by exploring the roots of the problem and Macro-Micro linkages

• Focus on action/ potential for change – taking action at individual, community and Government level. While it is important to evoke children's participation in caring for environment, it is important to emphasize the critical role that needs to be played by the government, its policies and programmes.

• Acknowledge the wisdom of cultural practices, but question traditional practices /religious beliefs that are not environmentally sound or harmful for the environment

• Present before the students the dichotomies, contradictions and the complexity of issues that account for difficulties involved in taking decisions. This will encourage them and give them an opportunity to make informed choices [3].

V.   MIND AND CONCEPT MAPPING

Useful method for teaching is mind and concept mapping. Write down the most important word or short phrase or symbol for the center. Think about it; circle it. Post other important concepts and their words outside the circle (Figure 1) [4].
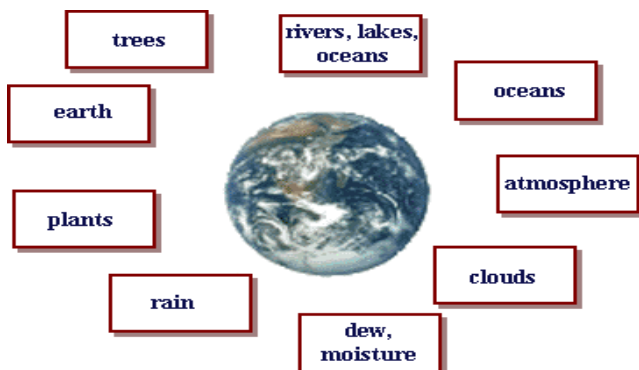

Fig 1: Mind an concept mapping [4]

Edit this first phase. Think about the relation of outside items to the center item Erase, edit, and/or shorten words to key ideas Relocate important items closer to each other for better organization. If possible, use color to organize information. Link concepts with words to clarify their relationships (Figure 2) [4].
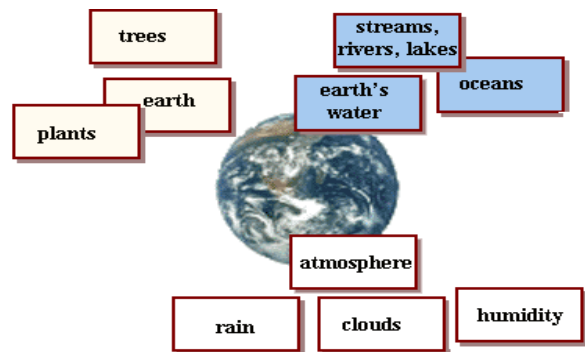

Fig 2: Mind an concept mapping [4]

Continue working outward. Freely and quickly add other key words and ideas (you can always erase!) Think weird: combine concepts to expand your map or; break boundaries. Develop in directions the topic takes you--not limited by how you are doing the map As you expand your map, tend to become more specific or detailed. Set the map aside. Later, continue development and revision. Stop and think about relationships you are developing. Expand the map over time (right up to an exam if necessary!). This map is your personal learning document It combines what you knew with what you are learning and what you may need to complete your "picture" (Figure 3) [4].
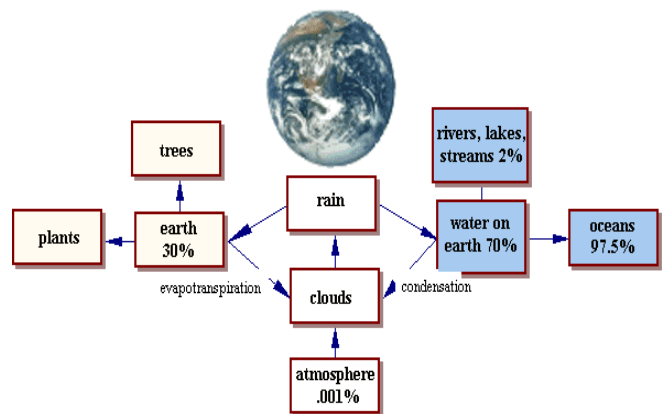

Fig 3: Mind an concept mapping [4]

VI.   INNOVATION PROCESS

An *innovation system* may be defined as "the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge" (Lundvall, 1992). The systemic nature of technological innovation is articulated by several related approaches (see the recent reviews in Kemp, 1997; Rip and Kemp, 1998;

