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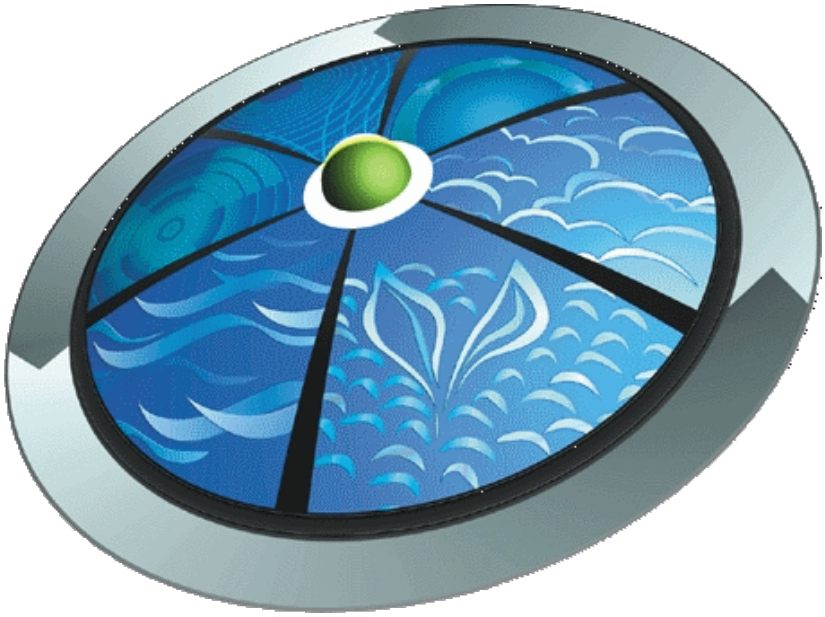
MAGYARORSZÁG MEGÚJUL
A projekt az Európai Unió támogatásával, az Európai Szociális Alap társfinanszírozásával valósul meg.

This material was made by the TAMOP-4.1.2-08/1/A-2009-0021 topic in the frame of University of Pannonia.

ÚJ SZÉCHENYI TERV

Environmental engineering knowledgebase
Series editor: Dr. Endre Domokos



20. volume

Environmental management and environmental law

Editor: Ákos Rédey Dr.

University of Pannonia – Institute of environmental engineering

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2012
Veszprém
University of Pannonia – Institute of environmental engineering

Environmental engineer knowladgebase

eddig megjelent kötetei

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3. Glossary

Total quality management (TQM): The alloy of TQM in different disciplines and driving the process, which aims to make all the activities of the organization's continuous improvement, improvement, and total commitment of all employees towards quality, in full satisfaction of the customer, reaches the product or service use. (BME TQM Center)

The integrated management systems: are called multi-band management system, which does not operate independently of each other independent of it, but closely related, interrelated, integrated with each other.

Integration of environmental aspects of the environment and use the resulting effects of certain environmental factors not in isolation, but the environment as a system should be assessed. Under the overall control of an efficient solution to environmental concerns should be integrated into the professional regulation;

Polluter pays principle (PPP): the recommendation of the OECD is based on principle, in 1974. It is to prevent environmental damage and removal costs to the polluter is required to undertake. Another approach (PUPP – Polluter User Pays Principle), the undertaking, the consumer must also involve;

The environmental management system (EMS): are joining the organization to understand the activities of which affect the environment. Designed to protect natural resources, pollution, and risks, the workers, and local residents to preserve the health.
Environmental Performance Evaluation (EPE) is a constant process and internal management tool that uses environmental indicators to compare the organization's past and current environmental performance of the organization's environmental performance criteria.

The Balanced ScoreCard (BSC) is a comprehensive framework for the leaders whose vision and strategy through a coordinated organized power the indicator system is broken down.

Life cycle: consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal.

Life cycle assessment (LCA): compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle.

Life cycle inventory analysis (LCI): phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a product throughout its life cycle.
Life cycle impact assessment (LCIA): phase of life cycle assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the product.

Life cycle interpretation: phase of life cycle assessment in which the findings of either the inventory analysis or the impact assessment, or both, are evaluated in relation to the defined goal and scope in order to reach conclusions and recommendations.

Comparative assertion: environmental claim regarding the superiority or equivalence of one product versus a competing product that performs the same function.

Transparency: open, comprehensive and understandable presentation of information.

Environmental aspect: element of an organization's activities, products or services that can interact with the environment.
Co-product: any of two or more products coming from the same unit process or product system.

Process: set of interrelated or interacting activities, that transforms inputs into outputs.

Elementary flow: material or energy entering the system being studied that has been drawn from the environment without previous human transformation, or material or energy leaving the system being studied that is released into the environment without subsequent human transformation.
Energy flow: input to or output from a unit process or product system, quantified in energy units. NOTE: Energy flow that is an input can be called an energy input; energy flow that is an output can be called an energy output.

Feedstock energy: heat of combustion of a raw material input that is not used as an energy source to a product system, expressed in terms of higher heating value or lower heating value.

Raw material: primary or secondary material that is used to produce a product.

Ancillary input: material input that is used by the unit process producing the product, but which does not constitute part of the product.

Allocation: partitioning the input or output flows of a process or a product system between the product system under study and one or more other product systems.

Cut-off criteria: specification of the amount of material or energy flow or the level of environmental significance associated with unit processes or product system to be excluded from a study.

Data quality: characteristics of data that relate to their ability to satisfy stated requirements.

Functional unit: quantified performance of a product system for use as a reference unit.

Input: product, material or energy flow that enters a unit process.

Intermediate flow: product, material or energy flow occurring between unit processes of the product system being studied.

Intermediate product: output from a unit process that is input to other unit processes that require further transformation within the system.

Life cycle inventory analysis result (LCI-result): outcome of a life cycle inventory analysis that catalogues the flows crossing the system boundary and provides the starting point for life cycle impact assessment.

Output: product, material or energy flow that leaves a unit process.

Process energy: energy input required for operating the process or equipment within a unit

process, excluding energy inputs for production and delivery of the energy itself.

Product flow: products entering from or leaving to another product system.

Product system: collection of unit processes with elementary and product flows, performing one or more defined functions, and which models the life cycle of a product.

Reference flow: measure of the outputs from processes in a given product system required to fulfill the function expressed by the functional unit.

Releases: emissions to air and discharges to water and soil.
Sensitivity analysis: systematic procedures for estimating the effects of the choices made regarding methods and data on the outcome of a study.

System boundary: set of criteria specifying which unit processes are part of a product system.

Uncertainty analysis: systematic procedure to quantify the uncertainty introduced in the results of a life cycle inventory analysis due to the cumulative effects of model imprecision, input uncertainty and data variability.

Unit process: smallest element considered in the life cycle inventory analysis for which input and output data are quantified.

Waste: substances or objects which the holder intends or is required to dispose of.

Category endpoint: attribute or aspect of natural environment, human health, or resources, identifying an environmental issue giving cause for concern.

Characterization factor: factor derived from a characterization model which is applied to convert an assigned life cycle inventory analysis result to the common unit of the category indicator.

Environmental mechanism: system of physical, chemical and biological processes for a given impact category, linking the life cycle inventory analysis results to category indicators and to category endpoints.

Impact category: class representing environmental issues of concern to which life cycle inventory analysis results may be assigned.

Impact category indicator: quantifiable representation of an impact category.

Completeness check: process of verifying whether information from the phases of a life cycle assessment is sufficient for reaching conclusions in accordance with the goal and scope definition.

Consistency check: process of verifying that the as assumptions, methods and data are consistently applied throughout the study and are in accordance with the goal and scope definition performed before conclusions are reached.

Sensitivity check: process of verifying that the information obtained from a sensitivity analysis

is relevant for reaching the conclusions and for giving recommendations.

Evaluation: element within the life cycle interpretation phase intended to establish confidence in the results of the life cycle assessment.

Critical review: process intended to ensure consistency between a life cycle assessment and the principles and requirements of the International Standards on life cycle assessment.

Interested party: individual or group concerned with or affected by the environmental performance of a product system, or by the results of the life cycle assessment.

Organization: group of people and facilities with an arrangement of responsibilities, authorities and relationships. Examples: company, corporation, firm, enterprise

Organizational structure: arrangement of responsibilities, authorities and relationships between people

Process: set of interrelated or interacting activities, which transforms inputs into outputs.

Product: result of process, product categories: services, software, hardware, processed materials

Project: unique process consisting of a set coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including the constraints of time, cost and resources.
System: set of interrelated or interacting elements.

Management system: system to establish policy and objectives and to achieve those objectives.

Quality management system: management system to direct an control an organization with regard to quality.

Top management: person or group of people who directs and controls an organization at the highest level.

Quality improvement: part of quality management focused on increasing the ability to fulfill quality requirements.

Effectiveness: extent to which planned activities are realized and planned results achieved.

Efficiency: relationship between the result achieved and the resources used.

Customer: organisation or pesron that receives a product.

Quality: degree to which a set of inherent characteristics full fits requirements.

Customer satisfaction: customer's perception of the degree to which the customer's requirements have been fulfilled.

Dependability: collective term used to describe the availability performance and its influencing factors: reliability performance, maintainability performance and maintenance support performance.

Document: information and its supporting medium.

Quality manual: document specifying the quality management system of an organization.

Audit: systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled.

Audit program: set of one or more audits planned for a specific time frame and directed towards a specific purpose.

Measuring equipment: measuring instruments, software, measurement standard, reference material or auxiliary apparatus or combination thereof necessary to realize a measurement process.

Environment: surrounding in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation.
Environmental management system: part of an organization's managements system used to develop and implement its environmental policy and manage its environmental aspects.

Environmental impact: any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects.

Environmental objective: overall environmental goals, consistent with the environmental policy, that an organization sets itself to achieve.

Environmental performance: measurable results of an organization's management of its environmental aspects.

Environmental policy: overall intentions and direction of an organization related to its environmental performance as formally expressed by top management.

Prevention of pollution: use of processes, practices, techniques, materials, products, services or energy to avoid, reduce or control (separately or in combination) the creation, emission or discharge of any type of pollutant or waste, in order to reduce adverse environmental impacts.

4. Preface

It is especially the boom after the Second World War that made running up production, selling and consumption of bulk articles possible. For the wide range of people, the “bait” was the availability of abundant material goods, and for manufacturers, it was the opportunity of immediately growing rich. Abundance provided a fast increase in the living standard and at the same time, as a consequence of this increase, it also predicted the gradual deterioration in the quality of life. If we look back – after several decades later –, such an increase in the living standard has not proved to be absolute advantageous.

Wilding, wasteful consumption and prodigalism accompanying the economic growth became general. While previously this was exclusively the privilege of a limited „élite”, with the acceleration of growth, this became general for people having an average income and even for those who have less than the average one. Since the low qulality, the very short lifetime, the bulk junk produced for usage, services of low quality and the cheap disposable goods concomitant with them pretend a certain kind of „rich” lifestyle, the wastefulness, the short-time “overproduction of junk” became the feature of social class belonging rather to the lower category of income and unfortunately becoming wider and wider.

Of course, all this is promoted by advertising, expanding consumer credits, manipulating general public and making a fetish of wasteful lifestyle. The waisful consumption became „democratized” and for the past decade it has become „available” for everybod – according to their needs.

In Hungary, at the change of regime and the appearance of multinational firms, an attitude has became nearly general. This attitude interprets even the spiral of growth that the increase in the wasteful consumption creates new demands, however this results in further wastefullness, waste material and environmental pollution. Unbounded and wasteful growth of production, service provision and consumption put an extaordinary load on the biosphere and, on the one respect, it exhausts natural resourses and, on another respect, by loading and polluting them, it creates conflicts and social problems. By this, the social driving force of economic processes also becomes the hindrance of these processes.

So it is not a chance that in our days economic growth cannot be evaluated in and for itself exclusively. The basic reqirement of forming our future is to meet the conditions of sustainable development by studying the interaction between the environmental protection and the economic sphere. To meet these conditons, strategical activities and series of actions are necessary. The significance of the environmental strategy is not questionable from the point of view of either economy or politics or society.

Assuring the trouble-free process of sustainable development is one of the pledges of forming our future. We all, as researchers, entrepreneurs, civil cervants or any citizens, are the participants in forming our future. Thus, the knowledges of the environmental strategy are important for those who intend to connect their economic interest with their commitment to the environmental protection: managers who want to form the future of their companies and enterprises, economic specialists sensible to environmental protection and environmental experts building the future of regions and settlements.

In the following sections, this subject-matter of instruction provides the environmental experts working in different fields of environmental protection and dealing with different environmental issues with knowledges by the aid of which an economic sector, a local government or a company can develop their environmental strategy.

5. General Questions of Environmental Strategy

What is the strategy? This concept is a Greek word, originally related to the art of war. The strategy is „the science of the preparation and conduct of large military operations, military expeditions and wars and the procedure or entirety of procedures applied during military operations". Albeit I referred to the interpretation of the concept of the environmental strategy in the Preface, maybe an interpretation worded on the analogy of the military strategy is not negligible, either:

The environmental strategy is the science of preparing, controlling and conducting operations we have to carry out out to protect resources and natural and man-made environment as well as a procedure or the entirety of procedures applied during actions.
However there is no exact definition in scientific literature for the modern interpretation of strategies, but the most important criteria can bring the terminology nearer to the reader. Such are: the strategy is a means for forming the future; the establisment of conditions of future forming is implemented through stragegic actions and series of actions; the function of a strategy is to launch changes by means of which we can increase the chance of a lasting success, etc. Note that these criteria cannot merely be interpreted in the field of economic strategy.

5.1. Features of Environmental Strategies, Strategic Levels and Changes

Considering that environmental protection is the entirety of social, economic and technical (natural scientific) processes and strategic planning is the conditon of future building, the environmental strategy cannot be regarded as a simple technical, economic or political category, but as a complex vision-centric process built on today's basis.

Environmental strategy planning is a continuous activity, which is generally done for a longer term (however we also know and apply planning for shorter term), and its goal is to bring business organizations or activities in progress, established or started to improve the state of environment, resp., in a „winning position". Since the environment of the implementation is in a continuous change, the funciton of the strategy is to timely start the changes by which the chance of steady success can be increased.

Environmental strategies can be as follows:

- global (e.g. pan-European, UN, EU, etc.),
- territorial or regional (e.g. Duna Valley, South-Lowland, etc.) and
- local (e.g. for a settlement or for a plant) environmental strategies.

The levels of strategy can also be defined from the point of view of a national economy or a business organization. From the point of view of a national economy, the levels of the environmental strategy can be:

- interdisciplinary (strategy of several fields or that of several sectors)
- particular (partial strategy restricted, not affecting the entirety) and
- functional (e.g. strategy of finance, education, innovation, etc.) strategy.

The levels of a corporate environmental strategy, for instance, in case of a company dealing with environmental protection, can be the level of :

- the entire company,

- shop and production units, and
- functional units.

It is the level of managers that is responsible for planning and implementing the strategy of the entire company. Planning has to cover all the activities related to environmental protection of the company. The strategy of the entire company consists of the synthesis of the strategies of the individual production units. Of course, putting individual strategies of medium level next to each other is not enough. To develop the strategies of production units, their interaction has to be taken into consideration. Functional strategies include the strategies of HR management, financial planning, international relations, research and technological development, marketing etc.

In recent years, the environmental protection too has been influenced by the faster and faster and unforeseeable changes of the economy. The conciliation of the interests of the environmental expectations as well as the those of participants in the social life and economy and even the long-term interest of environment protection at a macrolevel and the short-term political and economic interests is more and more difficult. It is only the organizations perceiving these changes in time and assessing the intenal requirements of changes and taking the necessary actions in time that can conquer the changes.

Social processes are indispensible in perceiving changes, particularly in the field of environmental protection. Thus, the participation of the community (co-workers in an organiziation) in developing, controlling and implementing the strategy is essential. The successful implementation of the strategy in the function of changes postulates such features the existence of which is not a question of money or material conditions but much rather expertise and culture (Csath, M. 1996).

These are as follows:

- attitude looking ahead, future-oriented and thingking in advance (capability for creating vision, revealing of strategic opportunities, timely identifying risks and capability for managing uncertainity and risks),
- lively reacting to information, continual looking out (capability for managing and considering information, hankering for information, demanding on getting acquainted with environment, etc.),
- capability for controlling our fate and future (active participation in the control of the future, exploring the opportunities and determining of the right direction of mission. etc.),
- capability for handling people (labourforce, team building, support, opportunities for decison making, etc.),
- continual seeking for opportunities (seeking for new products, services, solutions, R&D, as well as innovative results),
- managing complexity (national and international interrelations, conflict management, creation of coalition, diffusion orientation etc.)
- capabilities for changing (assessing demands, flexibility, capability for making decisions, creativity, continual learning, captivating and involving people, etc.),
- turning negative situations into positive ones (capability for recognizing advantages in addition to disadvantages, seeking for harmony, managing losses and gains politically, etc.),

- looking inwards with an outside attitude (capability for judging our situation from others's point of view),
- continually developing knowledge base (getting and actively using up-to-date and reliable knowledge),
- moral behaviour (taking social and environmental responsibility, creating values, showing risk bearing attitude, etc.),

The importance of strategic planning is mostly justified by the following processes:

- environmental uncertainity is increasing, and the cognizability of environment is getting worse,
- the rate of changes is increasing in relation to both environment and the economy,
- the possibility of cognizability of the future is getting worse and the rate of unexpected events is increasing,
- the effect of globalization is intensifying,
- the demand on strategic partnership is increasing,
- the expansion of regionalism needs the establishment of new systems of relations.

The rapid development of methodology of strategic planning provides new opportunities in the environmental strategy as well. While in the 1950s and 1960s simple pedictions, trend calculation, regression analysis were available, in the 1970s portfolio analyses, scenario models, solutions of matrix theory as well as SWOT analysis became general. The application of Porter model, Value ChainAnalysis and the 7S model were the results of the 1980s. In the 1990s, capability building, benchmarking, balance scorecard, TQM, organizations with less levels and resulting in more effective operation, process-oriented attitude, reengineering and, after 2000, change management, knowledge management, methods of network organization and seeking for competitive advantages based on different national cultures dominated in the world (Csath, M.2004).

The application of new strategic methods in planning the environmental strategy is still delayed, and generally scenario models and SWOT analysis became general – in several cases, in a dilettante way. For analysing, the application of mathematics methods of economy is timely even today.

5.2. **Theories of Strategic Planning**

To develop a good and efficient planning method for the environmental strategy, we have to know the possible approachings of strategic planning. According to Whittington, R. (2002), an English economist, these are as follows:

- classic school,
- school of progress,
- school of procedure, and
- school of system principle.

The representatives of the *classic school* say that the strategic planning has to be focussed, first of all, on maximizing profits. Its conditions can mostly be ensured by strategic planning based on rational principles. In the course of strategic planning, the fields expected to yield most profit

have to be aimed. Planning has to start from above and the principle of the highest efficiency has to be followed. Of the strategies developed in the field of environmental protection in the end of 1980s and in the beginning of 1990s, the strategy for protecting air quality proved to be exemplary, because of the emission of transport and power plants, the latter was given priority, and in this way we managed to meet our obligations undetaken in international conventions by an efficient strategy – achieving the highest effect with the smallest investment. Reducing the emission of transport drastically would have called for much more money and time.

The *school of progress* can be featured by the fact that participants of the economy carry on a continuous fight for survival, so more and more alternatives have to be continuously developed and managed in the strategy. The followers of this school are not confident that the strategy would be a rational action, and managers make decisions prudently and objectively. Majority of them claim that individual strategic steps are always decided by markets, the continuously changing demands of the community or a monopolistic position. This approach is shockingly similar to „green strategies", which, in the overwhelming majority of cases, are based on factors of uncertainty and the distrust thought of the management. The followers of the school of progress are fatalist, they believe in chance and the omnipotence of the effects of external factors.

The followers of the *school of procedure* do not believe in rational and emotionless strategic planning, but they have doubts about the omnipotence and completeness of markets. This approach assumes that decisions within the organization are made in accordance with an established routine but the logic of market is also based on customary law. From the point of view of the environmental strategy, this logic is strongly detrimental to the improvement of competitiveness based on environmental innovation and to the effective attitude on international markets. Albeit, no considerable strategic plan has been drafted for the development of environmental innovation for years, still competition systems in progress justify that rationality and emotionlessness are usually missing from conceptions and they rely on regular and used markets.

The followers of the *school of system principle* believe in rational and logic strategic planning, keeping in mind that strategies are developed by people so they cannot be completely emotionless. They are confident that strategic plans spreading to the future can be developed, but they do not believe in the general applicability of models and methods. They hold that the successfullness of the strategy depends on the „social integration", i.e. social demands have an influence of great extent on the successfulness of the strategy. This can question the universal applicability of the methods of strategic planning, since the strength of social influence can modify the course of processes. As to environmental protection, it is this strategic approach that seems to be the most reasonable, considering that the social function can have determinant part in the decisions of environmental strategy.

It is in the 1960s that the classic school was determinant and it was essentially built on economics. In the 1970s, the internal position (people, interests, internal corporate policy) came to the front and the psychological attitude of negotiation of the school of procedure became dominant. In the 1980s, the adaptation to the extenal circumstances, joining international markets and participating in the international distribution of labour became already dominant, primarily on the basis of economic and scientific reasoning. Since the 1990s, the stategic school of system principle has almost generally come to the front, taking the external and internal social, political and cultural relations into account.

For all the four schools, two methods applied to solving strategic problems can be realized:

- the first approaches from the side of methods (their variations can give solution to all questions), while

- the second starts from problems, and seeks for methods to solve them.

Considering the points of view of the four schools, we can find that they are between the two extreme opinions, depending on how much significance is attributed to logic, rationality in the process of developing the strategy, and how much to the subjective and creative elements. Accordingly, we can speak of rational and creative approaches (Csath. M. 2004).

In case of rational approaching,

- seaking for solution takes place analytic methods reasoning on logical basis,
- emphasis is shifted to consistent thinking and objectivity,
- strategic planning starts from the past and present,
- the nature of the way of thinking is vertical, and
- strategy development is regarded as a science.

In case of creative approaching,

- seeking for solutions is carried out by intiutive methods, including seeking for opportunities logically unimaginable as well,
- strategic planning leaves the generally accepted methods, and stresses subjective opinions,
- strategic planning starts from the future,
- the way of thinking is rather horizontal, lateral,
- strategy development is regarded as an art.

5.3. **Strategic Planning in Environmental Protection**

In the 21st century, strategic planning in the modern environmental strategy has a double function. A pure phase of planning includes the formulation of the strategic task, and a phase assisting the implementation incorporates the planning of actions necessary for the realization of the strategy. In case of economic strategies, these two phases are termed strategic planning and management.

So strategic planning

- has the task to set the environmental goals, find the ways leading to the goals, considering the circumstances of micro- and macroenvironment,
- is the carrying out of comprehensive analyses to ensure our future and plan and introduce the fundamental changes assisting the establishment of long-term harmony with the environment,
- is a process, in the course of which we determine general long-term goals and performances belonging to partial goals of shorter terms, by means of which the state of environment formulated in the vision can be achieved in an optimal way,
- is a proces, in the course of which we define actions for goals and partial ones, by means of which the goals can be achieved within a given time. We manage the carrying out of actions and continuously evaluate the results.
- is not a collection of methods, but analytical thinking, planning and implementing processes and making resources available for carrying out actions,

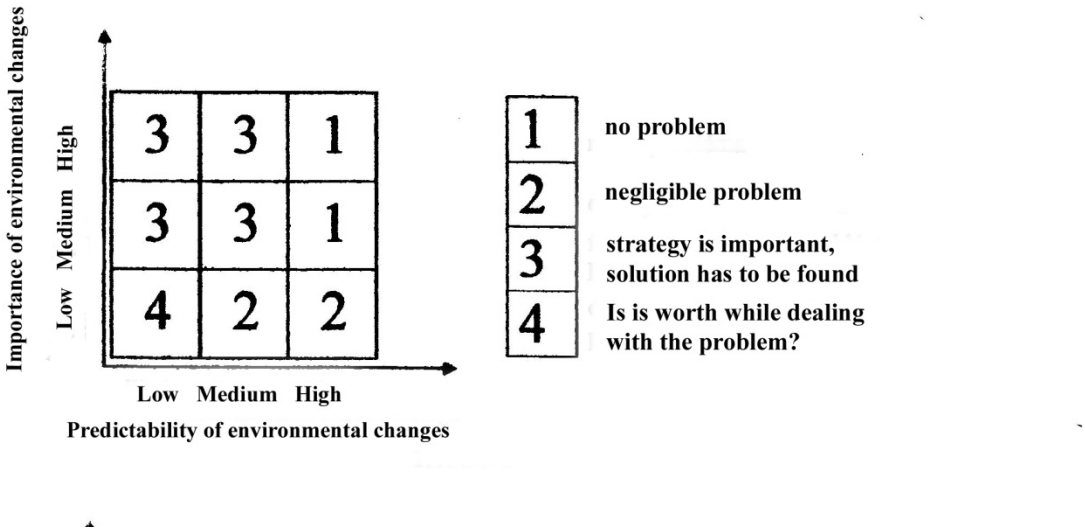
- is a process of continual re-creation, an initiative activity in the course of which we approach the mutually defined vision by means of continual changes, changings and developments and utilization of distinguished capabilities.

From the point of view of strategic planning, the knowledge of micro- and macroenvironment, the appraisal of changes, the security and reliability of information are important factors. Before we would start the planning process, we have to be fully aware of the importance of the environmental changes, the predictability of changes as well as the impacts of these changes. To judge the environmental problems, an aid is given by

- the matrix of environmental foresight and
- the matrix of environmental impact.

According to Csath M. (1966), both matrices can be well applied in planning economic strategies, and with miner alterations it also works well for environmental strategies.

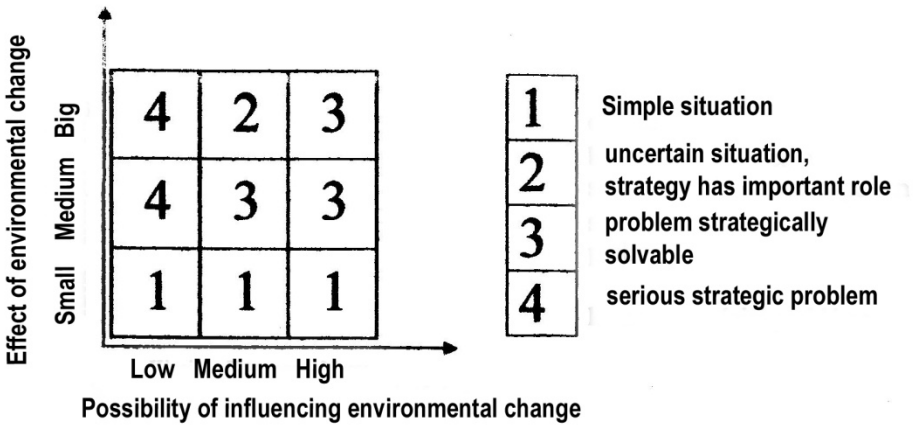
The matrix of environmental foresight shows how easy is for strategy developers to get acquainted with environmental changes, and how important these changes are for the human race, a nation, a region, a company etc. In this way, we can select the environmental elements that can be hold important from the point of view of the strategy. Figure 5.1 shows the matrix of environmental foresight.



5.1.Figure. Matrix of environmental foresight

On developing environmental strategies, the environmental elements defining the levels of decision making and criteria (social, economic and technical (technological) elements and their information) are of high importance.

The matrix of environmental impact opens the way for us to take the opportunities. Reconizing emergencies and the possibility of influence can partly ensure for us to avoid uncertain situations, and to take precautions against emergencies in time. Figure 5.2 shows the matrix of environmental impact and its strategic evaluation.



5.2. Figure. Matrix of environmental impact

Depending on in what way and to what extent we manage the strategic planning works and on what knowledge and capacities (skills) we possess and to what extent we take the ideas and proposals for changes of the society into account and to what extent we can have an influence on the environmental changes under the given conditions of environmental changes, we can speak of two kinds of strategies.

- active (going ahead) strategy and
- passive (reactive) strategy.

We speak of an *active strategy* if we foresee and evaluate the necessity of changes occuring in environment, and drive our neighbourhood to do so, and we initiate to do something new and else than others do. I go to meet changes, moreover I myself help them be induced. For all these, I use new knowledge and creative strategy development. For instance, an innovative environmental strategy improving the international competitiveness can be developed by applying this method.

We speak of a *passive strategy* if I follow changes, apply stop-gap solutions, try to get international money, and I get knowledge subsequently and plan actions following the events. We will have such a strategy if I want to achieve the environmental vision by using current technologies, and apply “end-of-pipe” technologies, and I acquire all these, together with operating instucions and possibly by international support, in international markets.

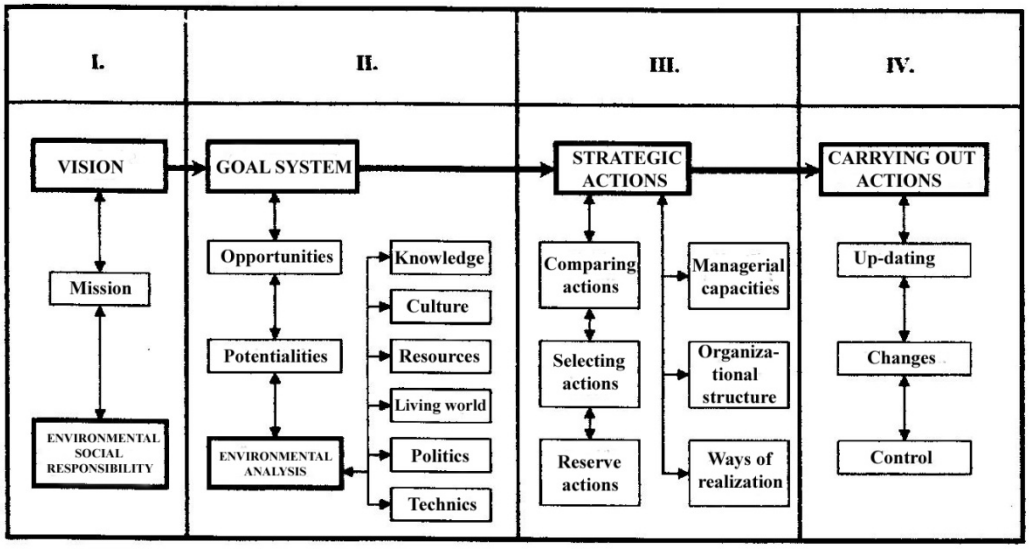
It does not matter, either, from where the strategic planning starts. A strategy can be:

- of origin from above, and controlled from above (e.g. government strategy for sustainable development, etc.),
- of origin from below, but controlled and co-ordinated from above (e.g. making use of EU assistances, etc.),
- managed at a medium level, but involving the lower and upper levels (e.g. regional strategy of waste treatment, etc.), as well as
- of origin from below and requiring implementation by companies (e.g. an EMS strategy).

6. Process of Strategic Planning

Strategic planning is the activity on the course of which by analysing the nature of changes in the environment and understanding them better and better, we form the methods and procedures applied to modify and improve them and manage their implementation with increasing chance.

A simplified version of the process can be seen in Figure 6.1.



6.0.1. figure Sketch of strategic planning process

The individual elements of the strategic planning process are interrelated with each other. This interrelation is generally bidirectional, and mostly we regards the vision as fixed and defined in advance. For environmental tasks, it is the vision and the environmental and social responsibility that are essentially determinant in planning actions. Considering the limits of actions, the change in the vision cannot lead to compromise but to opportunism. This is not in conformitiy with the ideology of the active strategy development yielding a winning position. If we adapt the vision to actions, it can result in a passive strategy. Formulating and planning strategy begin expediently with forming social responsibility.

The process of strategic planning consists of four phases, as can be seen in Figure 6.1:

- phase I is a creative one, in which we formulate our vision, mission, the question of environmental and social responsibility in the function of values and interests;
- in phase II, building and analysing the hiearchy of goals take place, therefore this phase is called methodological and rational one. The methods of analysis can be different: SWOT, PEST, model of Porter' 5 competition forces, portfolio, etc.
- phase III is also a creative one, which includes the actions, considering the differences between the individual alternatives, the ways of implementation as well as it lays down the organizational and managing conditions in the function of the actions;

- phase IV is the realization of actions, which can be regarded as a rational phase again. It is based on realitiy and it also takes the possibility of correction and modification several times.

In the followings, let us see the strategic planning process with a little bit more details phase by phase.

6.1. **Vision**

The vision is the determination of a target state which permanently shows the direction to be followed by each participant carrying out the strategy. The target state has to be fixed on every level of the strategy. In this respect, it does not matter wheather we are speaking of the implementation of the strategy of a company, a settlement, a region, a country or an international strategy.

To implement a strategy successfully, it is important for us

- to form a real vision,
- to make people concerned acquainted comprehensively with the vision,
- to strengthen the commitment to the vision, as well as
- to ensure that the individual partial goals and actions can remain within the limits defined by the vision.

At the same time, the formation of the vision is a choice of direction, too, and reveals the developers's scale of values, activity and suitability for taking risks. It is by the aid of the vision that we can concentrate on innovation, developing capacities (skills), carrying on acivities and remaning in competition. In case of economic strategies, we can speak of a competition-centric vision or a change-centric one. The environmental strategy knows and applies both visions independently of the ways the socio-economic conditions make reasonable for environmental protection.

In 1994, a professional team established by the Hungarian Academy of Sciences, headed by Láng, I., member of the Academy, completed volume 1 titled Természeti környezet (The Natural Environment) of an essay titled Magyarország környezeti jövőképe (Environmental Vision of Hungary). Since than the conclusions of this essay have been frequently cited, and the three scenarios, selected from the point of view of strategy, exist completely even today.

The writers of this essay took long term social, economic and technological conditions into consideration to define the directions of development. They made efforts in order that the individual directions will not deviate unfoundedly from the tendencies of economic development in question, and at the same time, they will be characteristically different. Priority was given to the reasonable utilization of environmental resources and the enhancement of environmental awareness. As in the case of each vision formation, they took the environmental and social responsibility into account, assuming the strengthening of achievement of middle-class status, the increase in the differences of individul and particular interests and the established state of democratic governing forms and systems of interest enforcement. This essay considered the changes of the domestic and European tendencies that were predictable that time, their interaction and the results of these effects.

Though, the development of several versions came up, the writers of the essay have prognosticated the formation of three fundamental and characteristic visions. These are as follows:

- scenario of *environmentally sound change of structure*, in which it is only the development of environmentally sound sectors of the economy that are primarily given priority,
- scenario of *change over to environmentally sound technologies*, where technologies currently polluting environment will be replaced by environmentally sound ones, and
- with *the surviving current structures*, the scenario of carrying out the necessary „end-of-pipe" interventions.

Since when Hungary became a full member of the EU, the conceptions of environmental strategy for the European Union of Hungary should also come to the front. From the point of view of visions representing the possible directions of development, it is possible that two fundamental arranging principles can be enforced . One of them is the unavoidable globalization, the negative impacts of which have to be managed, and the other is the position of environmental protection on the scale of values of Hungary. The successfullness or the lack of success in the national changes depends on whether the strategy of sustainable development can be implemented during the coming 20 to 25 years, or not. As a combination of these two arranging principles, we can take four essential versions of vision into account with realities of not obsolutely the same.

The four visions imaginable in this way:

- the scenario of *sustainable chance*, which assumes that the chances of sustainable development in Hungary will be the same or nearly the same as in the other member states of the EU and the implementation of the environmental programs of the EU will be successful in all member states.
- the vision of *East of Eden* assumes that the environmental programs of the EU will be successful, but the environmental aspects are not given priority in Hungary and in some other nations having acceded to the EU together with Hungary. Of course, Hungary too has to meet the expectations of the EU, but because of derogations we will be delayed, owing to this deferment we will neglect some environmental tasks for year.
- the scenario of *ragweed and concrete* vision is a pessimistic version, according to which the environmental programs of the EU will fail and no priority will be given to sustainable development in Hungary, either. In fact, this is a scenario of „catastrophe" from the point of view of both the economy and the society. On the basis of the current trends, we cannot expect such a secenario, however it can have partial results, which mean a warning for the future.
- the unsuccessful *"oasis in the desert"* environmental policy of the EU postulates, at the same time, a successful national environmental policy ensuring the conditions of sustainable development. It is not probable that an unsuccessful environmental policy of the EU would result in a opposite one just in Hungary, but it can be imagine that interests of some regions cause the strengthening of natural and environmental protection in these regions under pressure just because of the disproportions in Hungary.

In general sense, the environmental strategy of a company can be either competition-centric or change-centric. In case of a company dealing with environmental protection or related to the environmental industry, in connection with its vision, there are three fundamental tasks:

- an attractive, creative but attainable vision has to be formulated,
- getting all the employees of the company to accept the vision,
- the firm has to be managed every day in such a way that it will strive to attain its vision.

As a matter of fact, EMS means such a strategic planning where the vision is the state the company intends to attain by its environmental actions. In this case, the vision can be regarded as change-centric. If the goal of a company is to ensure its international competitiveness by environmental investments, e.g. by making environment-friendly products, then its environmental strategy is competition-centric.

It is important in all cases that vision should be attractive and feasible because, according to Csath, M. (2004), such a vision:

- determines the work and assists decision making and controlling,
- holds up and inspires people to attain the common goals, and assists inherence and creative culture,
- assists in concentrating to important things and discerning them from those to be done urgently,
- mobilizes, encourages innovation, particularly when the driving force of vision is higher than that of the elements of the control system based on frighteneing, and
- makes keeping relations in mind, holistic and system-oriented thinking and decision making possible.

The *mission* is interpreted in various ways and it is generally confused with the vision. In case of a company, the interpretation of this concept is relatively easy: the mission is the scale of values the company would write on its flag, if any, in other words, the mission is not other than the purpose and reason of the company's existence. A strategy developed by an environmental organization essentially reflects the calling, the mission of the organization, and at the same time, it is the reason for the existence of the organization and the mission of the institute. In general, we can say that a mission embraces activities that are typical and mostly promote the attainment of the vision.

For instance, the international competitiveness of a company is mostly ensured by innovation, therefore the mission that can be written on the flag of the company operation: R&D and environmental innovation. If the environmental strategy in a region fundamentally aims at ecotourism and organic farming, then its mission is the protection of natural values. If the strategy of a company intends to attain an increase in production and an improvement in quality and efficiency, the company can also chose the respect for employees as a mission. For a nation having a strategy of sustainable development, the mission can be the preservation of environmental values.

6.2. **Environmental and Social Responsibility**

Today, in the beginning of the 21st century, the protection of our environment is a sound strategic goal globally but even for a company as well. Companies polluting environment can have a serious loss of income, even if they momentarily evade environmental fines, if customers feeling responsibility for the state of environment will boycott to buy their products. Likewise, a nation polluting environment can loose serious advantages if it does not meet the environmental prescriptions of the EU.

Taking environmental and social responsibilities means a behaviour by which strategy developers try to minimize negative impacts exerted on environment and society and maximize services and values provided for the society, and in parallel to this, preserve and improve the state and values of environment.

From the point of view of environmental strategy, environment can be:

- microenvironment (so-called basis environment) and
- macroenvironment (in other words, general environment).

A unit (a company, a local government, a settlement, a region or even a country) on the activity of which the strategy is concentrated can be regarded as microenvironment. Natural, economic, political and social environment surrounding a microenvironment can be regarded as macroenvironment. Porter, M.E.(1980) described the composition of micro- and macroenvironment as follows:

The *general components of macroenvironment*: social – cultural, economic, political – and legal environment, levels of technology and knowledge, global and regional intstitutions as well as risk bearers beyond direct interests.

The *components of microenvironment* (environment of competition and market): companies, institutions or administrative units themselves, suppliers, buyers, existing and future competitors and substution products.

In respect of the strategy, the individual components of environment can have direct, indirect or indifferent effects on the strategic goal or on the planned strategic actions. The direct or indirect effects can concern

- employees, co-workers,
- those who are intersted,
- people (peoples) living in the environment,
- civil, economic and political groups of interst,
- vocational associations and
- the relations of companies and institutions developing the strategy.

Let us consider what corporate activities can be put into the subject of taking responsibility from the point of view of environmental protection:

- activities related to consumers (the company does not produce and sell products and technologies harmful to health or causing emergencies, use misleading ads and tempt consumers to take consumer habits perilous to them and unacceptable from the point of view of environment and public health by its advertising),
- activities related to employees (the company does not apply technologies harmful to health, working practices harmful to health on a longer run, and it ensures proper, safe and healthy working conditions),
- activities related to environment (the company does not pollute environment either by emitting harmful substances or noise or disuturb natural surroundings and landscape),

From the point of view of successful strategic planning and managing, it is important for us to make social sensitivity clear towards both the priority of the solution of environmental problems, and technics and technologies applied in environmental protection.

To what is the society sensitive?

I general, the priorites of environmental problems are determined by

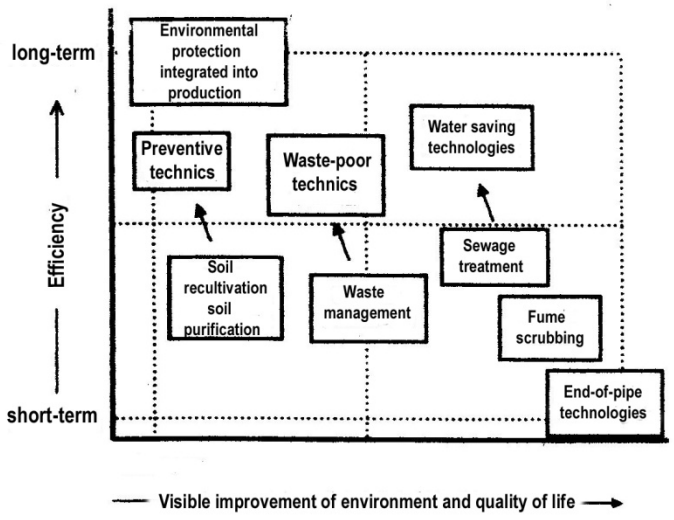
- the circumstances under which pollution was produced,
- the mobility of the polluting effect,

- the durability of the polluting effect,
- the spectacle of the pollution.

Social priorities are variable, they are frequently different even within a region. In the 1990s, it is the quality of air that played the leading role throughout the county, and later on this was replaced by the quality of water or the treatment of hazardous waste materials coming in the front. Perhaps, it is to the problems related to the quality of soil that the behaviour of the society is mostly indifferent.

As to the introduction of environmental technologies, it is dominant even today that the society concentrates, first of all, to the application of „end-of-pipe" technologies. Their results generally appear faster and more spectacular, and their application is cheaper and better suits the limited economic possibilities. Environmental protection integrated in production and said to be the fundamental condition of sustainable development, i.e. applying preventive environmental technologies is more expensive and their investments keep on, therefore the community can only gradually rely on their expansion. The greater problem is that it is the short-term developments that are determinant for politics as well, so preventive interventions yielding results in long-term do not play determinant role.

Figure 6.2 shows the priorities of the application of environmental technologies.



6.0.2. figure Social priorities of the application of environmental technologies

The priority system of society shown in the figure is base on a survey conducted in an industrial region in 2006, so it also shows its specific problems. Of course, national priorities have different characteristics in the territory of the country so they can be different, but for the safe implementation of the strategy the conciliation of priorities with people is absolutely necessary.

For the successful acceptance by the community and involvement of people in implementing the strategy, it is important and inevitable for us to ensure a harmony with different development conceptions and, particularly, with the regional development conceptions.

The question comes up that whether the employees themseves of firms or organizations and the society live according to the vision or rather the mission It is of the utmost importance in the environmental protection that high appreciation of creative people striving for innovation

should be the part of the mission. Nevertheless, in practice we can find that officials of higher rank are affraid of, or, in a better case, feel an aversion for subordinates having independent thinking and nervesly react to people's critical objections and improving intentions. Accoding to Csath, M. (2004), such an interpretation of the environmental and social responsibility causes serious disorder in operation and deteriorate human relations as well.

A similar situation comes up even in the case when the conditons to be met by the responsibility to the society of the native country and those compulsorily to be met by the requirements of the EU are not the same. The quality of products for international markets meets the environmental requirements, they are marked with a logo of environment-friendliness but in case of products for home market, cost reduction is put in the front and, with or without a logo of environment-friendliness, environmentaly unsound products are marketed or technologies detrimental to environment are exported.