Foxon, 2003). These approaches emphasise that innovation is a dynamic process, arising out of interplay between different actors, and involving both knowledge flows and market interactions. Moreover, because of the multiple feedbacks and types of learning involved, these approaches do not draw a rigid boundary between the innovation of a new technology and its diffusion. This enables a more subtle and realistic picture to be drawn of the drivers and barriers to technological innovation and diffusion, although the approach has not (yet) yielded a model in mathematical form to match or replace the epidemic and rational choice models of diffusion [32]. Nevertheless, we argue that innovation systems approaches, and Innovation process, to be effective, must be sustainable. The organization must provide an environment to "incubate" ideas which mature and translate through implementation into products or services. An innovative organization is lead, not managed. A sustainable innovative organization is fluid and "organic", almost biological in nature to foster constant creativity vital for the success of modern organization [25]. The sustainable innovative organization foster creativity by following a variation of the model discussed below:

• Organizational mission is defined and aligned to incorporate widespread trust and respect for individuals.
• The Corporate mission is communicated throughout the organization.
• A successful creating organization is a constantly changing dynamic organization to create new practices, processes, services and products of value to itself and its customers [30].

Organizational innovation reflects the recognition that new ways of organizing work in areas such as work-force management (such as employee empowerment, new people partnership, or positive action to involve all employees in order to make work organization a collective resource for innovation), knowledge management, value chain management, customer partnership, distribution, finance, manufacturing, etc. can improve your competitiveness [29].

Process innovation can and should happen at various levels within the organization as no organization can depend solely upon innovation occurring at one level only. Successful organizations have an innovation process working its way through all levels of the organization. Hamel (Harvard Business Review) states, *"Innovation has become a mantra: Innovate or Die. Acompany can't outgrow its competitors unless it can out-innovate them. Surely everyone knows that corporate growth – true growth, not just agglomeration – springs from innovation."* This article will provide various examples of process innovation, using the various innovation drivers, which include technology [31].

Finally, innovation systems approaches emphasise the importance of institutional factors in influencing the rate and direction of innovation. These range from habits of thought and action to policy and regulatory frameworks (North, 1990; Hodgson, 1988) [32]. The early work in this area focussed on national innovation systems, particularly

undertaking comparative studies of how the innovation performance of different countries reflects their different institutional arrangements, including: systems of university research and training and industrial R&D; financial institutions; management skills; public infrastructure; and national monetary, fiscal and trade policies (Lundvall, 1992; Nelson, 1993) [32]. More recent work has sought to apply innovation systems analysis to countries' efforts to promote innovation for environmental or sustainability goals. Jacobsson and Johnson (2000) developed and applied an analytical framework for analysing the diffusion of renewable energy technologies from an innovation systems perspective [32].

VII.   APPLICATION OF SYSTEMIC THINKING

Following the hypothesis, a survey was conducted to determine how companies assess application of systemic thinking (dialectal systems theory approach) and environmental innovations, education and how they maintain opportunities for establishing long-term sustainable development. The purpose of the article is to illustrate and find an answer to the question what dialectial system approach can bring in the long run for sustainable development and show an example, based on this methodology.

The survey was performed from September 2007 to January, 2008. Out of 120 questionnaires sent, 66 or 55 % were returned. The polled companies were asked if they were thinking about the possibility of systemic thinking (dialectial systems theory approach) as a tool for environmental innovations supporting sustainable development. 52 % company replied that they did not think of such a possibility. 33 % of companies replied that this is unknown methodology, and 15 % of companies have thought about the possibility of systemic thinking (dialectical systems theory approach) as a tool for environmental innovations supporting sustainable development (table 1).

Q: Have you thought about the possibility of systemic thinking as a tool for environmental innovations supporting sustainable development ?	Frequency	Percentage
Yes.	10	15
No.	25	38
We have not though about it.	9	14
Unknown methodology.	22	33
Together	66	100

Table 1: Results [15]

The next question for the polled companies referred to their opinion about what they would do in future environmental innovations activities. 12 % of polled companies replied that they would have adequate knowledge and skills. 78 %

of polled companies replied that they would be faced with the lack of skilled workforce, who would be able to initiate and start the environmental innovations.

A case study was developed. Personal interviews were carried out with five environmental decision makers in companies, in order to get a deeper understanding of environmental innovations meaning for sustainable development.

The interviews lasted approximately one hour, were not recorded but simultaneously written down. According to interviews, companies which accepted systemic thinking were faced with the following consequences:

· improve cooperation, co dependence, relationships, connection, openness,
· improve competitive ability
· manage environmental legal obligations,
· improve environmental performance,
· save money,
· improve pollution prevention
· reduce environmental risk [15].