7. Environmental Vision and Goal System of Attainment

The first elements of strategic planning is the environmental vision and its fundamental principle: defining the mission. It it advisable for us to take scenarios worded in chapter 2.1 into consideraton – adapting them to appropriate practical situations. When we develop either a national or a regional or a corporate environment strategy, the starting basis should be, in any case, in accordance with the development perspectives the economic situation and international relations of the country make possible.

7.1. Environmental and Economic Conditons of Forming Vision

Laying the foundation of a strategic vision is made possible by the following alternatives of development:

Since the scenario of *environmentaly sound change of structure* is based on considerable changes, so the change-centric vision is focussed on changes. It postulates an optimistic prognosis represented by economic predictions, which, at least, reckons with a continuous yearly increase in GDP of 5.0%-5.5% and assumes the stucture change of consumption and production, in which environmental aspects are highly emphasized. The differentiation of the degree of supply of the society decreases, distribution becomes more equable and its quality and value improve. The extent of the use of natural resources does not increase, but their exploitation will be more reasonable and their use will be more efficient. Economic branches and sectors making the adherence to environmental requirements more difficult or hindering them from being met fall into the background but environment-friendly economic activities will be determinant. Thus, the economic structure changes, R&D, innovation and education get stronger, the culture of society and the demand for quality increase, and the use of environment-friendly products and technologies becomes general.

The scenario of *change of technologies to environmentally sound ones* can also be regarded as an optimisic version in a long run, it stresses the changes of applied technologies, so it can be regarded as a change-centric vision. Since the complexity of tasks also aims at the improvement of competition conditions, therefore it is regarded a competition-centered vision as well. With the change to environmentally sound technologies, the structure of consumption and production moves towards that of the developed Middle- and Western European countries, the utilization of natural resourses increases, but the rate of the renewable ones utilized does not increase. The specific environmental load decrases throughout the country, and the regional distribution is equalized. Of course, this can mean that the load can strongly decrase in certain regions but in other regions we have to reckon with an increase in the environmental load. The basis of the development and changes is that, in addition to minor changes in economic structures, preventive environmental technics and technologies integrated into production will be widely applied, possibly in all economic sectors. The part of innovation is determinant and of strategic importance and the innovation is an improving instrument of competitiveness. This scenario, for attaining vision, can be imagined with an increase in GDP of minimum 4.0%-4.5%.

With the *survival of the current structures*, improving the state of environment and keeping the competitiveness on the current level under limited economic conditions (the increase of GDP does not reach 3.5%-4.0%) can only be attained by means of “end-of-pipe” technologies. Instead of changes, it is almost exclusively the maintenance of competition position that can be the determinant factor of vision, therefor here we can plan to attaing a competition-centric vision at best. “End-of-pipe” technologies can give visible results in a short run, however they

only delay the solution of problems, but they do not eliminate them. However, limited economic and political interests are generally not capable for supporting the long-run environmental protection serving sustainable development and integrated into production on a strategic way. It is noteworthy that in the beginning of the 21st century, the environmental conceptions in Hungary regard this as a real vision almost exclusively.

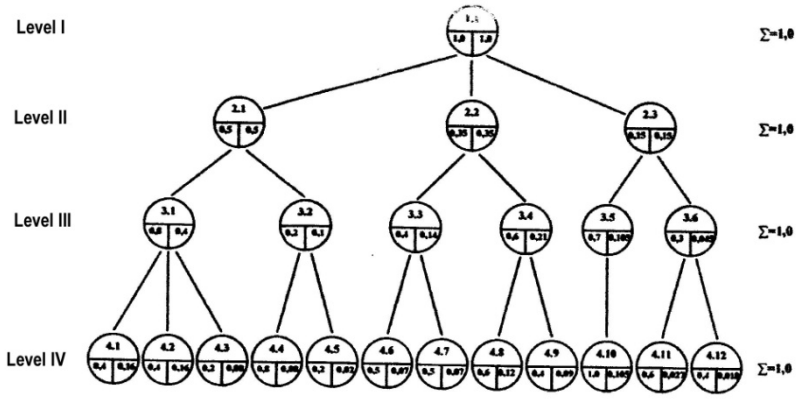
Data concerning the increase in GDP can be deducted from the considerations of the economic policy of the past decade.

7.2. Strategic Goals and Goal Systems

The set of goals and goal systems is essentially determined by the expectable variations of the vision. It is important for us to create a real vision because successful implementation can be attained in this case only. In the course of analysing goals and partial goals, we frequently find out that the vision is based on the realization of unfounded goals and at the same time, the vision cannot be the sacrifice of the creation of an inefficient strategy.

In the function of the vision, the next step in strategic planning is to set up one or more goal systems. It can happen that there are more direction leading to the realization of the vision, and each of them calls for attaining important goals. For simpler strategies, the vision calls for attaining one strategic goal, so a goal hierarchy can be assigned to this vision (Fisher, L. 1971). At the same time, a goal hierarchy sets the levels of the strategy, on which the state of goal has to be kept, independently whether a corporate, national or international strategic planning is in question.

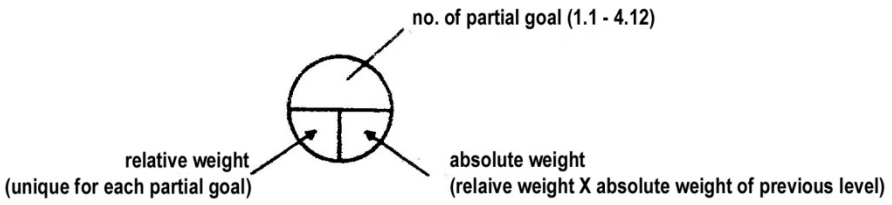
To present a goal system and determine the states of goals, it is the best for us to use a goal diagram, in which partial goals and their weight in the whole system or within its goal hierarchy can be specified. Figure 7.1 shows the goal diagram of the investement of a waste material treatment sytem.



7.1. figure Goal hierarchy system (goal diagram) (Source: Fischer, L. 1971)

The breakdown on the lower level of a well-constructed goal hierarchy is already so detailed that the goal can also be considered the goal of the action. A sound strategy can well make use

of the absolute and relative weight of the individual partial goals in deciding the importance of individual actions. Figure 7.2 shows the elements of a goal diagram



7.2. figure Elements of a goal diagram

Let us fill up our goal diagram with proper a content.

1.1. Main goal: (Level I) Investment of a waste material treatment system

2. Partial goals (level II)

- 2.1. Eliminating deficiencies
- 2.2. Area planning, inducing needs
- 2.3. Financial goal, economical investment

3. Partial goals (level III)

- 3.1. Enhancing performance
- 3.2. Implementing new investment
- 3.3. Planning of weighted areas
- 3.4. Activating private sector
- 3.5. Exerting influence on economic activity
- 3.6. Reducing costs to minimum

4. Partial goals (level IV)

- 4.1. Applying new materials and technologies
- 4.2. Collecting waste materials selectively
- 4.3. Compressing, dehydrating
- 4.4. Establishing up-to-date protection
- 4.5. Reducing risk of accidents
- 4.6. Modernizing transport
- 4.7. Building new regional roads
- 4.8. Serving new industries
- 4.9. Serving new residential areas
- 4.10. Setting starting time
- 4.11. Reducing building costs to minimum
- 4.12. Reducing operating costs to minimum

It is advisable for us to break down the goal diagram to a level, where, from the point of view of implementation, one partial goal practically means one task, or includes one „action". In this way, we can analyse and evaluate tasks strategically almost equivalent.

7.3. **Analysing Opportunities and Potentialities**

Before starting strategic analysis, it is advisable for us to consider under what political, social, technological and economic circumstances we will implement our strategy. Scilicet, strategic actions can be regarded as a function of more variables that are limited by opportunities and potentialities.

Opportunities determine the scope of action within which goals set can be successfully attained. *Potentialities* assist in carrying out actions within the scope of action. In the course of consideration, we explore the opportunities and potentialities for implementing partial goals deduced from goal diagrams and probably treated as possible actions. We can make the analysis of environment more comprehensive if we study opportunities and potentialities on a higher level of the goal hierarchy then, with this knowledge, we go on with building our goal system.

For instance, the sensitivity of the community to some environmental problems or economic conceptions of the development of a region, serving environmental protection as well, can be regarded as an opportunity. The proficiency or available resources of a company ready to co-operate can be a potentiality. For instance, the utilization of an environmental competition is an opportunity, and the nature of environmental protection of the region where this pecuniary assistance will be used is a potentiality.

The foundation of decision making on exact actions is laid by the preparation of decision, then the decision or series of decisions. Although the whole "arsenal" of criteria of decision making should be taken into account even on creating our vision, yet the practice shows that it is the actions planned that give basis for attaining consensus. The pledge of the successfulness of environment strategies is that they should meet the conditions and expectations on political, social, economic and technical-technological planes as well.

What do these planes mean?

The *political and social plane* includes

- the stability of internal and foreign affairs,
- the consensus of internal politics necessary for environmental protection,
- the integration of environmental protection into national and regional plans,
- the integration of environmental protection into corporate strategies,
- the acceptance and co-operation by society,
- the regulations by acts and international conventions in conformity with EU directives,
- education on every level, etc.

The economic plane includes

- an economic stability and reliability, a workable economic structure,
- settled conditions of ownership,
- the participation of small and medium enterprises in the renewal of technology,
- the existence of financial coverage, improvement of creditability,

- skilled labourforce,
- better utilization of R&D capacity,
- long-run security of environmental market,
- the harmonization of economic and environmental priorities, etc.

The *technical plane* includes

- the harmony of economic structure and applied technologies,
- the fit with regional and local conditions, development plans and infrastructure,
- the development of innovation,
- the technological level of the environmental industry,
- the preference of up-to-date and environment-friendly technologies,
- the conformity with technological regulations and stipulations,
- qualification according to ISO 9000 and ISO 14000,
- environmental safety and reliability, as well as
- training, vocational training, education, etc.

These criteria of decision unambiguously encompass opportunities and potentialities that can be appraised from the side of politics, society, economy and technology (technical and technological).

Appraisals have to be carried out on every plane, and we have to make efforts in order that decision made on different planes can be balanced. The frequently guided or enforced negligence of the balance can jeopardize either the successfullness of the strategy or the safety of the solutions. Some cases: Exclusively technological and economical aspects were taken into account in the realization of waste incinerators. Disregarding the opinions of social movements set back the reasonable domestic waste material management for years. A false economical attitude having become general at the end of the sixties disregarded the technical, technological reasonings, which hindered the economical operation of sewage treatment plants because they were underloaded or overloaded. In case of Bős-Nagymaros, the extreme priority of community's opinion lead to a solution which economically was the least advantageous. But we can abundantly find such cases event today. Guided, frequently politically guided, strategic planning is not an example to be followed.

A feature of environmental strategies is that it is the internationally formulated and suggested directives that have to be taken into account on carrying out analyses in the course of planning. These directives have to be given priority when these actions are composed and made final. Majority of directives were formulated on the UN Conference on Environment and Development in Rio de Janeiro in 1992, and they got into the history of environmental protection as Rio Principles. From strategical aspects, the most important are (Kovács, Gy-né 2000):

- the principle of awareness, the coverage of the entirety of economy and environment, recognition of the laws of environmental changes, and their development on this bases,
- the principle of proportion, establishing an optimal ratio between differentiated environmental activities and economic processes based on the objective laws of nature and economy,
- the principle of balance, ensuring mutual conformity among environmental processes,

- the principle of significance and urgency, because of the shortage of available resources, an order of priority and urgency of individual environmental problems to be solved shall be established,
- the principle of prevention, preventing environmental pollution, reducing them right at their origin, since this activity is more efficient than eliminating damage,
- the principle of territoriality, harmonically solving local and regional environmental problems in order that direct participation of community will be ensured,
- the principle of partnership, which ensures that on the basis of confidence established among the government, market players, local governments and the society, those who using and damaging, or rather polluting natural resources should take moral and financial responsibility of their activities,
- the principle of international co-operation within the EU in bi- and multilateral international relations, in order that the policy of individual nations will not hinder economic development of other nations and measures taken will not have disadvantageous effect on other nations.

A feature of environmental strategies is that with what weight we take these principles into account in evaluating goal hierarchies, and by this what weighting is given to individual partial goals in the matrix of result. Environmental impact assessment also means strategical planning in a certain sense. It is known that the original Leopold impact matrix includes two kinds of weighting. It gives prognosis, on the one hand, for the magnitude of the impact, and , on the other hand, for the significance of the impact. On setting up a goal hierarchy, practically an impact assessment has to be carried out, where the results are expressed in percentage, also taking potentialities and opportunities into account.

Csath, M. (2004) characterized the relation of vision and goal system determining it by a quote from a novel for children, Alice in Wonderland by Carrol L:

‘Would you tell me, please, which way I ought to go from here?’ - asked Alice the Cat. ’That depends a good deal on where you want to get to,’ - said the Cat. ‘I don’t much care where –‘ said Alice. ‘Then it doesn’t matter which way you go, ‘ - answered the Cat.

The reason for which the vision is important is that the vision determines the direction of current activities and decisions. If there is no vision and goals then it does not matter what we do, there will be no result.

8. Methods of Strategic Analyses

In general, a strategic plan is made for a well-definable period of time. The reason for the problem is that continuous and dynamic changes take place in our environment, and the direction, rate, magnitude and effects of these changes have to be equally considered. A strategic plan is implemented whithin a complicated environment which can be well characterized, for the analysis of which several methods are available. In the environmental strategy, we can use the same methods, with some modification, as those used in economic or market strategies, of course, in conformity with given tasks.

Strategic analysis consists of the following four major elements built on each other:

- collecting information,
- analyzing and evaluating information,
- making predictions, as well as
- comparing results with data and predictions used in strategic planning.

From the above, we can seen that the analysing work does not end in the second phase, but in the course of strategic planning and managing it has a controlling role in the subsequent works, too.

In the followings, let us see what methods of analyses we can use in the environmental strategy.

4.1. Using SWOT Method

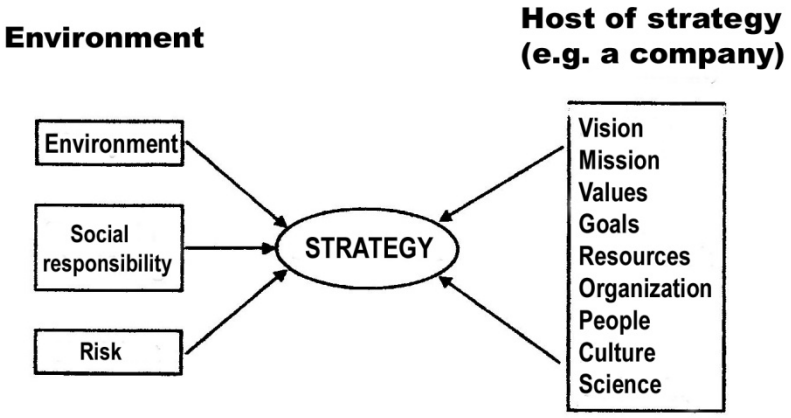
Albeit, there are several modern methods of analysis available for developing economic stategies, it is the SWOT method that can be mostly effective for developing environmental strategies. This method of analysis fits well in the process of strategic planning as well. It is the method also extending to macroenvironment that is effective for analysing environmental processes, therefore we use the SWOT method incuding the analysis of macroenvironment for planning global and regional environmental strategies.

SWOT is an abbreviation the letters of which stand for

- **S** = Strenghts,
- **W** = Weaknesses
- **O** = Opportunities
- **T** = Threats,

i.e. it means the analysis of strengths and weaknesses and the assessment of stategic opportunities and threats and risks. In other words, we can say that, with the SWOT method, we consider the relationship between the „host" (governments, local govenrnments, civil organizations, companies) of environment and the strategy and reveal the strong and weak points, opportunities and threats in these relationships, then knowing these, we make efforts to create a harmony between them by the aid of the strategy.

Figure 8.1 shows a simplified relation system (Csath M. 1996).



8.1. figure SWOT method in strategic planning (Source: Csath, M. 1996)

Of course, we can equally use the SWOT method for developing global, regional or local strategies on all the three levels of strategy. Accordingly, the host of the strategy can be either the owner of the region or the chief of the strategic level. So the selection of the micro- and macroenvironment is a determinative condition of the analysis.

By appraising strong and weak points we can recognize the „competitive advantages and disadvantages" of the host of the strategy and its advantages and disadvantages utilizable from the point of view of solving environmental problems. On analysing the environmental opportunities and treats, we can recognize the key factors of success and safety under the condition of which we have to successfully implement our strategy. We can also identify the factors, at which developers of the strategy has to be strong in order to successfully realize the target state.

On revealing strong and weak points and appraising opportunities and threats, we analyse the strategic process, i.e. it is our strategy itself that we analyse. Of course, this also includes the appraisal of opportunities and potentialities, provided they are the parts of our strategic plan.

In the following two cases, I demonstrate the use of the SWOT method in developing the environmental strategy of a company and the national strategy of sustainable development.

Case 1. Environment-centric management systems (EMS) are mechanisms controlling the operation of a company or an organization, the direct goal of which is to keep the utilization of resources and environmental pollution under control, and indirectly they serve for improving the environmental performance of a company (organization). Practically, we can regard them as the strategic plan of the company, which is essentially based on analysing the internal situation, i.e. the SW part of the SWOT analysis, which is also termed *diagnostics*. This is a typical case of the use of SWOT method, where the analysis of the internal situation can start with raising two sets of simple questions:

- Who are we, what are we capable for, who do we serve and what do we do?
- What does our environment expect from us, what should we do, what is the desired future state?

Practice confirms that, in general, there is no two identical answers given by managers, employees and others interested in these two questions. The situation is made complicated by a series of questions that have to be raised, and these questions do not have to be referred to the present only, but to the future as well.

Analysing the internal life of an organization is not an easy task, a lot of sincerity and a critical attutude are required to carry it out. Analists are in difficult situations when they want to reveal the real reasons for problems of all fields, levels and activities of a company. Revealing strengths and weaknesses can often assist in separating internal contradictions as well.

Case 2. In case of a national environmental strategy, e.g. when we plan the strategy of sustainable development, analysing also starts from the current situation. So the questions raised are comperehensive and more complex:

What is the situation and environmental state of the country like and what do we do for our environment at present?

What do citizens concerned and national and foreign organizations think of us and the state of our environment?

To what extent are the conditions of sustainable development met?

To what extent are we intent on and prepared for implementing our strategy?

Strong and weak points, opportunities and threats become unambiguous by giving answers to questions related to the desired future state:

- What environmental state do we intend to attain by implementing our strategy?
- What new results are to be produced for our strategy?
- What economy and culture do we want to realize by the development?
- What international moral judgement would we like to attain, etc.?

Of the questions raised in relation to the current situation, the most important is that to what extent the conditions of development are met in the fields of economy, technics and technology. Namely, the shortfall in these fields can not mean weak points only, but even risky situations in implementing the strategy.

8.1. **Diagnostics in Strategic Planning**

The function of diagnostics is to reveal the weak points of implementation and operation in the course of activities to be carried out in the interest of environmental objectives. Diagnostics covers the entirety of the operated organization, fields and activities directly and indirectly concerned. In case of a company pursuing environmental activities or providing environmental services, the circle of participants concerned can be rather easily determined. The situation is more difficult when a task of government or local government is carried out, since the circle of participants is not transparent enough, and in addition, it can frequently vary.

In knowing the strong points, we can identify factors that can successfully promote the realization of our goal. Later on, these can became even success factors. By assessing weak points, we can get acquainted with the influential factors that can hinder us in attaining our goals or that can mean disadvantages in the effective operation of the organization. For instance, when a company intends to take part in an international competitions, the emplomyent of an experts experienced in this field can be advantageous, or when we want to ensure a certain professional standard of a research institute, the presence of a university in town from which acknowledged experts graduate can mean andvantages. At the same time, the absence of these can mean competitive disadvantages to other partners or competitors.

Diagnostics examines the operation of an organization, the realization of strategic tasks by analysing the available resources and capacities (skills).

This examination can be, in one respect, general, and in other respect, detailed.

In the course of a general analysis two factors are determinant:

- the image created of the country, region or company and
- the image of global, regional, organizational, business culture.

We have to take notice that it is not indifferent even in the „environmental competition" slowly emerging, what image is formed of an organization or a company by the society, customers or clients. The general image formed of the applicant can be a decisive aspect even in awarding a competition.

In the course of detailed diagnostics, we have to reveal the elements, states and practicability of resources, knowledge and capacities (skills) and opportunities and potentialities lying therein. Accordingly, analysing has to cover the assessment of

- physical resources (buildings, machineries, equipment, instruments, raw materials, energy, etc.),
- financial resources (available capital, creditability, profit, pecuniary assistance, etc.),
- human capacities (knowledge, culture, managerial moral, etc.) and
- technology (up-to-dateness, standard of R&D, environmentally friendliness, etc.).

The above fields of analysis can be well interpreted in case of a company pursuing manufacturing activity or providing services. But likewise, it is effective for us to analyse the work of companies pursuing environmental activities of other nature or even the operation of an environmental investment by a local government.

The individual elements of diagnostics can also be approached from another side. A part of these can be understood or assessed through accountancy or by the aid of well-defined measuring numbers. Another part is not concrete and cannot be numerically measured and, in fact, its assessment is difficult. Accordingly, resources and capacities can be:

- concrete (e.g. capacity of machineries, environmental technics, effects of technologies on emission, extent of pecuniary assistance, etc.) or
- abstract (e.g. environmental culture of a company, expertise, amount of information, etc.).

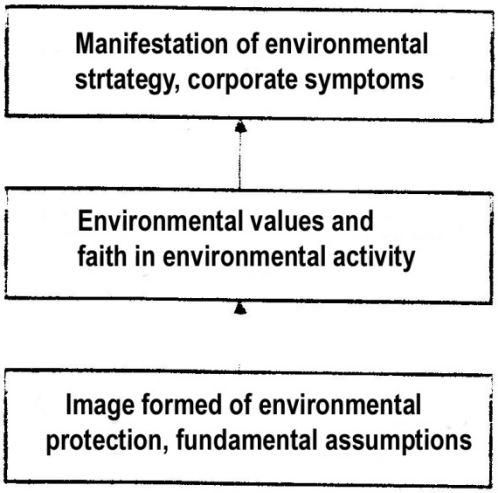
In general, diagnostics has two levels. On the first level, resources are analysed and strong and week points are identified. On the second level of analysis, we determine the capacities created with optimum combination of resources by the strategic plan and, ultimately, meaning competitive advantages as well.