In spite of general availability and well-spread concepts of strategic management, research showed that only few managers think about the future, about environmental innovation for sustainable development. Figure 4 presents number of Eco- schools in Slovenia.
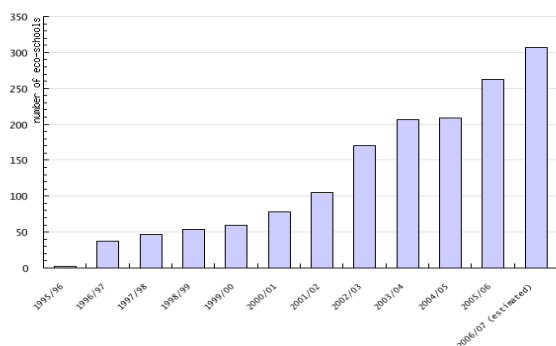

Figure 4: Number of Eco- schools in Slovenia [18]
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The educational challenges for sustainable societies are great for several reasons: (a) the global sustainability challenge is unprecedented in both magnitude and complexity, (b) there is no history of societies willingly and deliberately taking steps to institutionalize restraints and change individual and collective behaviors to achieve greater sustainability, and (c) a constructive educational response must include a comprehensive, coordinated attempt to redefine the human role in nature and reexamine many assumptions, values, and actions we have long taken for granted [9]. We must "prepare each student to lead a sustainable lifestyle" and "place ecosystems concepts at the intellectual center of all disciplines" [19]. In outlining an array of strategic actions and initiatives promoting education for sustainability, the report focuses on six themes:

1. Lifelong learning within both formal and nonformal educational settings.
2. Interdisciplinary approaches that provide themes to integrate content and issues across disciplines and curricula.
3. Systems thinking as a context for developing skills in problem solving, conflict resolution, consensus building, information management, interpersonal expression, and critical and creative thinking.
4. Partnerships between educational institutions and the broader community.
5. Multicultural perspectives of sustainability and approaches to problem solving.
6. Empowerment of individuals and groups for responsible action as citizens and communities [20].

These themes reflect an acknowledgment that education about the environment and sustainability is interdisciplinary in nature, must allow for multiple perspectives, depends on collaboration across agencies and groups, and presumes a lifelong path of learning that extends through all levels of formal education into a variety of nonformal settings. The task, simply put, is to transform prevailing mindsets to recognize the long-term limits that nature imposes and the need to "nurture, rather than jeopardize, the ecological systems" that support our activities [21]. The Guidelines provide a conceptual framework for environmental education, and they are organized around themes that are well aligned with the ideas shaping education for sustainability. Indeed, some have suggested that education for sustainability has become the new focus and justification for environmental education[22].

The organizing themes for the NAAEE guidelines are as follows:

· Questioning and analysis skills.
· Knowledge of environmental processes and systems.
· Skills for understanding and addressing environmental issues.
· Personal and civic responsibility.

These themes clearly complement the six themes of "Education for Sustainability," and they reflect a connectedness among natural systems, human actions, and the need for individuals and groups to analyze issues, make decisions, and take actions that support sustainable ecosystems. It is also clear from these two sets of themes that teaching for sustainability cannot be relegated to a single course or subject area; the themes of education for sustainability must come to permeate all subject areas at all educational levels [23].

VIII.   CONCLUSION

It is paramount importance for the company to make its sustainability decisions after it has thoroughly studied and

analyzed possible course and outcomes, risks and benefits brought about by such a decision [5]. Management should not focus on short-term benefits, but on long-term consequences of sustainability aimed at long-term efficiency and effectiveness of the company's business and environmental activities. Sustainable business can be a fatal strategic decision for the companies in the future [12]. Most of the environmental challenges we face could be resolved if each individual and organization slightly changed their habits and practices. The key to achieving this is education – providing the knowledge and desire for change to happen. A truly sustainable society will only be created when caring for the environment becomes second nature to us all Ultimately, most of the environmental challenges we face could be resolved if each individual and organization slightly changed their habits and practices. The key to achieving this is education – providing the knowledge and desire for change to happen. We as individuals, and indeed society as a whole, change our habits all the time. Ten years ago very few people recycled their waste yet today the majority have learnt the habit. For many it is no longer a conscious effort, recycling has simply become the way things are done. Small changes such as this accumulate to change the paradigm of our society. A sustainable society will only be reached when caring for the environment becomes second nature to us all.[5]. The theory on the basis of the practical experiences envisages sustainable development planning as a process of continuous improvement [17]. New environment issues dictate the redefining of economic interests in the wake of the recognition, that the natural environment is a limited production factor [11]. The interest of customers, users, developers and others in the environmental aspects and impacts of products is increasing [13]. Education for Environmental Excellence in Global Marketing is no more question. Education and environmental management with environmental policy is a first step to sustainable development. Today's students are tomorrow's leaders and decision-makers. They need to learn and practice the skills necessary to protect, preserve and restore the environment quality. Environmental education will lead to the acquisition of knowledge, the development of analytical skills, the beginning of environmentally conscious attitudes and ultimately, a responsible behavior [14].

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