For a manufacturing company, where an environmental review or state assessment is being carried out, and tasks to be performed are intended to be determined within a framework of EMS, the exploration of resources can be carried out in the following manner:

- Concrete resources: machineries, equipment, technologies, R+D+I, financial position, raw materials, etc.
- Abstract resources: knowledge, capacities (skills), culture, intelligence, flexibility, commitment to environmental protection, environmental consciousness, etc.

From strategic aspect, corporate (organizational) culture is one of the abstract resources that is the most interesting and mostly difficult to be assessed. This is particularly interesting when the commitment to environmental protection is assessed. Essentially, it means a scale of values, behaviour, readiness to co-operation and standards of environment and environmental protection. Analysis is particularly important in the case when the members of an organization frequently have to make decisions. Experience shows that because of either the internal or external changes or the modificaition of criteria of decision, the flexibility of an organization and the level of corporate culture – first of all, environmental culture – are important when we plan environmental strategy.

It is Schein, E., professor at Massachusetts Institute of Technology, USA, who developed a 3-level model for analysing corporate culture in 1985. Having adapted this model to the analysis of environmental culture, we have got the relation in Figure 8.2:



8.2. figure Corporate model of environmental culture

The lower level includes our opinions created of and feelings roused by environment and environmental protection, which are the fundamental assumptions that have influenced our consciousness and the evolvement and development of which have taken place through our previous activities and relations.

Level 2 already differentiates our assumptions and gives what we think good and bad as well as valuable and negligible. At the same time, it determines in what we believe, since to develop and implement a strategy we need commitment and faith.

At last, level 3 includes the outward indication of all these, expressions and manifestations given by the organization and people altogether or separately. An important part of this manifestation is the will, since there are several cases where everybody speaks of the necessity of changes yet nothing happens. Further on, I will discuss the role of the will in the chapter on the implementation and organizational questions.

8.2. Types and Grouping of Environmental Analyses

Environmental assessments and analyses can be divided in four groups:

- with *traditional environmental impact assessments* (EIA), we assess projects together with their expectable direct and indirect cumulative impacts,
- with *strategic environmental assessments* (SEA), environmental impacts are assessed on the levels of policies, plans and programs in the earlier planning phases in periods preceding the carrying out of EIA,
- the third group includes analyses which allow us to appraise impacts of wider range by that means tha social, environmental and economic analyses and impact assessments, appraisals are continuously and systematically carried out, considering permanent changes as well. Such are, for instance, *sustainability impact appraisals.*
- The fourth group includes *environmental audits*, such as analyses and audits preceding the establishment of environment-centric management systems (EMS) or the planning of task systems of corporate management systems of environmental awareness.

According to R. Goodland (1933), environmenatal assessments can be divided into two groups:

- traditional reactive environmental assessments (environmental impact assessment of projects, regional environmental impact assessment and assessment of cumulative environmental impacts), and
- proactive environmental assessments of strategies (environmental assessments of plans within and among sectors, those of plans and program comprehensive or rather concentrated to a given geographical unit, those of politics and conceptions, those of sustainability and those of global programs).

The goal of strategic environmental assessments (SEA) is to integrate environmental aspects into decision-making processes. Since decision making is preceded by a strategic analysis, environmental aspects have to be integrated into the analyses of both macro- and microenvironment.

In the European Union, various kinds of assessment methods and analyses are used with various designation and names. For instance:

- strategic environmental assessment (SEA)
- strategic environmental analysis, SEAN,
- environmental appraisal, EA,
- E-test,
- sustainability analysis, SA,
- integrated environmental assessments,
- green accounting,
- Environmental management systems, EMS, etc,

Analyses belonging to impact assessments and environmental audits take place in accordance with descriptions in pervious chapters. However, strategic environmental analyses and sustainability analyses deserve some particular attention.

According to Szilvácsku, Zs. (2003) a procedure is termed *strategic environmental analysis* if

- the determination of the content, scope and the extent of details of an analysis,
- the preparation of revealing and analysing studies and report,
- the co-ordination with the participation of authorities and community in the course of the whole process,
- the consideration of the results of analyses in decision-making,
- preparation of easily intelligible summaries for the community, and
- the monitoring of realization

are simultaneously carried out.

A *strategic environmental analysis* is the partly realized form of SEA. The goal of the analysis is to promote the development of environmentally advantageous solutions already in the early phase of planning. The analysis is iterative and flexible, i.e. it allows the community to take part in the whole course of planning, necessary modifications to be transferred and makes the changing adjusted to the results of monitoring possible. The methodology of environmental analyses generally follows that of strategic analyses, and in this case, it can align itself with the demands of concerned parties or change according to the demands of users. Social aspects to be taken into consideration in analyses dominate here in the field of environmental protection.

At the same time, this can be regarded as negative in extreme cases, since political influence of individual organizations concerned can be dominant in decision-making.

Environmental tests or E-tests is primarily applied in the national political practice in order that the integration and the environmental aspects of sustainable development will be represented. They have a major part in that the individual questions of environment and economy are assessed in their effects on each other before they would be regulated by means of legal or technical parameters and these regulations would become compulsory due to legal regulation.

In the course of E-tests, the use of environmental information has three possible ways:

- in the first case, the minister concerned makes use of environmental information and he/she makes use of it to correct the draft of rules and acts,
- in the second case, the minister concerned, preferably the minister of environment, make use of environmental information in order to attain the modification of rules of law submitted to the government for approval,
- in the third case, the Parliament or its committe concerned make use of environmental information in order to make necessary modifications of drafts of rules of law.

Again, an *environmental appraisal* is a partial SEA, which is primarily used for appraising the impacts of plans of area planning. The appraisal procedure functionally fits in the process of planning of area planning, and in ideal case, it is already connected to the starting phase. Appraisals take place in an iterative way. The elements of the procedure are:

- characterizing environment,
- considering the content of the plan in depth and in detail,
- considering directives, goals and ways of implemetation in accordance with the criteria of sustainability.

According to Szilvácsku, Zs.(2003), the British government, for example, suggests the use of 15 criteria according to three aspects. These are as follows:

1. Global sustainability:

- energy efficiency of transport: emission,
- energy efficiency of transport: method,
- built environment: energy efficiency,
- renewable energy potential,
- CO_2 emission,
- habitats.

2. Natural resources:

- air quality,
- preserving and protecting waters,
- structure and quality of soil,
- preserving minerals.

3. Quality of local environment:

- regions, landscape structure and open lands
- quality of urban environment,
- community's access to open lands,
- building quality.

Appraising environmental takes place on the basis of a simple matrix, which allows directives, goals and ways of implementation to be appraised in conformity with the given criteria (e.g. by the aid of point systems). One of such matrix-based appraisals is the Leopold impact matrix, which we use in the course of a EIA. In this case, the aspects are different, but the methodology of analyses based on matrices is the same.

Sustainability appraisals attempt to jointly enforce environmental, social, economic and technological dimensions within the frame of a common appraisal process. The determination of goals and directives are in the middle of the appraisal, i.e. wheather the set goals are correct and wheather the given directives are feasible. The course of the appraisal consists of the next steps:

- determining goals and directives in accordance with national and international expectations of sustainable development,
- integrating national sustainable development into the given strategy,
- appraising strategic variations and opportunities on the basis of set goals,
- appraising directives and feasible variations (actions),
- recording results,
- establishing and evaluating monitoring by using indicators.

Sustainability analyses are preferably used for developing regional economic plans and strategies. Accoding to international experience, the participation of the society is not an element of sustainability analyses. It is bad experience that involving civil organizations practically takes strategic planning aside. The reason for this is particularly that sustainability, as a concept, has been given such a wide interpretation that makes the enforcement of strategic aspects impossible. Another problem is that the wide interpretation of sustainablity breaks down

the task, and a particular field requires sustainability conditons of its own, so the standpoints of the Rio Conference of the UN do not prevail, either.

To improve the quality of life and the social position of the community – without jeopardizing the keeping capacity of the environment – it is essential for us to formulate the goals and content of sustainability. To this, some fundamental priciples have to be laid down without aiming at completeness:

- sustainable development essentially is a social category. Today, we have to live in such a way that we will not jeopardize the expanding opportunities of futer generations. We have to produce and consume goods in such a way that the results of our life will establish the conditions of a better social welfare.
- the goal of sustainable development is a continuous better social welfare. For attaining this, economy is a means and environment is a condition;
- environment is a condition in the sense that we cannot exceed the keeping capability of our environment;
- the economy is a means in the sense that it is indispensible for us to attain goals, but it is not the economic results that serve as exclusive goals;
- sustainable development also means that all questions of the environment and development are interrelated.

9. Analysis of Corporate Strategies

It is a corporate interest that companies have to develop their environmental strategy on order to protect environment. The qualification in conformity with either ISO 14000 or EMAS requires us to plan environmental strategies and carry out actions.

When we regard environmental protection as a market element as well, we have to analyse both macroenvironment and microenvironment in developing corporate strategies.

9.1. Analysis of Macroenvironment

Micro- and macroenvironment and their relation system have already been shown in Figure 3.2. STEP and PEST methods, which differ from each other in their names only, serve for analysing macroenvironment. Likewise SWOT, STEP is also an abbreviation, in which letters stand for as follows:

- **S** = Sociological
- **T =** Technological (technical-technological)
- **E** = Economical and
- **P** = Political

Other economic strtegies prefer to use the abbreviation of PEST, where letters stand for as follows:

- **P** = Political-legal
- **E** = Economical
- **S** = Socio-cultural
- **T =** Technological (technical-technological)

To get acquainted with macroenvironment, we think that this latter method is more effective when we develop environmental strategies. Without aiming at completeness, let us consider what factors play important roles in macroenvironment from the point of view of environmental protecition.

National/international economic situation:

- the tendency of economic situation, features of national and global economy and – within this – those of individual countries,
- what roles environmental protection plays in the economic policy of a given country or an international organization,
- what tendency national income has and how much is spent for environmental protection of that,
- what tendency inflation has and what roles environmental investments play in inflation,
- what the rate of employment is in environmental protection,
- how environmental investments, etc. return.

Techical, technological knowledge:

- what environmental researches are in progres and, as a result, what technical, technological development can be expected,
- the efficiency of national environmental innovation,
- what level environmental industry represents,
- what tendency technology transfer has among indivudual countries and economic sectors,
- tendencies and priorities of R&D,
- what demands for new kinds of knowledge emerge,
- how general environmental protection integrated into production is instead of “end-of-pipe” technologies, etc.

Governmenal policy:

- what role environmental protection plays in the work of the Parliament and government,
- what environmental assistance systems are operated by the government,
- what fiscal, financial and investment policy is expected from government,
- wheather foreign or national investors will be preferred,
- to what extent government promote international co-operation in environmental protection,
- to what extent the environmental policies of the European Union and government are in harmony, etc.

Legal factors:

- law and order and legal security of the nation,
- the position of legal regulation of environmental protection,
- quality of jurisdiction and legal security of environmental protection,
- legal conditions of operation of environmental civil organizations, etc.

Natural environment, state of environment:

- the state of national environment and its expectable changes,
- tendency of the quality of natural resources,
- extent and volume of available natural resources,
- regulations and preferencies connected to environmental protection,
- assessment of the state of environment in connection to international data and the values of transmission,
- correlations of the features of state of environment, etc.

Culture, scale of values:

- scale of values accepted in society and its tendency,
- environmental culture,
- health culture,
- the level of culture and intelligence of the society,

- features of pepole's relation,
- knowledge base related to environmental protection and knowledge of environmental sciences, etc.

Social position, structures:

- position and operation of environmental civil organizations,
- tendency of living standard,
- social mobility,
- generality of corruption,
- tendency to strive for perfecion by society and sensitivity of society to environmental problems,
- tendency towards expectable time of life, etc.

Global and regional institutions:

- the operation and the relation system of environmental institution systems,
- connecting with international organizations,
- relations to universities, colleges, research and development institutes, etc.

These points of view have to be taken into account when we analyse macroenvironment, of course, we also have to consider local priorities and particularities. Such an analysis is very expensive and complicated for a small enterprise or a local government. Therefore, most organizations have the analysis carried out in co-operation with each other or they concentrate on most important and stressed elements, aspects.

One thing is sure, information obtained about macroenvironment is of determinant significance from the pont of view of strategy development. The importance, predictability and impacts of environmental changes can be judged on the basis of the amount, quality and reliability of information. Matrices shown in figures 9.1 and 9.2 can be used for analysing them. Strategy development also depends on to what extent we can have influeces on environmental changes.

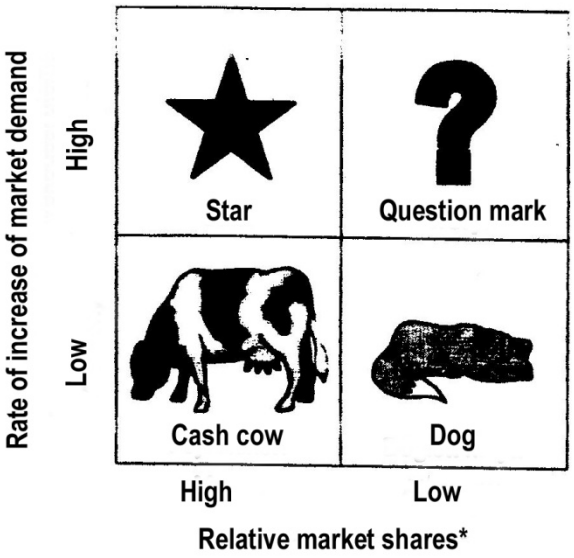
9.2. **Analysing Microenvironment**

There are several methods available for analysing microenvironment. The most popular are portfolio methods, models of life cycle and the model of "Porter's 5 forces".

Portfolio methods:

Portfolio methods are primarily used when we analyse microenvironment for developing strategies of companies making environment-friendly products, implementing environmental technologies or providing environmental services. This is the best-known market analysing method. Its basis is to analyse and compare opportunities given by the products and serveces of a company and environment. Since environmental protection is a more and more determinant market factor as well, it cannot be omitted from the collection of requirements of environmental strategies.

The simplest version of portfolio analysis it the BGC-matrix, shown in Figure 9.1, which has been developed by the **B**oston **C**onsulting **G**roup (named after it) in the United States.



9.1. figure BGC-matrix (Source: Csath, M. 2004)

On studying the possibilties of the application of portfolio analysis, we generally speak about products. Nevertherless, the concept of products can be substituted by services, technological development, innovation, new environmental methods or investments and even organizational units at any time.

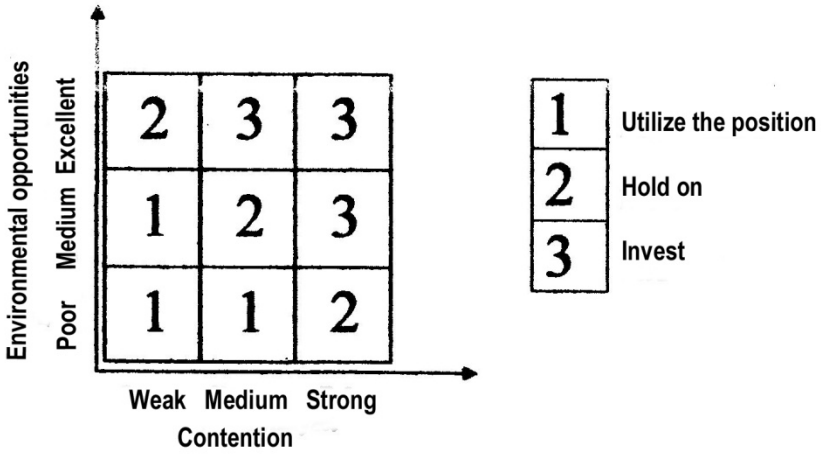
I mention in advance that besides its environmental goals, any environmental investment, environment-friendly product or servece is also a market category at the same time. Accordingly, they can be analysed in the function of the trends of their market demands and relative market shares in our strategy. By the aid of BGC-matrix, we can group products and assess their profit generating potentiality, profitability from the point of view of either environment loading or environmental pollution. This assists in formulating strategic directions, too.

Star products are those for which market deamand continuously increases, their production ensures a good market position, market shares and the improvement of efficiency of the company. *Question mark products* are those for which market demand increases, but market shares of the company is poor. Good examples for this are several Hungarian small enterprises, which should be in the international environmental market, but their capital intensity is not enough or they are not given opportunity to penetrate to the market. *Cash cow products* are those with which the company dominates the market, but demands are smaller and smaller. These products are already on a descending path. Finally, *dog products* are those for which market demands is low and the market position of the company is also weak.

What do these findings mean from strategic viewpoint? In case of stars, profit is high and opportunities increase. Strategies have to include new investments and capacity increase for further growth. In case of questions marks, profit and efficiendy are low, however all these can increase, either. Strategies have to include prospect analysis, considering possible investments, capacity increase or phasing out of production. In case of cash cows, profit is still acceptable but the rate of growth has slowed down and the profit is still stable but it is of declining tendency. Stategy has to tend to take opportunities, possibly with minor investment as far as it

is worth, but R&D activities have to be started for new products. In case of dogs, the expectable efficiency is unreliable and low. Strategy almost unanimously makes phasing out desirable.

The BDG matrix is an excellent means for revealing a general position. At the same time, it only reckons with market factors: the tendency of market demands and relative market shares. The General Electric, GE, has improved the method with analysing environmental opportunities and contention, and developed the McKinsey-GE portfolio matrix shown in figure 9.2.



9.2. figure McKinsey-GE portfolio matrix (Source: Csath, M. 2004)

The analysis is separately carried out for the assessment of environment and contention. Considering their importance and significance, we assign numerical values to individual characteristics (e.g. market size, labourforce situation, environmental technologies, market shares, costs, quality of environment, etc.), then calculating their weighted arithmetic average, we can characterize the attractive force of environmental opportunities and the contention of the company.

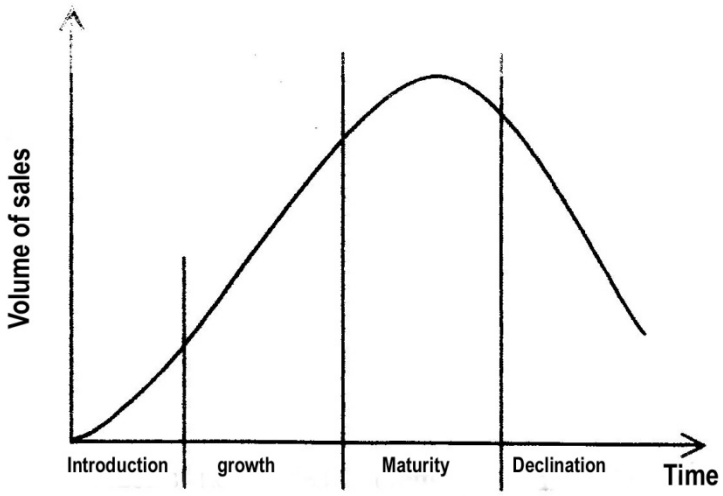
Models of life cycle:

On analysing microenvironment, from the viewpoint of strategy development it is important that in what phase of their course of evolution products and services are. This course of evolution lasts from the market entry till declination and it has four phases. These are as follows: the phases of entry, growth (boom), maturity (culmination) and declination (phasing out). Figure 9.3 shows the model of life cycle (Csath,M. 1996).

In the phase of *entry*, the product, service is less known, a few people buy it, mainly those who are wealthy. Quality problems can periodically occur. There are only a few companies taking part in competition. The strategy of the company primarily aims at creating clientele, employing highly skilled labourforce, product innovation and applying environment-friendly technologies. Establishing a reliable image of the company is a key factor of success. Marketing activity is of strategic importance.

In the phase of *growth*, the product becomes known and wanted. Quality and reliabilty improve. At the same time, mass production starts, which may be detrimental to quality important from

environment viewpoint. From strategic viewpoint a key factor of succes is that products, sevices should maintain their quality and reliabilty in spite of mass-production. Let us imagine that



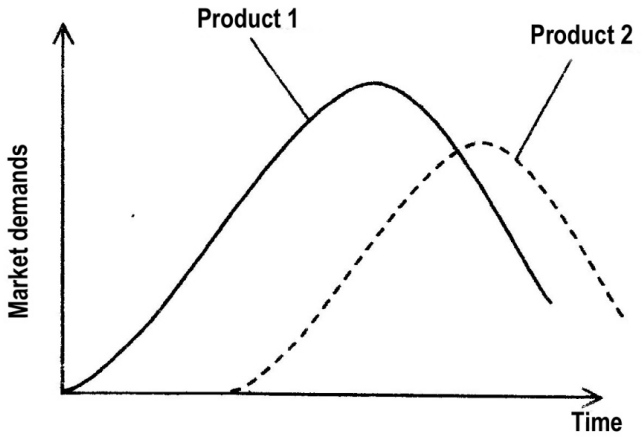
9.0.3. figure Model of life cycle

how much the judgement of the company would worsen if one of its products qualified as environment-friendly more and more would loose its environment-friendly features, or in spite of more severe prescriptions it would meet older requirements. In the phase of growth we can create a „brand name", by means of which we can ensure market advantage over our competitors.

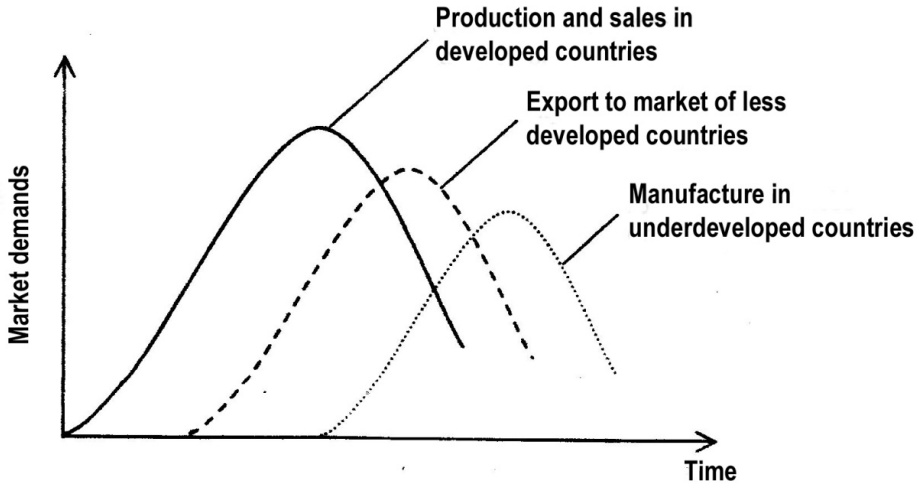
In the phase of *maturity* the market is saturated, the product becomes general, and demands for innovating the technology emerge. In the course of production, excess capcity come into being, and to keep the price competitive the staff of well qualified specialists is dismissed. New markets are sought for the product, products or services are essetially diverted to markets of countries less developed. The company can make a trial of innovation, bringing out and running in a new competitive product, which can be the improved, innovated version of an old product or a completely new one. From strategic viewpoint, the improvement of cost effectiveness, innovation or market research are of key importance in this phase. As to the future of the company, environmental innovation can be determinant from the viewpoint of market. In such cases, it is advisable for the company to introduce a quality management system according to either ISO 14000 or EMAS.

In the phase of *declination*, the product losses its market, it can be sold to a more and more narrow clientel by strong marketing only. Product differentiation is decreasing and prices are falling. With contunuously phasing the product out of the market, production is reduced and huge excess capacities emerge. From strategic viewpoint, cost reduction, rationalization of capacity, increased innovation activities and finding new markets are of key importance. In any case, we have to consider that the environmental parameters of a new product by which we utilize our capacity should be better than those of the former one.

The company can ride out the phase of declination with a product or service in two ways. Either innovation is stressed and a new product or service is entered into the market, by which the company utilizes its free capacity and gets new results and income, as can be seen in Figure. 9.4, or the company seeks for new markets for manufacturing the product according to the logic of Figure. 9.5.



9.0.4. figure Life cycle of product with the introduction of a new product



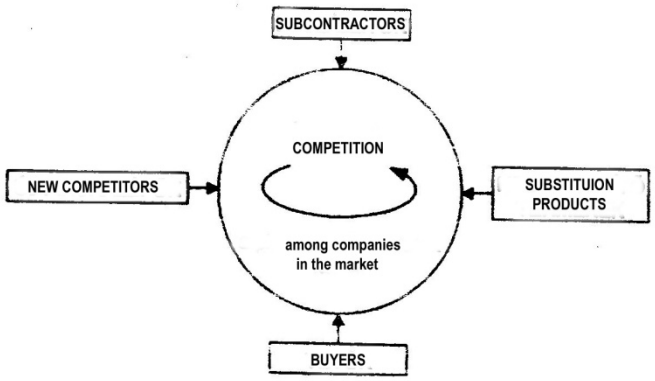
9.0.5. figure Life cycle of product in the international strategy

Seeking for new markets, as an international strategy in environmental protection, takes place typically. Today, a formerly environment-friendly product of a developed industrial country does not meet the environmental directives applied in that country no longer. A country is sought, where this product meets the environmental prescriptions better than those sold previously. After a short time, in the mother country problems arise in connection with manufacture as well. The production development would cost too much, so the management of the company moves the complete production technology to an interim country or to any of a

more underdeveleoped countries, where the product can be sold still for a certain time, moreover it sells well.

The model of Porter's 5 forces:

When we consider environmental aspects as well, the "model of Porter's 5 forces" is the most suitable for analysing microenvironment. This model features the microenvironment with five influential forces of competition. These are as follows: competition among companies on the market, subcontractors (suppliers), buyers (users), new companies entering in the market (new competitors, new service providers) and substition products (environmental activity of another goal). (Porter, M.E. 1980). This model is shown in Figure. 9.6.



9.0.6. figure Model of Porter's "5 forces of competition"

Let us look at a subject frequently emerging in environmental protection, the problem of the establishment of a regional waste deposit ground.

If I have an enterprise labelled with environmental protection, then in the course of my activity, a contention has already been established in the environmental market. Let us suppose that there have already been two working enterprises dealing with waste treatment, or possibly they operate a waste deposit ground. I decide that I too take part in waste management of the region, perhaps because in this way I can also draw on funds of the EU. My contention obviously changes. In one respect, because of the appearance of new competitors, who think it is worth while establishing an new waste deposit ground, in another respect, altenative solutions can emerge, so they can be regarded as „substitution products". As I expand my enterprise, I increase the number of my subcontractors or the volume of waste material (e.g. I buy new technologies, machineries), and at the same time, the number of my buyers or the amount of service increases, since I will treat more waste material and meet the demands of more "buyers".

According to Porter's model, the competition has horizontal and vertical elements.

Horizontal elements: competitors entering the market and the supply of substitution products, vertical items: subcontractors and buyers (they can also be termed as supply).

Let us see what characterizes these elements of competition from environmental aspect.

Companies entering the market, the new competitors, can be regarded as market participants primarily influencing contention in the field of prices and innnovation. At the same time, products and services using environmental technologies and environment-friendly products come into the front in response to people's demands. Taking the tendency in international markets as well into account, it is only products or services the manufacturers or providers of which have got a quality management system in accordance with ISO 14000 or EMAS and the knowledge and technology content of the products or services is high that can only be considered competitive. This also explains the competition in the field of innovation.

A high percentage of manufacturers say that environmental protection is expensive and only the rich can afford environment-friendly products. Today, advertising against wasteful consume is not general at all yet. However, proper strategic demonstration of environmental protection integrated into the course of production, manufacture, preventive measures and properly applied economical material, energy and water saving technologies can stand up to these signs. Proper communication is important on every level.

For the evolvement of market conditions in classical sense, there are four possible structures: monopoliy (there is only one company in the market), duopoly (two companies share in the market), oligopoly (there are more than two, but not too many, companies in the market) and finally perfect competition (when a lot of companies share in the market).

If one or two companies dominate the market or even the environmental industry, by meeting environmental requirements, a few participants have more chance to set prices at their will and squeeze additional competitors out of the market. At the same time, in the lack of competitors there is a high risk that these companies refuse subsequent innovation including that of environmental protection or even they can return to outdated but cheap manufacturing technologies.

The more companies share in the market, the bigger is the chance for that environment-friendly production and service remain and, indeed, it is only companies having environmental strategy that prove successful in the market.

It is obvious that the company is profit-oriented and tends to sell its products and services at a maximum prices reasonable for buyers in order to increase its profit. If the price already exceeds an extent the buyers are willing to pay, then they go over to another article or service or a cheaper solution of nearly the same use value, which is called *substitution product*.

The function of a substitution product evidently depends on how much buyers, users insist on a certain product or how the price of a substitution product relates to that of the usual product. Today we can generally say that people, industry and economy accept more environment-friendly products, services and technologies if prices are almost the same, particularly, if they can be handled almost equally or better, than the ones accustomed to.

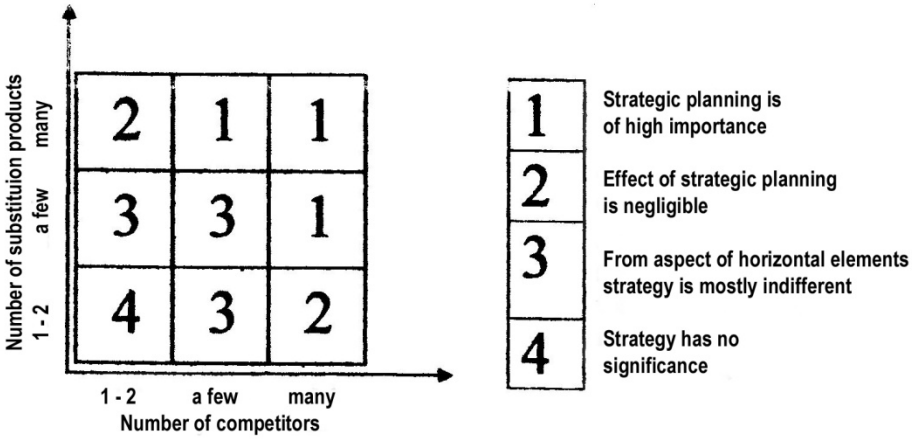
An example for the use of a substitution product: Galvanic sludge can only be stored in a waste deposit ground for hazardous substances. Its water content is high, so its deposit is very expensive in proportion to the volume of the deposited material. The water content of sludge can significantly be reduced by the use of a thermal procedure, sludge can be pressed in a mould, and it can be deposited in a volume approx. one fourth of the original one. The total costs of this latter procedure can be lower than those of sludge with high water content, therefore the latter is chosen.

In most cases, the number of new competitors and that of substutition products appearing in the market are in inverse ratio. Since in case of a few competitors, prices can more easily be manipulated and increased, thus more and more cheaper substitution products appear in the market. But if the competition is perfect, prices are not increased, moreover in majority of cases

discounts are also given, and there is no need for substitution products in the market or, if any, only in a very low number.

Figure. 9.7 shows the correlations of the two horizontal elements of competition, which are important from point of view of strategic development.

From point of view of the analysis of competition structure, it is important for us to compare the vertical elements as well. The number of *subcontractors* and the quantity and quality of raw materials, resources, semi-finished products as well as the demands for produced goods and services, i.e. the *number of buyers* can be determinant in respect of the corporate strategy. For subcontractors, fulfilment, deliveries scheduled in advance, the quality and environmental adequacy of products are of essential importance.

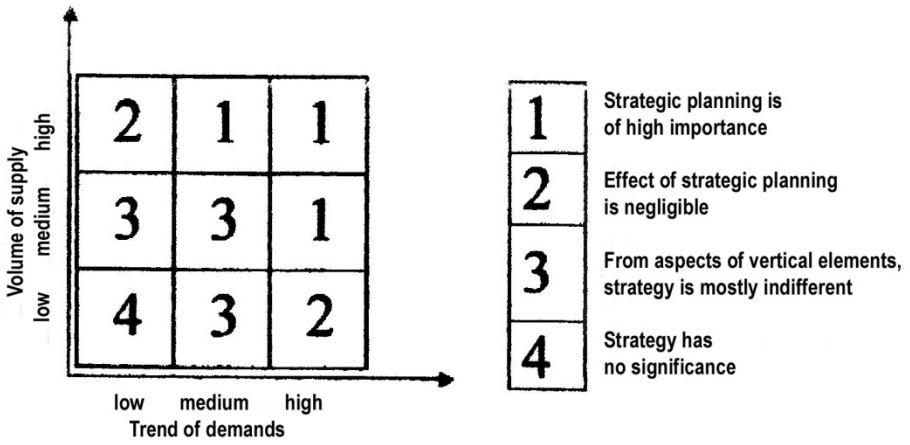


9.0.7. figure Matrix of horizontal competition structure

The number of buyers, thus the tendency of supply, is the function of the living standard, including the commitment to environmental protection.

In majority of cases, vertical elements are in direct proportion. The more the subcontractor, or rather the volume of delivery, is the more the production is and the more products are marketed, therefore the amount of products sold will also increase.

From the point of view of statregic development, the two elements of competition show the correlations that can be seen in Figure. 9.8:



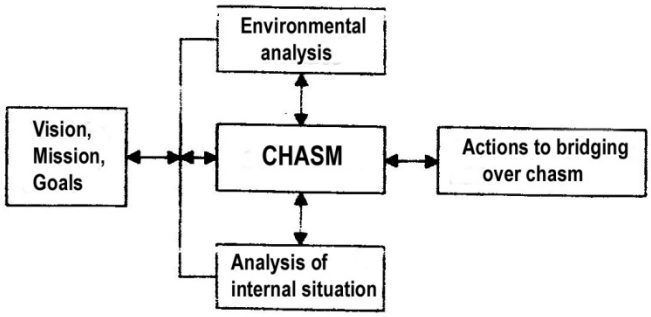
9.0.8. figure Matrix of vertical competition structure

The Porter's model core phylosophy is the competition among the market participants. Because of the failure of the economic policy during the past years and the moral and economic crisis, more and more experts claim that co-operation and the establishment of fair alliances among suppliers, manufacturers, buyers and traders have a great chance to lead to a situation in which each participant gains. But in a cutthroat competition such a situation can develop in which each participant, but particularly environmental protection, loses.

10. Strategic Actions and their Environment

In the knowledge of goals defined by the vision and having made environmental and social responsibility clear, we have properly laid the foundation of strategic actions by exploring opportunities and potentialities and by analysing micro- and macroenvironment. Albeit, some strategies put actions before analyses in sequence, environmental aspects rather inspire that environmental analysis should precede the development of actions. Since considering the results of analysis, we can exclude actions that would only be effective in economic or political points of view, but they would take environmental points of view into account only partly or not at all.

In the course of analyses, points of view assisting the determintaion of goals as well as, in the knowledge of environmental and social responsibility, possible acts, steps and actions, come to the surface. To select the most adequate actions, it is important for us to have as much information as possible and as wider range of opportunities as possible. And again, to create a supply of actions we need creativity. Having selected actions, we have to evaluate them as much aspects as possible and compare planned actions, then we make a choise. Figure 10.1 shows the bock diagram of action planning.



10.1. figure Action planning (Source: Csath, M. 2004)

10.1. What is Meant by Environmental Strategic Action?

Strategic actions are actions, concrete activities by the aid of which we

- proceed towads our vision through attaining our goals,
- can completely take environmental opportunities including those given by natural environment,
- can reduce the loading of evironment and avoid environmental pollution,
- prevent the development of environmental emergencies,
- advantageously combine market interests and environmental aspects,
- gradually develop resources and human capacities,

- continuously improve the quality of life, and
- sustain and innovate comptetitive advanatages obtained in environmental protection.

Strategic actions means changes in the life of people who are directly or indirectly partakers in carrying out actions. Depending on their nature, actions take more or less time and occupy people concerned for more or less time. The conditions of success are that people have to be interested in carrying out actions, they have to spend time on this job and behave in an ethical way and appoint persons responsible for carrying out. Another condition is that resources, technics and technologies necessary for carrying out have to be available in proper time and place and with proper safety.

By comparing actions, we can select those that can most successfully be carried out. Actions unscreened by criteria have to be handled as reserve for cases when circumstances and interests radically change and, by involving additional resources, new actions can be started or actions have already been started have to be stopped because of any reason.

Developing actions requires creatitivy, so as wider range of participants as possible has to be involved in the process. At the same time, activating people too motivates them to acceptthe strategy and become interested. In addition, people's acceptance of participation enriches the *action generating process*.

The actions of environmental strategies can be:

- of production (e.g. incorporating preventive technologies into production processes),
- of reseach and development (e.g. developing a new environment-friendly technology),
- of market (e.g. entering a new environment-friendly product to the market),
- of organization development (e.g. establishing an organization ensuring the operation of a new environmental competition system),
- of resource rationalization (e.g. utilizing renewable energy resources instead of fossil ones),
- of traning (e.g. training an expert staff capable for implementing an EMS),
- of marketing or rather communication (e.g. advertising and organizating an action for rooting out ragweed) and
- of alliance conclusion (e.g. involving schools into environmental actions, testing water quality, defending protected birds, etc.).

Strategic actions can start changes in comparison to existing situation. It is important that these changes should be necessary for management and acceptable for society. In cases when corporate culture and the level of people's culture are not in harmony with the level of the necessary changes, we will have difficulties in having our strategy accepted. For instance, if a firm has produced environment-friendly products only for domestic market up to now, and it has not any sort of experience on the requirements of international markets, then the employees of this firm can fear with good reason that the company can go bankrupt and they loose their job.

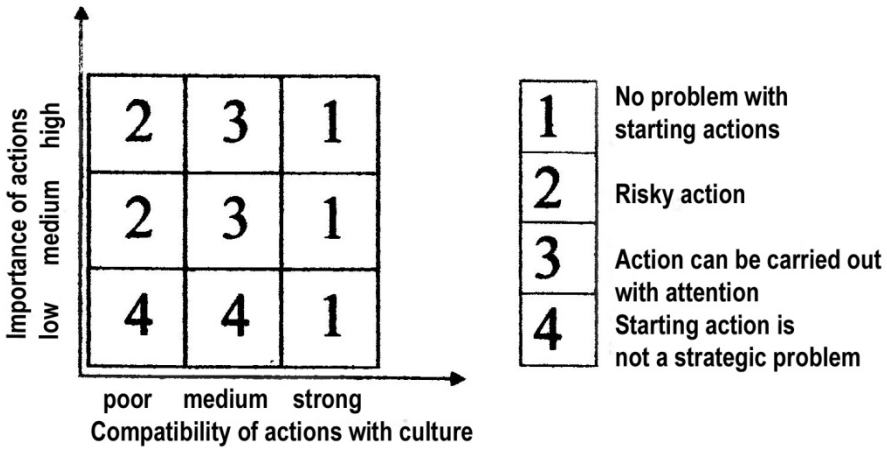
In the course of the analysis, we have already revealed strong and weak points. Let us see some cases what actions we can plan to maintain strong points and to strengthen weak ones:

- if the knowledge level of people can be considered strength in the strategy of an organization, then strengthening of motivation, development of a proper human strategy

or ensuring of permanent training and further training are regarded as maintaning actions;

- if the qualification, knowledge of people is the weak point of an organization, then improving, strengthening actions can be, for example, appointment of proper managers, a comprehensive and up-to-dates human policy or the development of incentive systems;
- if R&D is the strength of an organization, then this can be further strengthened by continuously monitoring international technological development, researching new themes, carrying out actions assisting innovation;
- if R&D is a weak point of an organization, i.e. there is no earlier results, then the situation can be improved by elaborating a development strategy, rewarding patents, actions serving the concentration of resources;
- if the organizational culture is strong and good, then expanding the corporate culture, increasing appreciation and feeling of security or strengthening proprietary attitude will serve for improving the situation;
- if the culture is a weak point in an organization, then we have to organize actions to establish a uniform corporate culture conforming to new goals and improve the state of environment and general feeling and establish the conditions of a positive communication;
- if the economic position of an organization is strong from strategic aspect, then this can be held by involving new capitals and increasing property;
- if the economic position is a weak point, then to right the situation, we have to improve the efficiency of operation or make actions to more deliberately allocate resources.

Figure. 10.2 assists in evaluating the success of actions.



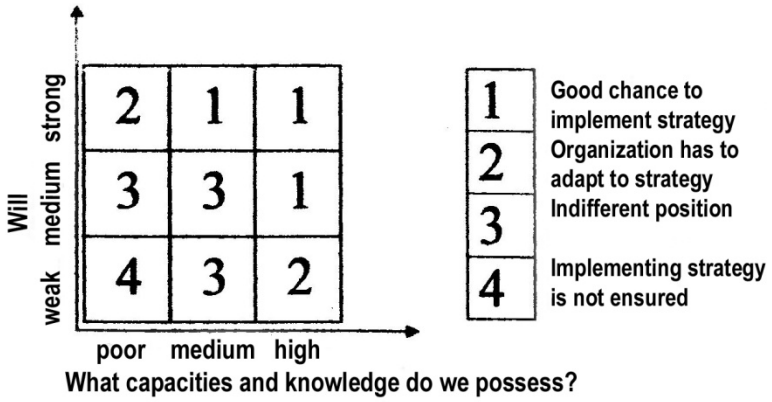
10.2. figure Risk matrix of organizational culture

10.2. **Will and Commitment in Strategic Planning and Management**

People's participation in understanding and implementing strategy are featured as follows (Csath, M.1996):

- will,
- motivation,
- commitment,
- awareness,
- qualification,
- weight of participation,
- idea and
- managerial support.

Figure 10.3 shows the strategic significance of the will.



10.3. figure Strategic aspects of the will

On the basis of the figure, we can see that we have a serious chance to implement our strategy only if the knowledge level, culture, will and commitment to strategic goals of managers are equally high.

Interesting behaviour patterns can form in the relation of people (managers). Reflections can be as follows:

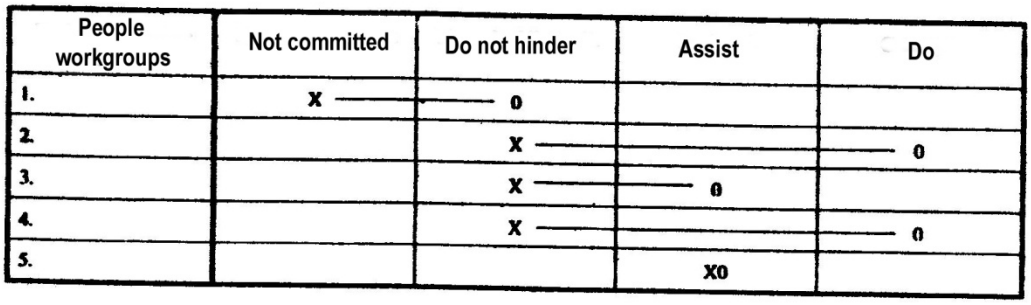
say - I forget
show - I remember
involve me - I fulfil
charge me - I solve

Analysing what commitment we can expect from our colleges, workgroups and society and how much we could need and by what methods we can attain the required level of commitment is a useful method.

As we can see in Figure. 10.4, the extent of commitment can be at least of four kinds:

- people generally are not committed at all and they probably resist to be,
- people are not committed but they do not prevent actions being introduced (indifferent)
- people assist actions, or rather

- actively take part in carrying out actions.



10.4. figure Diagram of commitment

„0" in the figure means the commitment level what we expect from individual participants, parties concerned, workgroups in order that they will successfully carry out actions. The expectable behavior of the same participants is marked with X. If we draw a line between points 0 and X, we can see what a large task the building of commitment is. If points 0 and X are coincide with each other, commitment aready exists. Methods for building commitment are:

- continuously demonstrating the clear and definit commitment of management in relation to the introduction of actions,
- closely connecting motivation, performance evaluation and acknowledgment to the expected level of commitment,
- authorizing people, workgroups with power and giving them right to make decisions and providing them with necessary information.

10.3. **The Pledge of a Successful Strategy is a Successful Management**

A significant condition of corporate culture, and the culture of strategic management as well, is that an organization and its management should hold the same opinion of important questions. If, for instance, managers are quite serious about actions to be taken for environmental protection, but subordinates have opposite interests, or vice versa, then we have problems with the scale of values or motivation sytems do not convey the scale of values in a proper way.

Figure. 10.5 shows a possible relation system of managers and subordinates for planning actions from the point of view of commitment building:

10.5. figure Efficient managerial relations in building commitment (Source: Csath, M. 2004)

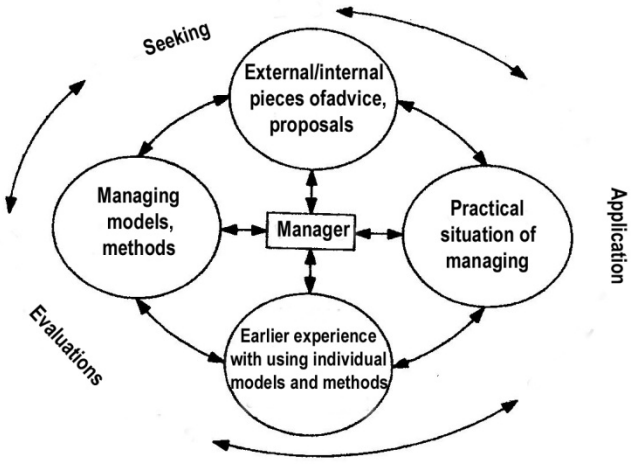
In the relation between YOU and ME, we speak of interpersonal efficiency, in the relation between ME and THEY we speak of managerial efficency and in the relation between YOU and THEY we speak of organizational efficiency. The common area is the domain of values generally accepted, on which commitment is primarily based.

Managerial attitude, thinking and style in the 21st century widely differ from the former ones. Traditional attitude encircles managers with a certain kind of myth and does not enforce any democratic attitude. It should be mentioned that a claim to interpersonal, managerial and organizational efficiency can equally be found in the democratic managerial style, but the method by which the domain of general scale of values can be continuously expanded should be in the hands of managers.

Main features of the change in managerial attitude in the end of the century are as follows:

- the world is not a battlefield we can ruin and where we are continuously fighting with our environment, but an ecological system, the presevation of which is our main task;
- a company or any organization involved in strategy is not a machinery but a community;
- managing is not a control but a service. Dissents should also be considered;
- employees are not children or subordinates but colleagues;
- we do not have to manage by filling others with fear but by vision;
- changes are not an absolutely necessary evil but an opportunity for development;
- environmental protection is not a supplementary to a country economy or rather to the management of a company but it is its part.

A manager should not expect the appreciation by his/her colleagues but deserve. Managers too have to develop a strategy of their own, perpetually progress and learn and regularly analyse strong and weak points of their own. Figure. 10.6 shows this learning process.



10.6. figure Lerning process of managers (Source: Csath, M. 2004)

Quinn, R.E. (1992), an American economist and sociologist, attempted to analyse managerial learning starting from tasks expected from managers. According to him, the situation of managers is also difficult because they simultaneously have to manage tasks of different types. They have to be open, creative, co-operative and flexible and, at the same time, they are expected to effectively run the organization and manage tasks in a performance oriented way. Quinn divided requirements to be met at one time into four groups:

- flexibility and looking outwards, capability for determining vision and creating commitment to future,
- rational capability for looking outwards means a good analysing capability, a clear goal setting, guiding and opportunity analysis,
- flexible capability for looking inwards means human oriented management, allocating decisions, authorizing people to power, jointly building scale of values, team-work and managing conflicts on the basis of consensus,
- rational capability for looking inwards makes internal control, stability assurance, unambiguously assigning responsibility possible.

It is sure that these capabilities cannot equally be found in individual managers. Therefore self-control is important, i.e. managers have to be fully aware of strong and weak points of their own. There are various surveys of questionnaire, by the aid of which managers can idenfy and decide what capabilities of their own should be developed. Capabilities of such kind can be managerial, examplary, innovative and controlling ones. The profile of managerial capability of a manager in question can be drawn on the basis of self-estimations. A good result can be the pledge of the successfulness of the strategy.

11. Implementing Strategies

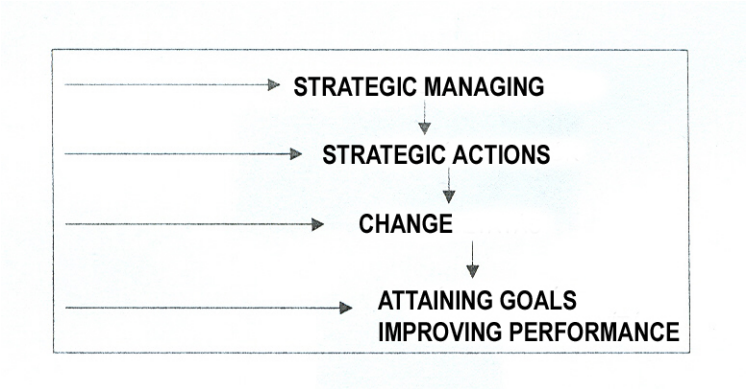
Without implementation, even the best strategic plan is worth nothing, and without a good strategic plan, implementation becomes hurry-scurry and substitutes.

Implementing a strategy consists of two important phases:

- carrying out and controlling actions and evalutating its performance and
- feeding back and carrying out necessary modifications.

7. 1. Strategic Actions and Changes

Changes can be introduced into the life of a firm, an organization or environmental protection through strategic actions. This process is demonstrated in Figure. 11.1.

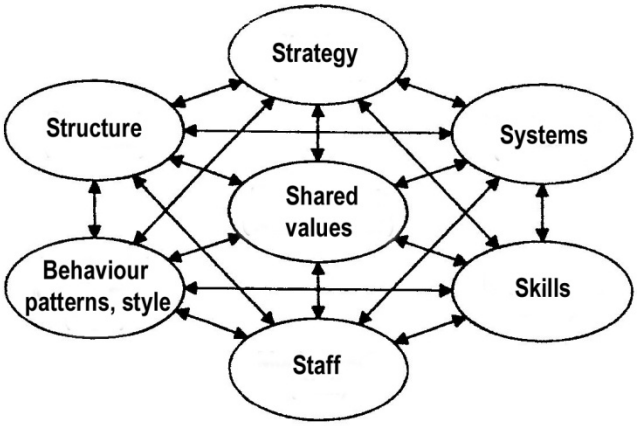


11.1. figure Strategic actions and changes

According to strategic advisers, to carrying out strategic actions and changes belonging to them successfully, we need successful co-opreation in seven fields. These are as follows:

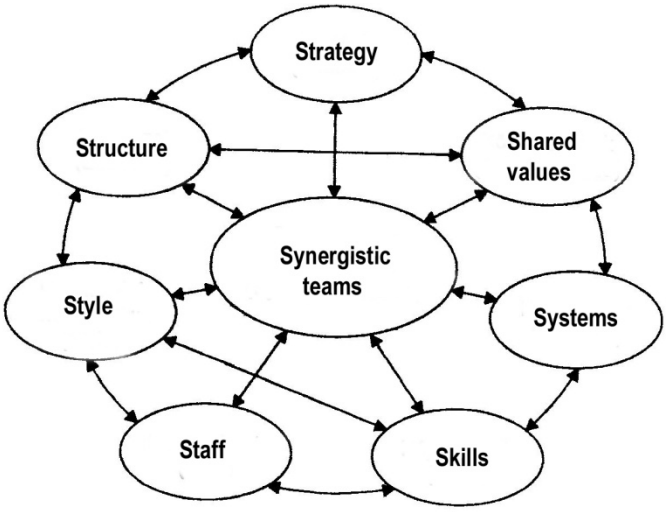
- entirety of strategic actions assisting in attaining the vision,
- entirety of organizational structure and spheres of activity,
- entirety of formal and informal processes, systems of decision making, control, evaluation and communication within the organization,
- behaviour patterns,
- shared values of which people are and would like to be proud, at what people are successful and what they refuse,
- knowledge, experience and commitment of all employees as well as
- entirety of capabilities, strengths, competencies, quantity and quality of available resources.

The interrelatons of these seven fields are shown by 7S model of McKinsey in Figure. 11.2.



11.2. figure 7S model (Source: Csath, M. 2004)

Carrying out actions and attaning results successfully are guaranteed by a continual renewal, learning and fresh ideas. For this, however, there is a need for proper experts and to authorize them to decision making. Instead of a centralizing managerial method based on power, democratic management, asserting capabilities of mentor and putting the real team-work into the front are desired. This is the condition for successfully carrying out f actions and changes, too. It is advisable for us to expand 7S model, and to use 8S model in Figure. 11.3.



11.3. figure 8S model (Source: Csath, M. 2004)

To successfully implement our strategy, we need five elements (Galbraith, J. R. 1995). These are as follows:

- entirety of vision, goals, scale of values, mission and actions to be carried out,
- proper organizational structure and operating,
- entirety of value producing processes taking place,

- motivation interlinking people and organizations,
- available staff of experts together with their capabilities, knowledge, will and commitment.

11.1. Efficiency and Successfulness of the Implementation of the Strategy

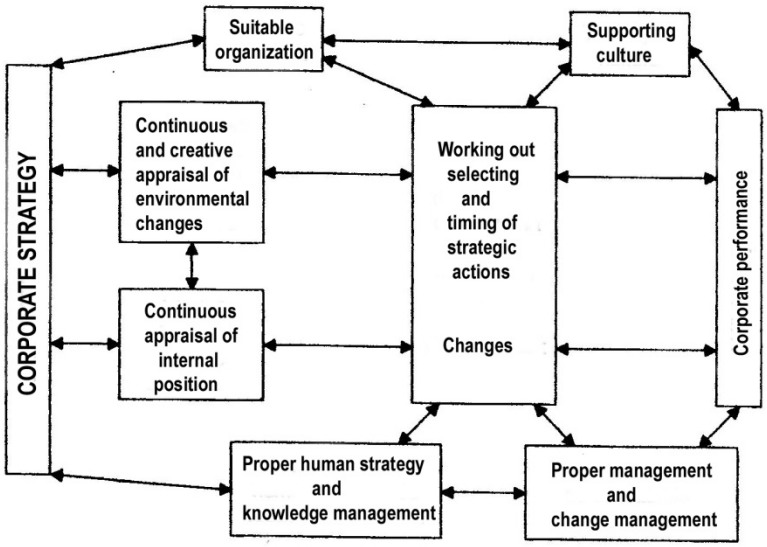
To establish and maintain harmony among elements and systems in accordance with certain theories and models, it is important for managers and controllers of the strategy to continuously analyse the efficiency and quality of operation of individual partial fields. This is served by controls and corrections carried out in the course of progress. Analysis has to be resolute and unambiguous, so we have to prepare effective questionnaires we can use for assessing either individuals or groups. Similarly to environmental revisions, analysing has to cover the performance of the company, too. The continuity of analyses also allows us to make up arrears. If our performance is better than the level we planned, we have opportunity for additonal corrections, which might improve the successfulness in carrying out other actions.

In general, strategic objectives are not static, since the real goal of a strategic planning is to permanently and continuously improve our environment. Therfore, on controlling we can reveal opportunities that can lead to additional changes or better results.

Using ARC model (Architecture-Routines-Cultures) (Saloner, G. 2001) can be the pledge of the successful implementation of the strategy. Interpretation of an ARC model, e.g. in the chapter of the environmental strategy can be as follows:

- Architecture = relation system, hierarchy of actions, tasks planned in the strategy, selection of executers, their appointment to posts, motivation system, condition system of management, formal and informal relations, ownership, scopes of responsiblity, etc.
- Routines = environmental regulations, directives, rules of law, operating rules, decision-making and controlling mechanisms, customs, etc.
- Cultures = intellectual level and scales of values existing in the region, process of socialization, conditions of social participation, environmental awareness, knowledge level of implementing organizations, etc.

The ARC model stresses the importance of the relation between the strategy and the everyday practice. Ultimately, ensuring the level of individual elments and establishing their harmony are the tasks of the manager or managers responsible for implementing the strategy. Implementing the strategy means that strategic actions start changes and carrying out these changes leads to attain strategic goals, and realize vision. The conditions necessary for the successful implementation of changes have to be ensured by managers. Figure 11.4 shows these relations.



11.4. figure The conditions for the successful implementation of the strategy (Source: Csath, M. 2004)

11.2. **Time Horizon of Strategic Planning**

During earlier decades, the objectives of the economy was generally laid down in 5-year plans in the past socialist countries. For developing strategic plans of a company, 5-year cycles were also in use in the Western countries. However, the use of 5-year cycles made planning mechanical and did not take the particularities of individual sectors, market trends and features of individual development periods into account. In particular, it became the barrier of development in the case of environmental protection, since, in several cases, the result of an environmental investment might appear in 10 to 15 years.

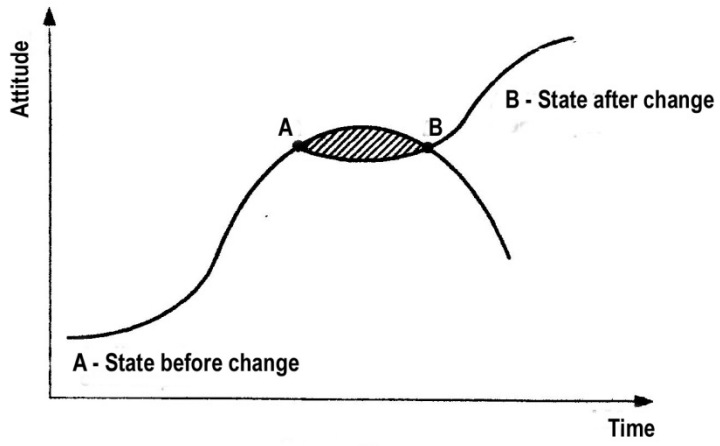
As far as the priority of „end-of-pipe" technologies was pushed by limited financial conditions, strategies developed for 4 to 5 years proved successful. Expanding environmental strategies, however, put off the time horizon, and strategies connecting to long-term plans may settle the time horizon of strategies in 30 to 40 years, either. On the basis of national experience, the environmental strategy of a company is generally prepared for 5 to 10 years, in case of the manufacturing strategy of an environment-friendly product this period of time is 3 to 5 years, and for the strategy of an environmental R&D, including the implementation of innovation, the average time is 8 to 15 years, but, for instance, the strategy of sustainable development for a country is prepared for 30 to 40 years.

There is neither an exact method nor a generally usable formula for fixing the time horizon of strategic planning. It is practical for us to start from what is dictated by the reality of the realization of the planned vision. However, we have to pay attention that these strategic plans should be in harmony with short- and midle-term plans and they should take action programs having been developed for partial fields into account. If they deviate from the general strategic direction very much, we have to pay a great attention to their modification.

The representatives of environmental protection frequently run into two errors,

- either they regard the predictability of environmental changes as a limit or
- leave the opportunities of real changes out of consideration.

In thea strategy, both are unacceptable because either it limits the formulation of vision and limits the point of time of implementation or it makes the implementation of strategy impossible by unconsidered, unreal requirements. The time of necessary changes is approached by Handy's reasoning (Handy, Ch. 1977). We can use this reasoning in any strategy developed for environmental protection. It is reasonable for us to start changes when we cannot see its necessity yet. Independently wheather it is a change in manufacturing technology, the development of an evironmental service or the strategy of changes necessary to implement a regional development program. Figure 11.5 shows the timing of a strategic change

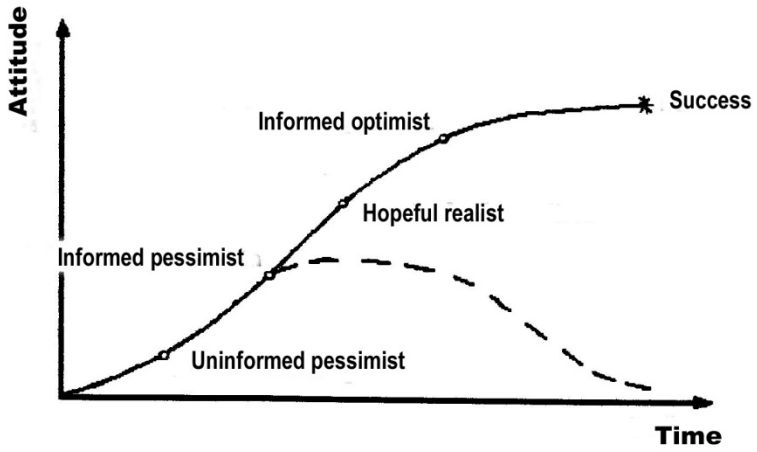


11.5. figure The timing of a strategic change

In Figure. 11.5, the operation of the company, the implementation of environmental tasks and that of a regional or a national plan is still successful in point 'A'. The changes started here – the results of which can be expected in a certain time only – can prevent the state from starting to deteriorate. By the time we arrive to point 'B', the results of changes appear and improvement can be seen in attaining goals set. If we started changes only at this point of time 'B', the results get to the descending branch and we can give an impetus to activities again with a huge loss of time only.

It should be noted that hatched area between points 'A' and 'B' covers an uncertain, chaotic period of time, during which old regulations are still alive but new ones is already effective, too.

In the course of carrying out strategic actions, the participants of the strategy can behave in different ways. This is shown in Figure. 11.6.



11.6. figure Behaviour in the function of time

The features of behaviour are as follows:

- few information, so there is a great confidence, vision can clearly be seen – uninformed optimist,
- sufficient information, but just for this reason, doubts emerge, and image is not so encouraging, fear of failure – informed pessimist,
- information is settled, a realistic image emerge, and participants begin to consider the task of his/her own, there is a little light in the tunnel – hopeful realist,
- information takes its place, the end of the tunnel can be seen, everybody feels the task of her/his own and keeps fingers crossed for the success – informed optimist.
- we get out of the tunnel, we have been succeeded in attaining our goals and realized our vision.

11.3. **Competitiveness and Environment Protection**

Practically, the essence of every strategic plan can be that we should remain competitive in every field of environmental protection. The company should remain competitive with its environment-friendly product, the local government should remain in competition with others by attaining its environmental goals, but our country too should attain its environmental objectives in conformity with the other nations of the Euroean Union. Any arrears in this field can produce political, social and technical-technological consequences. In the course of implementing the strategy, the behaviour of organizations can be as follows:

innovative	-	act, plan, advertise,
offensive	-	lay stress upon marketing and communication
defensive	-	adapt themselves well (frequently far inordinately!)
indifferent	-	do nothing.

The question raised in connection with the economist, M.Porter's theory and having induced great international disputes seems to be answered nowadays. Porter stated already in the beginning of the 1990s that the more and more severe environmental prescriptions can improve the competitiveness of companies, either. The basis of Porter's theory is that he considers the competitiveness with a dynamic attitude and he regards environmental protection as the key category of innovation. Since innovation is one of the most important factors of enhancing competitiveness, the environmental innovation improves competitiveness. However, this also requires that companies and their managers should

- not have negative attitude to environmental regulation,
- treat it as a challenge,
- react to environmental demands in an innovative way.

Porter's views gave rise to heated debates among all those who – although do not question environmental protection as a social goal – claim that environmental activities of companies do not improve but rather worsen competitiveness.

As a reason they offer the argument that while ecological constrains reflect social demands, the external factors of the operation of companies are given. Essentially, environmental pollution can be traced back to inefficient utilization of resources. Consequently, meeting the environmental demands postulates environmental protection integrated into production, the introduction of clean or rather cleaner (material-saving, energy-saving) technologies. These can produce high additional costs in the running-in phase of production, which reduces competitiveness. It is known that the competitiveness of a product decreases when the product has reached the maturity. At the same time, costs necessary to meet environmental demands continuously increase. In general, this increase is gradual, since they follow the more and more severe regulations. However, we cannot exclude that, in case of certain acivites, innovation does not become economical and it can reduce the competitiveness of a product or service.

Nevertheless, the process of integrating environmental protection into production becomes a factor increasing competitiveness only in the case if the national economic environment has the following four potentialities interacting with each other:

- Differentiated and future oriented circumstances of demand. The question is wheather the society is ripe enough to accept environment-friendly products and technologies and wheather there is environmental awareness of high level. Wheather the market is sensitive enough to accept environment-friendly products. If circumstances of demand suits this, then it stimulates environmental innovation.

- Multi-coloured and differentiated nature of connecting and supplying industrial sectors. According to Porter's conclusions, the international competitiveness of a country developes vertically (between industrial sectors based on each other) or horizontally (through supplementary or substitution products) along the so-called clusters of industrial sectors. Such a cluster includes the whole set of the given industrial sector: set of knowledge, technology, manufacturing culture, demands for joining market culture, etc.) In the field of environmental protection, the establishment of new clusters (environmental industry, sewage purification, waste treatment) is already in progress. The wider and more developed the connecting palette of the industrial sector is, the more the role building up markets and strengthening circumstances of demand of innovation becomes stronger.

- The introduction of the corporate environmental strategy into the national competition environment. Compared to Hungary, in the European Union, environmental protection can be regarded as a factor of competition, thus companies can remain in competition in the

market only if environmental activies have a distinct role in their strategy. Environmental protection has to be regarded as a factor of competition by Hungarian companies as well and they have to integrate it – similarly to other economic factors – into the strategy of their own.

- Up-to-date environmental regulation supporting innovation. The first step is taken by the government, when, generally responding to social demands, it makes environmental regulation more severe. Regulation becomes a factor increasing competitiveness if its goal is to enforce the best technological answer. Generally, this produces positive effects on companies of solid capital and negative ones on companies lack of capital. Of the member nations of the EU, the leaders (Austria, Finnland, Sweden, The Netherlands, Germany) outrun and get advantages. We have to count that, in the beginning, making regulation more severe results in a reduction in competitiveness. Thus, the strategic significance of regulation cannot be questioned. The strategy being prepared of sustainable development, which has to put environmental tools, new technologies and product devlopment into the centre, can be of great importance.

Of the players of economy, of course, not everybody reacts equally to the demands required by the regulation. Accordingly, considering the attitude of developers, we know five types of stategies of local governments and organizations:

- *Those who fail to adhere*, indifferent or resist to environmental regulation. These unconcerned firms, the operation of which is not so risky and their market opportunities less depend on used technologies, are passive against environmental protection, because they regard it as a „trend of fashion", and they do not mind if they are backward, either, if they do not come up to the market. These firms continue to damage the environment, regularly wriggle out of responsibility and are economically tied to classes of society that are economically under pressure.

- those who adhere to regulation, *the defensive*. These organizations are generally maximalist, and though they follow the legal regulation, essentially they have a cost-oriented management. They strive to meet environmental requirements by means of „end-of-pipe" technologies at as less costs as possible.

- Those who overfulfil environmental requirements, *the offensive*. These firms consider the risks of their operation so they are one step ahead of regulation. But their methods primarily do not serve the integrated environmental protection, but essentially aim at the subsequent elimination of pollutions.

- *Those whe have* outstanding *enterprising spirit* from the point of view of market and environmental protection, who regard the environmental protection as a factor of competence and integrate it into their strategy. They are surpassingly innovative, and by replacing old technologies, they use new environment-friendly technics and technologies in the production and service provision. They have a corporate management system of environmental awareness.

- A few firms, where the whole environmental innovation has already become determinant in their market strategy, belong to the *leading innovators*.

The process of imlementing the strategy will only be successful, if the company (region, country, etc.) prevents its management from becoming unstable for a longer run, well reveals the new situation, completes the environmental infrastructure, induces innovation, applies new technologies and stabilizes the management in conformity with the new situation again.

12. Managing Environmental Conflicts Strategically

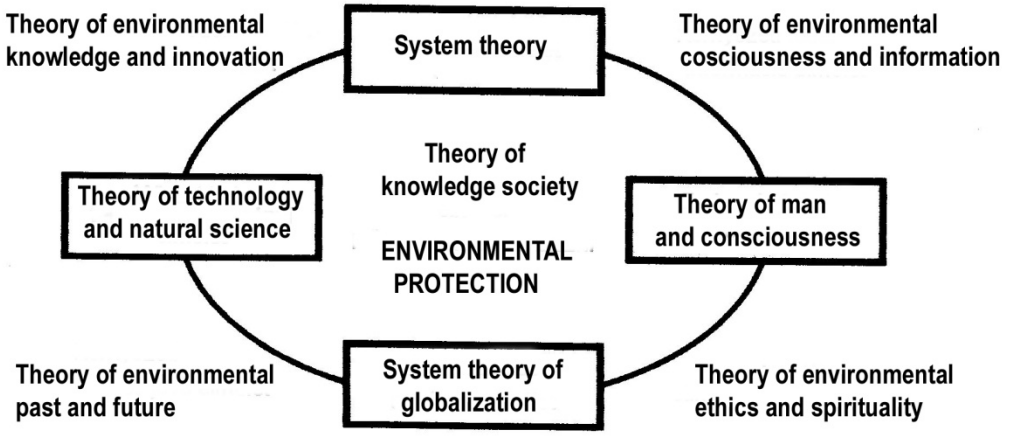
Stimulation, rise of conflicts have „historic" traditions. It is not a chance that the word „conflict" has become one of the catchwords of social psychology. Conflicts belong to the life of humanity and because the human value judgement is multi-coloured, their evolution is an indispensible concomitant of development.

The word conflict is of Latin origin, it has developed from the future participle of 'confligere'. It refers to 'arma confligere', which was soldiers's activity before battles – they striked arms and shields together. Sometimes, fear inspired by the loud noise of arms and the loud noise before a fight resulted in the running away of the enemy without any fight.

A 'conflikturus' or brandisher was a strong warrior, who, standing in front of the legion, conducted the clamour. (See in its modern versions: president of a pary, clique leader, spokesman, etc.). In the course of millenia, the content of the word 'conflict' has changed and become wider, nevertheless brandishing speeches of some 'conflikturus', demonstrations and collection of signatures remind us of the historical past.

12.1. General Procesess of Evolution of Environmental Conflicts

The theory of information era is the so-called *theory of knowledge society*, which is fundamentally defined by four theoretical fields: cosmos theory, system theory of globalization, theory of man and consciousness as well as system theory of localization (Varga, Cs. 2001). From scientific aspect, the approach of environmental protecion as a theoretical task requires quite new ways, methods and ways of looking at things in relations shown in Figure. 12.1.



12.1. figure Environmental protection as the theory of information era

Many people state, but also many people question that environmental protection is the first concrete result of paradigm shift. It is not a chance that the most various classes of society are the representatives of almost all disciplines, but the two 'cultures', the most definitive players

of our human and technocrat world too want to take part in discussing every environmental question, when they set the vision and develop the strategy. It is enough for us to examine the series of events which were the cornerstones of environmental reasoning then, by evaluating the realization of objectives, that of the implementation. The scientific representatives of the 'two cultures' want to have shares from the environmental tasks, they want to take part in decision-making and take intellectual challenge. All these give newer and newer opportunites for conflicts to evolve.

Formation of a new global vision is one of the environmental priorities. Sustainable development, as a basic idea, however can give real vision only if we take national particularities into account. Albeit, reality is revaluated on both global and local levels, the preservation of local values and nature of multi-colours is the interest of all of us. From the systems of environmental sciences separating from each other a new integrated basic knowledge comes into being, with a new logic, a new way of thinking and a new scale of values. To solve environmental problems, we need a new operation theory and a national environmental industry based on innovation. This means a new intellectual challenge in the fields of both science and practice. As a consequence of the challenge, the probability of the evolution of conflicts increases, which raises a new question, the question of responsibility of the intellectual class of technology.

Let us see how many sorts of factors producing environmental conflicts there can be:

- environmental protection as a social macrovalue belongs to concepts not exactly defined and the interpretation of which can easily be linked to political, economic and, possibly, technological interests. The society uncomprehendingly faces various scales of values and its standpoint is mainly influenced by emotional factors.

- macrovalues are missing from the microexperience of personal and social life, so from the consciousness of the service of environmental protection. Many people try to make individual efforts of their own, packed in values presented as the goal of the society and generally accepted, acceptable by everybody. In many cases, this goal is to have either an economic consideration or an extreme environmental reasoning accepted, obtaining the support of a wider stratum of the society or, at least, reducing the resistance to their efforts.

- unfortunately, the comprehensive socialization of environmental protection resulted that today everybody knows all about environmental protection, at least he/she claims it. There are prophets of multi-discipline who feel at home in every field of environmental protection, and there are people who label themselves as experts in the sphere of interest of their own. There are a lot of experts working legally and under the counter, whose opinions conflicting each other but always sounding authentic for the society automatically result in conflicts and passing over the oponions of other parties intensifies these conflicts.

- in the course of making economic decisions, environmental problems are rarely given priority. Decisions are generally featured by short-term attitude and, in this way, the final solutions of environmental problems are not supported but the delay of these problems are preferred. Wasting financial resources is an economic category, today environmental protection is not an economic factor but social demand. This process aroses and intensifies conflicts between the economy and the society.

So, how do environmental conflicts (conflicts of environmental protection) arise from strategic aspect?

Major steps of the process are as follows:

planning for establishing values

striving for realization,

assumption with considering environmental protection,

justifying,

sensing resistance,

interests become known,

defining the object of conflict,

making decision.

In detail:

a) In the *planning phase*, somebody (firm, person, entrepreneur, institute, local government, government office, etc.) sets a certain value upon a given activity, product, technology or solution he proposed. In most cases, he judges that his goal serves the interst of the whole society, i.e. it represents a macrointerest. This is particularly asserted when this matter is entered in a national competition. Plans necessary for starting the action and obtaining permits are completed.

b) In effect, *striving* to implement the plan that is given values starts with planning the strategy. The composition of the plan has to show a „prophetic" effort, the basis of which is the determination of the target state in the mirror of environmental social responsibility. Appraising the expectable situation in the field of environmental protection is made possible by identifying strong and weak points of planned actions as well as opportunities and risks in the course of strategic planning.

c) On the basis of the above, we can make two *assumptions*. The point can be that from general human point of view (from political, economic or technical points of view as well), the value to be realized is necessary, important and useful and it does not jeopardize the state of environment. Another case is that the planned activity producing values jeopardizes the environment to some extent, but the danger resulted in is less than the usfulness of the establishment and the resulting pollution remains within the limits allowed by rules of law. Of course, should this latter statement be false, the planning phase has to be changed by the aid of strategic actions.

d) The person or organization starting the implementation is interested in justifying or at least self-justifying that the activity will not cause irreversible damage or damage not allowed by rules of law in environment. This justification is carried out by preparing the necessary parts of environmental plans, conducting environment impact assessment and environmental impact studies or obtaining necessary licences from authorities. In the aforesaid first four steps, the person or organization taking actions moved wihin a defined circle, the representatives of which can be well defined, but the circumstances can also be well defined in the same way.

It is the investors, planners, supporters, authorities, banks and professional experts who take part in this partial process of investments, but the rules and condition system of the preparation phase of investments as well work under circumstances that can be planned. We may not forget either that the investor has devoted significant money and energy to attain his/her goals.

e) People interested in implementation *sense resistance* that some persons, groups, social strata want to thwart their efforts, goals and interests and oppose the implementation. In many cases, resisters represent or, for some hidden reason, undertake some different economic or political interests. Anyway, the conflict becomes evident among two or more groups of interest.

f) When conflicts become public, the *interests* motivating the behaviour of resisters, people not interested, *become known*. Of course, on the other hand, interests represented by the investor and executer also become public. Both parties may have real or alleged interests or values in their sleeve. These interests move on a rather wide scale {material interests (e.g. reduction of the price of the real estate), loss of profit proportional to alleged risk, degradation of the state of environment (e.g. quality of air, water and soil, noise level, etc.), rearrangement of power conditions, declining of prestige of interest safeguarding social organization, etc.}. In the majority of cases, the detailed analysis of individual motivations is extemely difficult, because they should be picked out from the shell of society protecting slogens of public that appears on the surface and „that cannot be questioned" .

g) When conflicts and interests are made public, a process starts which results that *the object of the conflicts can be defiened*. The situation is simpler if the conflict has two well-definable parties representing the interests (e.g. an investor and a local government). In such a case, the object of the conflict can easily be defined and made unambiguous and the conflict can generally be resolved. The situation is more complicated if the resistors of opposite interests are social groups, civil organizations, NGOs or social organizations motivated by some economic interests. In such a case, the real reason of the conflicts and the motivation of the resisters can be revealed with difficulties and the analysis of the possible outputs of the solution is also problematic. The reasons for this are as follows:

- compared to the determined system of people interested, the resisters of opposite interest, constitute a stochastic group, within which slogens are identical at best, but motivations and resolution methods are different and, in many cases, contradictory.

- the behavour of resisters of opposite interest can appear in different forms (breaching agreements, violating conventions, protesting, insults, emotionally terrorizing outsiders, counter-lobbying, questioning expertise of experts, questioning reliable permits, etc.). The question is to what extent these behaviour patterns can be regarded as ethical or wheather their possible prevention on an official level can be justified.

-in the majority of cases, the manifestation of facts of opposite interest takes place on an emotional basis or it slips to an emotional plane. Motivation on an emotional base cannot be analysed, evaluated and disputed on an intellectual base. A lot of concret cases can be mentioned for these reasons but because of sensitivity of social groups I prefer to bring forth cases for types of conflicts.

h) Now a special situation has come into existance in the process of the evolution of conflicts. On the one hand, for the investor it came out that the return of the amount having invested by this became doubtful, since even the plans based on experts examinations and approved by authorities do not mean safety for him/her. The „reasons" of resisters of opposite interest have become known, a vague guess has formed about their „motivation", but their behaviour is unforeseeable. In this difficult situation *of decision*, people interested have to behave in such a way which yields an output advantageous for them with the highest probability. That is why the knoledge of behaviour pattens and the analysis of conflicts are of high importance in the strategic planning.

12.2. **Ethic Questions of Engineers**

In the beginning of the 21st century, human behavour and, at the same time, behaviour connecting to the implementation of strategies and the scientific foundation of strategic tasks are influenced by two factors:

One of them is that the situation was complicated by paradigm shift at the end of the century. In Hungary, the change of regime and the political process having prepared the way for this change practically coincided with the advent of information era, the change of scientific attitude and the new intellectual challenge. New synthesizing systems of thought have appeared and these have completely transformed, moreover even today they are transforming the system of the sciences, strategies, ecomomy and society. Some disciplines have received new importance and the scientific verification too is laid on other bases. The faultless and effective operation of this system, however, postulates that engineering activities too is more than an engineering science or management. Environmental protection itsef cannot be exclusively regarded as a technical category but as a political, social, economic, even moral, ehtical one in a wider and more comprehensive sense.

Another factor is the loss of people's faith, and at the same time, the degradation of moral values in addition to profiteering.

In the German pavilion at Hannofer EXPO, a wording that can also be regarded as a slogen caught me: „In the past we saw the present far happier than now we see the future!" These words are frightening, but, at the same time, make us think. What can be the reason for this pessimistic emotional manifestation related to environmental protection as well?

Ethics is a science dealing with human actions. Of the other social sciences, maybe the jurisprudence is the closest to it. Ethics considers the internal principles of human actions while jurisprudence considers the outer ones. It happens several times that for some internal compulsion our conscience protests our acdtions, though we have not violated any rule of law.

Moral defines the internal laws of human actions, adhering to which is sanctioned by the words of conscience and public opinion (Legeza, L. 2004). Law defines the external rules of our actions, its observation is guaranteed by the government, the administration of justice. Accordingly, an engineer's actions is motivated, on the one hand, by the law, and on the other hand, the society, his/her commitment to environment, in which professional aspects also play a determinant role.

As liability belongs to law, in the same way, resoponsibility belongs to ethics. The sphere of activity of an environmental engineer is a legal instrument, in which his/her rights and liabilities are laid down. In general, the sphere of responsibilities is also laid down, but this cannot be a pledge that he/she will always and everywhere follow ethical expectations. The responsibility of an engineer is rather an ethic quetion, irrespectively wheather it is related to problem solving or to relatons with colleagues, to managerial responsibility or to a creating phantasy.

Let us consider briefly in what we can catch the ethics of the environmental strategy.

The economic growth we can experience all over the world changes our environment to a significant extent and it can result in exhaustion of resources and seriously jeopardize natural systems. In securing the balance of nature and preserving its values, engineers including environmental ones also have a great part.

Moral and ethics are human concepts, they cannot be extended to the nature. We cannot expect that the nature should follow rules of law. It is only human being who can take conscious actions, so people have responsibilities for and obligations to the nature. Only people is able to intervene in the nature, and by doing so, damage it, and it is only people who is able to eliminate or prevent damage by taking counter-measures. Even in legal and ethical sense, engineers are liable and resoponsible for settling the state of the environment.

There are two basic views having evolved in the relation between environment and people:

- anthropocentric and
- environment-centric (ecocentric) view.

The anthropocentric view subordinates environment to human interest. Nevertherless I note that people's primary interest is a clean and beautiful environment worthy of people and the improvment of the quality of life. Thus, environment-centric thinking cannot be without people's interests, either. Interconnecting these two scales of values could also be the basic idea of sustainable development. People of our era is strong enough to have a determinant influence on nature, but also to eliminate, or at least diminish envionmental damage caused by people.

People's free actions, including ones forming nature, also imply responsibilities. Since it is only modern technics and technologies that are capable for changing nature and the damage to environment can be eliminated only by developing these environment-friendly technics and technologies, environmental protection is an important point of view and technological task for engieneers. We have to pay attention to the natural living space of future generations and the aesthetic values of nature. Engineers have to solve their problems by using as less raw material and engergy as possible and by applying technologies producing the least emmission and waste material. It is not advsable for engineers to undertake jobs resulting in significant damage to environment. Ignorance, greediness and selfishness are the major sources of the deterioration of our environment!

Let us consider to what extent opportunities are given for the intellectual class of engineer. To what extent is the creative work of engineers appreciated in our country and all over the world?

On the basis of the lectures of C.P. Snow, professor at Cambridge University, Henry Petroski identified the sharp separation of the „two cultures", technical and human ones, as the main reason for the degradation of engineering acitivity and its decrasing appreciation. Nevertheless, the main point of interest of this is that Snow's articles and lecures were published and professed, resp., in the end of the 1950s and in the beginning of the 1960s, while Petroski put the intensification of this phenomenon in the 1990s and in the beginning of the new millenary (Petroski, H. 2005).

In Hungary such a sharp separation of human and technical cultures was less experienced in the 1950s and 1960s, though majority of prominent experts having human erudition of high level, comprehensive scientific knowledge, good literary ability of specialist and an established professional knowlege were gradually removed – for baffling reasons I cannot understand. In engineering life, specialization, education based on vertical knowledge system and politics putting scientific sound foundation on the back burner and claiming practical attitude is continuously spreading. In the representatives of technical culture, howerve, there was a cohesive force which prevented the representatives of the „other culture" from making decision on technological and, in many cases, exclusively technological questions.

In the second half of the 1980s but particularly after the change of regime, it became disquieting that intellectual relations still partially operating were separating and two typical groups were formed even in Hungary, the intellect of „engineering" and that of „words". As a result of this

separation, the communication skill of technical experts significantly declined, and the communication is dominated by the „experts of words", deserving their name, on both national and international levels. My personal experience also justifies that in questions requiring considerable scientific, thorough grounding, not an expert's opinion but the populist opinion of a media star or that of a dilettante star politicien is authoritative. As a result of this, even people on the same intellectual level and in the same financial situation and having the same social root separate and they hardly communicate each other. Maintaning this dividing role of the two cultures practically misleads the society as well, it claim that the socio-economic processes would have two separate parts, a material and a spritual (intellectual and emotional) one. It can be dangerous that this dividing tactics controls the behaviour of the political elite as well.

When in the beginning of the 1980's the interpretation of Snow's theory began to be dealt with at American and British universities, by that time the problem of the „two cultures" had already become acute in the developed Western countries. The human side became determinant and engineering faculties having rather small number of students were driven out of social discussions. It is the human sciences that moved into university campuses and by calling globalization to aid, it also undertook the critics and interpretation of the technical side. Bridging over the increasingly deepening chasm proved more and more hopeless endeavour. In Hungary, the separation process accelerated during these years and, with some unpleasant political concomitants, resulted in the discrimination of engineers's community.

This period of time is mainly featured by that engineers are continuously forced to a defensive standing-point by the representatives of the human side in all questions of which they know precious little: such as the questions of nuclear accidents, air crashes, air and water pollution, river regulation and energetics. Administration and communication stress one side only and, most of all, indoctrinates the responsibility of the engineers's community into common knowledge. They almost never advocate engineer's knowledge and experience. Unfortunatelly, technical experts have frequently faced experience of failure and this meant serious fall in creative works. It is not a chance that outstanding, unique, durable works of engineers, technologies of high knowledge content in environmental protection and engineer's papers, studies and professional articles are hardly born today. It is not a chance, either that the lack of comprehension and insuffient expertise result in pessimistic statements.

Of course, there have been and are always experts striving to bridge over the chasm between the „two cultres". Elaborating the conditions of sustainable development, designing and carrying out its technical and technological equipment and processes and technically and scientifically laying the foundation of sustainability cannot be imagined without knowledge of natural science, society, engineer's ethics and even arts. To interpret sustainable development correctly, ensure proper attitude and establish conditions, the symbiosis of the „two cultures", based on scientific ground and complementing and supporting each other is essential.

Engineer's activites for protecting our environment are more than an engineering science or technical management. Sharing between the „two cultures" is misleading, in addition to the culture of its own, a crative activity should also contain the connection to the other culture. Engineer's activities, the "engineering" should not contain technical calculations and drawings only but also knowledge, scientific research, technological development, artistic creation, morally unassailable basis, and the chapters of engineering law, environmental protection, quality of life and branch politics. Of them it is the moral value that is the most important, since if it is not possessed by the others, then they will not be for the benefit of humanity.

12.3. **The Significance of Human Behaviour Patterns in Strategy**

Considering the knowledge of human behaviour patterns in the process of strategic planning is of importance from several points of view as well.

When establishing environmental and social responsibility and analysing, we have to judge people's attitude, supporting or opposing behaviour and the role and effect of human responsibility. In relation to potentialities and environmental opportunities, human behaviour patterns appear as strong or weak points, factors supporting or creating critical situations. Strategies are implemented by people, so their behaviour can be determinant as a human factor, a managerial or even an organizational attitude.

We cannot neglect that, besides microenvironment, the environmental strategy can be determinant for macroenvironment as well. Thus, social behavour patterns have an influence on the implementation of strategy or its feasibility.

In the majority of conflicts, perhaps because of regulated relations of interest as well, the behaviour orientation is actually a preference represented by the interested party for some possible solution of the conflict. As to preferences, we can reckon with five basic types ((Barlai, R. 1998).

These are as follows:

a) Competitive orientation (enforcing self-interest), when the interested party strive to attain his/her goals with desregarding the efforts of parties of opposite interest or possibly suppressing it.

b) Co-operative orientation (co-operation), satisfying the efforts of both parties on the basis of identity of interest or its creation (e.g. by combining their resources, the efforts of both parties can be satified, while the parties cannot get this result separately).

c) Orientation of compromise (compromise), when the interested party makes efforts to effect a compromise with the party with opposite interest on the basis of mutual concessions in order that the different interests will be partially enforced at least.

d) Defensive orientation (defence), when by pushing the efforts of his/her own into the background, the interested party lets the other party's efforts prevail because of alleged or attainable other possible interests (e.g. withdrawal results in the least loss or because of a compensation got in another field, giving up earlier interests is profitable).

e) Orientation of estrangement (becoming impossible), when the two parties do not understand each other and, in the given situation, both parties are completely uninterested and stiffly insist on the standpoint of their own, or because of economic or political factors any solution is hopeless (e.g. parties discuss a solution for which there is no finance).

In the course of managing conflicts, the behaviour patterns of the participants can be as follows according to the individual orientations:

a) competing (self-assertion),

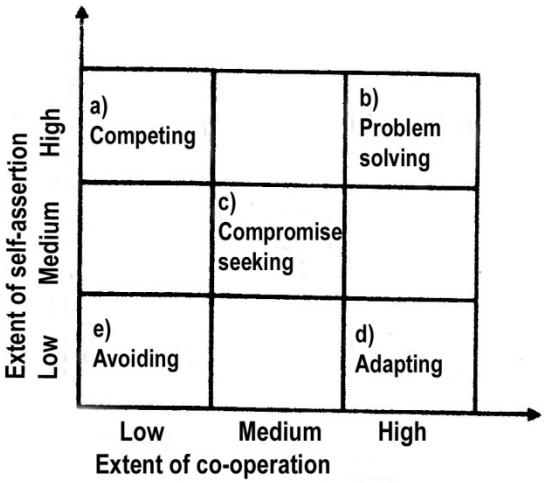
b) problem solving (co-operation)

c) compromise seeking (sharing in expectable result),

d) adapting (arranging),

e) avoiding (withdrawing).

Of course, pure behaviour patterns occur rarely but if we fix the behaviour patterns in the co-ordinate system already used several times and common in strategies in the function of self-assertion and co-operation, we can define the various character delineations, behaviour patterns, which can be seen in Figure. 12.2.



12.2. figure Behavour patterns in the function of self-assertion and co-operation

We have to consider that

- for the competing type, if the interested party wins, the party with opposite interest lose,

- for problem solving type, both parties can win,

- for compromise seeking type, it is difficult to judge the extent of the profit or loss of the individual parties, it is the strategy that can give the answer to this,

- for avoiding type, both parties lose,

- for adapting behaviour, the intersted party loses, the party of opposite interest wins.

It would be good if the individual behaviour patterns were so unambiguous. We have to notice that the behavior patterns can be variable even within the individual social groups, but in the function of time, depending on change of conflicts and the formation of external factors, they can vary man by man in the course of the decision making process.

For this reason, considering the behaviour patterns of the five basic types as well as the four transitional ones (often instable) and therefore causing confusion in statisctic evaluation, we can identify six so-called „mixed" types:

These are as follows:

If in a conflict somebody behaves in a competing way or withdraws after poorly seeking a compromise or possibly behaves in the avoiding way without any intent of co-operation, this type can be named *lonely wolf*.

If starting from the competing basic behaviour, the interested party chooses the problem solving behaviour pattern by means of compromise seeking to solve the problem: he/she can be named *manager type*.

If the problem solving, compromise seeking and adapting behaviour patterns dominate in somebody's behaviour, he/she proves good *team player*.

If the avoiding, compromise seeking and adapting behaviour patters are determinant, we can say that the party concerned primarily makes use of his/her power in an indirect way and generally chooses withdrawal and leaves the responsibility for decision to others. This type is often named *mother of the family*.

If a problem solving person behaves in the way of avoiding behaviour pattern after seeking compromise, his/her name is *touchy prima donna*.

If starting from the competing behavour pattern, somebody behaves in a way of adapting pattern in the end, he/she is the *stupid seller*.

The individual behaviour patterns have got their typical conversational forms, which regularly appear in the discussions of the negotiating parties. For the five basic types, these are as follows:

Phrasing of *competition*: I don't change my opinion! … It's my opinion that's reasonable …, I know this better! …, To be quite clear! …, Do as I've told you! …, etc.

Phrasing of *problem solving*: This is my opinion, and what about yours? …, As a matter of fact, what's the problem?…, How can we solve it? …, Let's try to find a common starting base… etc.

Phrasing of *compromise seeking*: Let's find a solution quickly …, I'm going to yield in this, and you're going to yield in that … I'm ready, if you're also ready …, Let both of us prefer winning to loosing …, Let's find a solution halfway …, etc.

Phrasing of *adapting*: I thouhgt in this way …, I agree …, I'm ready to accept your opinion …, I do as you tell me …, I don't want to offend you …, I'm glad that we agree on this! …, etc.

Phrasing of *avoiding*: I can't assume the responsibility for this … We'd rather not to discuss it now .., Let's return to this later…, This doesn't come within my activities…, I'm not in a position to enter into a dicussion …, I don't want to express my opinion on this subject…, Now I've no opinion…, etc..

In the case of mixed types, these phrasings occur, of course, one after the other, but with some kind of human consistency. In resolving conflicts, each type can have a positive or negative part. Therefore, do not let us regard none of them as unambiguoulsy positive or negative.

13. ENVIRONMENTAL ASSESSMENT; EVALUATION of the NATURAL RESOURCES

Written by Miklós BULLA, Széchenyi István University, Győr

ABSRTACT: The greatest challenge of environmental management is to create balance between increasing civilisation demands and decreasing natural resources. There is an essential need of the information about the current state of the environment and tools for predicting how this state would be change due to different effects. So the theme of the essay. The presentation of an environmental analysis model Aim and utility: environmental condition varieties as well as effects on people; economic and social activities behind the effects and their influence on changing environmental policy regulations; establish a conceptual organization which can support the analysis of interactions. We propound the requirements of evaluation of the state of the environment, then review three Soft Computing methods and their feasibility in modelling environmental processes. The GRID based on CNN, FUZZY RULES and CA seem to be promisable for modelling complex, highly nonlinear processes and able to ground tool-kit for supporting environmental decision making.

INTRODUCTION

Towards (getting ready) for the next millennium, the environment and development inconsistently connected tend to become a key issue or rather the key issue.

On one hand huge technological and consumption systems have been established, urged forward by the desire and pressure of expansion. On the other hand lack of development still prevails from the point of view of the vision of the industrial consumption, moreover, humiliating poverty, which makes everybody think of their attitude to nature.

Therefore, development is not only right but it's must. This should mean change at the same time as regarding "traditional" growth compared to the monotonous quantity production and consumption which shouldn't be continued. To be more precise, it could be continued somehow, nobody knows how long, but its dangers are to be seen more and more clearly.

This is a hard limit and a warning as well, the effectiveness of plundering environmental resources can be maintained only with joint effort. Maintaining the wastage (material, energy) or even the expansion or it would be followed by losses and sacrifices.

The state of the environment is continuously changing. Partly due to the never-ending or recurring geomorphologic and biosphere-forming events, partly due to impacts of activities of - today already prevailing – anthropogenic (social and economic) origin. So the balance between the increasing civilization demands and the natural resources has to be created. This is the duty of environmental management. In order to reach all these aims, the management has to be organized i.e. such environmental policy should be established in that environmental management makes environmental protection part of the activities so separate "environmental policy" disappears. Generative research has begun at the Department of the Environmental Engineering, cooperating with the Institute of Information Technology and Electrical Engineering of the Széchenyi István University. The central topic of this research is modelling and controlling extremely complex, non-linear and non-deterministic/non-casual environmental processes.

13.1. MATERIALS and METHODS

13.1.1. 5Requirements of the evaluation/assessment of the state of the environment

In order to handle the emerging tasks it is indispensable to get to know the changes forming the quality of the environment, to explore the causes of the changes and the expectable consequences thereof.

It is necessary to have information that:

- provides the actual state of the environment,
- explores the casual connections,
- indicates the probable trends of the changes.

All these mean that the determination of environmental policy objectives and tools and the elaboration of an actual environmental policy are not possible without exploring the state and the changes thereof, the more and more exact evaluation. So the first, basic step is the evaluation of the state of environment. In order to fulfil this task – since it is a rather complex one – it is necessary to integrate the results of basic and applied research of different sciences in an interdisciplinary way. According to the objective (examination of the sustainability of regional development), the evaluation of the state of the environment is part of the comprehensive environmental management.

Within the frame of this, it is necessary to perform the analysis of the changes in state occurring in the environmental media and systems (soil, water and air) and the economic and social processes causing them. Knowing all these the occurring processes can be understood and characterised so the effects may be calculated and forecast.

Since the data sources and the information sets are wide-ranging, their simultaneous illustration and analysis, the derivation of the models require information systems and GIS within this.

Adequate aspects – where the selection of criteria includes value selection – are necessary to the state evaluations supporting the decision-making as well as application of evaluation methods (professional systems). So the evaluation aspects also have to be elaborated.

The requirements according to the evaluation aspects are those on whose basic any states of environment or environmental process can be considered as “good”, “bad”, etc. So these are the reference bases of evaluation. In this classification system we consider long-term human biological and economical-social demands against the environment as evaluation criteria. As a matter of course, the validation of these aspects makes necessary the common, optimised consideration of many, relatively well separated aspects.

In the evaluation aspects there are well-formulated requirements towards the state and the quality of environment. These three: ecology, human ecology and economy evaluation aspects cover the whole spectrum of adequate demands against the environment.

The applicability in the evaluation of the state of the environment of these aspects provide the solution of three further tasks:

- Firstly, a set of parameters suitable for classification of the change according to the given aspects can be specified (and the actual values of these parameters can always be obtained!).

- Secondly, a value scale has to be constructed for the chosen parameters so that the environmental state can not only be described but also evaluated.
- Thirdly, evaluation algorithms are to be implemented, which can carry out a reconstructable and objective evaluation. These will allow for the investigation of more alternative scenarios and interactions described by a large number of parameters. They will also increase the reliability of decisions.

Together with all these, it is also necessary to built in highlighting processes into the algorithms

13.1.2. Aims and Objectives

There are two approaches to the environmental future. Regarding the objectives the environment (earth, water, air, vegetation, settlements, landscape) must be protected and improved. In order to attain this, economical and social task should be defined (production, consumption, industry, agriculture, transport, forming of consciousness).

The task of research-development: to analyse

- the changing conditions
- the cause of the changes, artificial or natural.

The aim is to sketch the right survey and then have known the correlations we can work out intervention programmes.

The analyses of the environment: the comprehensive analysis of the components and connections of environmental management needs, the applications of the results from other sciences. There is not one environment science which can join together the natural (or close to this state) and built environment changes as well as interactions of social activities.

However, it is essential to take into consideration another attitude and approach which looks at the changes and regulations in a different way: a reasonable, conscious and rational management of environmental resources.

The environment should provide the basic essentials (social and biological). In order to attain this defined goal we need – in a systematic form – information from the exact sciences and their suitable application which can help work out the causes of changes of the environment condition.

The protection of the environment, especially the establishment of long-termed and preventive policy does not aim at cancelling or liquidating the harmful effects on the environment, or several and varied tasks, but joining together, interlacing and coordinating.

(I.) Defining the informative needs an their fulfilment on a geometrical basis, the foundation of a network, operating on the complex analyses.

(II.) Taking account of the risks, ranking according to the condition evaluations. Analysing the risks and setting environmental policy priorities.

(III.) National summary; regional, thematic reports; analyses and informative materials.

(IV.) The analysis of international domestic, social and economical relations from the environmental point of view. Estimation of international commitments and stipulations. International relations (especially CEE and EC).

(V.) The follow-up of the public opinion regarding the demands of environmental policy.

(VI.) Set our objectives, implementing methods, work out the policy form. Preparation of environmental improvement strategy:

- national environmental policy
- department, section tasks
- in the form of regional improvement roles, namely long term national strategy, priorities and intensive programmes.

(VII.) Examining the effectiveness of controls and regional programmes.

(VIII.) The implements for achieving this policy, juristic and the proposal of economical controls. The resource utilities – a comparative economical analysis.

(IX.) Exploring and supporting professional knowledge. Ensuring the flow and availability of professional data, coordination of knowledge acquisition.

(X.) Environmental conscience formation, collaboration with the state education development (high school curriculum retraining courses).

(XI.) Editing publications, preparing materials for the Press, public relations.

(XII.) Keeping in touch with other institutes and environmental activities and campaigns.

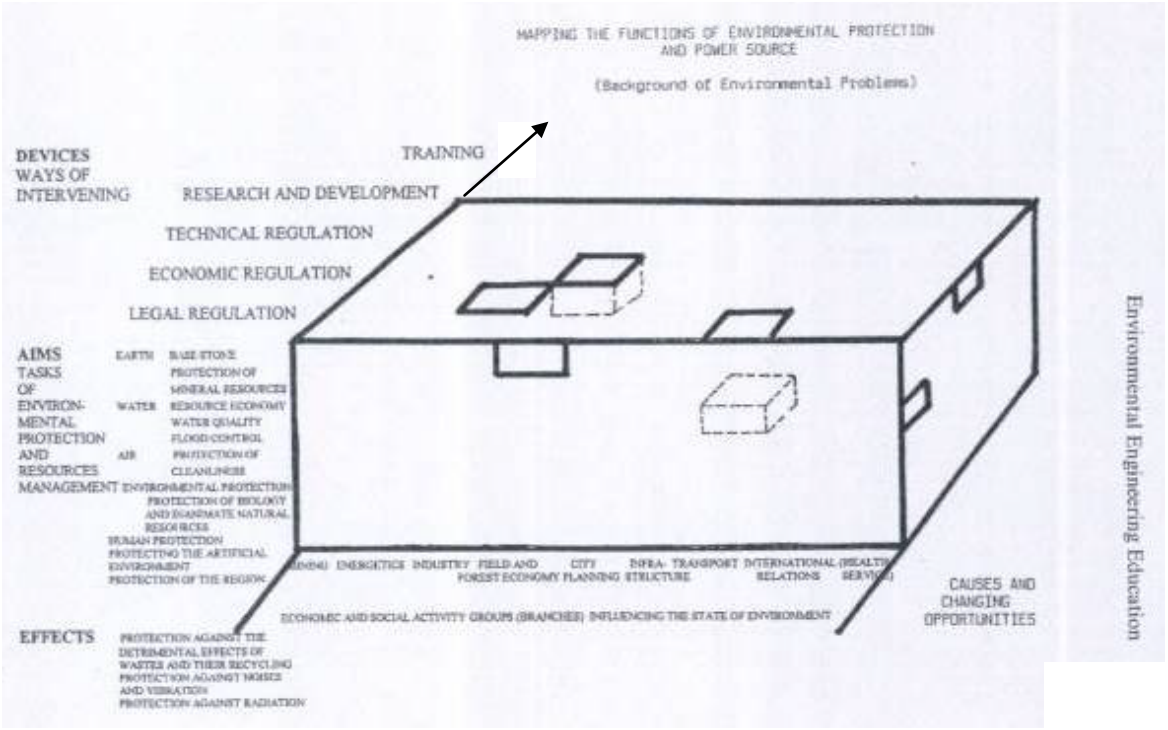
13.2. MODELING of the ENVIRONMENTAL – as well SOCIAL and ECONOMICAL – PROCESSES

13.2.1. Environmental Model

The introduction to the problem sphere helps in analysing and finding out connections Figure 13.1.

The advantage of this “problem-sphere” model is that it is very descriptive. Environmental problems are complex, multiphased, stereoscopic and they have involved from several causes. In order to handle them we should analyse the causes of state changes – effects – economical and social activities: defining and eliciting the causes, as well as the dominant effects / identifying the causes or effects. The model comprises the means of regulation – or rather presents – (to a certain extent), regarding the choose of methods, but it cannot offer a proposal. Similarly it does not describe the measurement of the risks that derive: public health, ecological and economical risks. Neither are the different preventive and preceding measures analysed.

However, it was suitable for pointing out the connections and it can be improved according to the above mentioned needs and demands.



13.1. figure Sources: Bulla, 1989.

The environmental "problem–sphere" model therefore in the interest of the concrete program formation as a "decision tool" first of all supports the risks and input, namely the aims, priorities and the social groups involved.

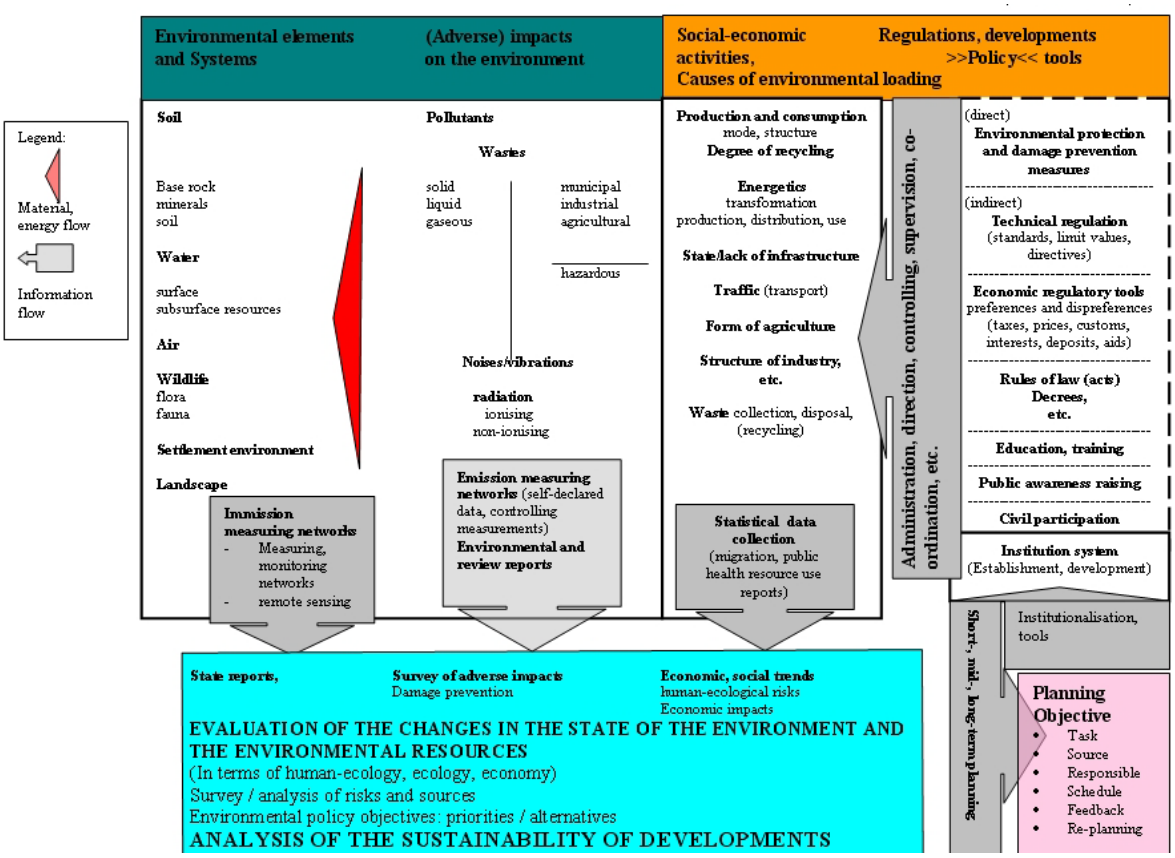
All these define and complete the dimensions of political changes. As well as the components of the process and interaction, information types, necessary disposal definition.

The result the model of the analysis of environmental management (Figure. 13.2.) does not include the natural interactions and it does not describe the details: environmental media, effects, social and economic activities, causes, constituents of policy change, means of institutionalizing. But it is suitable to define these, namely this is the main aim of the following analysis. Without the exploration of the components and connections of environmental economy there are no possible, effective means to define the objectives of environmental policy, to indicate/mark priorities, improvements, interventions of varied scales, regional, local and punctiform effect. By no means: working out environment protection programmes, achieving them, supervising them, summarizing the results, indicating new aims, priorities and tasks.

In short the never-ending management of environmental economy is continuous.

The environmental economy is the conceptual term of this new environmental strategy. this, as a new paradigm expands not only the direct relationship of people and environment but on economy and society as well. Namely it is integrated, systematic and pragmatic contrary to environmental protection which is elaborated in a different way and it is mainly defensive and analytical.

Model of environmental management and analysis



13.2. figure Model of environmental management and analysis (Bulla, 1993, - 2003)

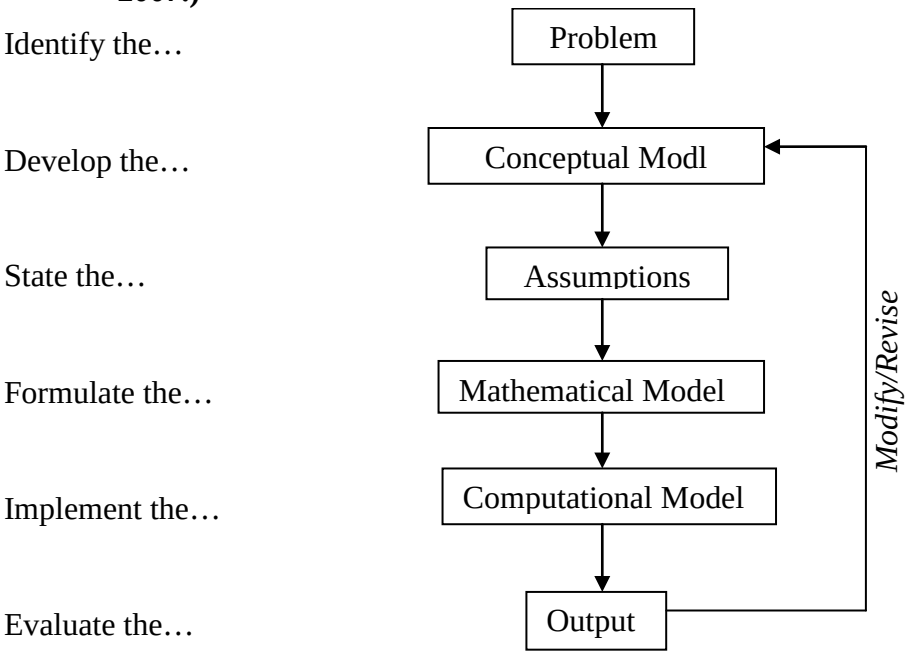
The use of the model serves the realization of system-principled analysis. The information flow, the structures, material, energy – that is, it aims at supervising and controlling the statical, dynamical and guiding systems.

Considering that the drawing up of the environmental aims and means cannot be done without exploring the condition and its social background, the first step is the evaluation of the environmental state.

We deal with the establishment and development of suitable expert systems based on proper mathematics that is suitable to evaluate the state of the environment in a wider sense. The aim is to analyse the relationship of the changes as consequences of (adverse) impacts on the environment, as well as the relationship of social, economic and technological processes being the sources of these impacts.

With the help of this analysis the state changes depending on the changes of environmental loading can be forecast and the environmental and impact assessments can be expanded and developed further. In the course of the regional programmes and development the expected impacts of political programmes aiming at the regulation of the users of the environment can be predicted, so they can be implemented. Regarding the costs it is possible to choose and elaborate the most favourable and suitable ones.

13.2.2. The modelling process (Source: M. J. Barnsley: Environmental Modelling 2007.)



13.3. figure Schematic representation of the modelling process.

A model is a simplified representation of a more complex phenomenon, process or system; an environmental model is one that pertains to a specific aspect of either the natural or the built environment. Environmental models have been developed to represent, among other things, elements of Earth's climate system, hydrological processes, ecosystems and biogeochemical cycles. The principal purposes of these models are threefold: to increase knowledge, and hence to reduce uncertainty, of the phenomenon, process or system that the model purports to represent (i.e., to improve understanding); to provide a tool with which to estimate the state of the phenomenon, process or system at times and locations other than those for which observations are presently available (i.e., to facilitate prediction); and to provide a framework within which "what if" questions can be asked about possible changes to the state and operation of the phenomenon, process or system under specified conditions (i.e., to perform simulations).

The production of an environmental model involves a process of abstraction: in the sense that most environmental models deal with abstract concepts and ideas (i.e., mathematical formulae and computational code) rather than physical objects and events (i.e., conceptualization); in terms of identifying and extracting the most important elements of the phenomenon, process or system and discarding the least significant ones (i.e., selection); and in the sense of summarizing the essence of the phenomenon, process or system (i.e., encapsulation). Building a well-designed model therefore forces one to examine carefully, analytically and in detail the component elements of an environmental system, the processes and structures that govern the relationship and interactions between them, and the spatial and temporal scales over which they operate.

In principle, the process of designing, building and using an environmental model can be divided into a series of discrete stages. These stages are shown schematically in Figure 13.3., and are described in detail below. In practise, the boundaries between the different stages are not always well defined and progression from one stage to the next is seldom as straightforward or as linear as Figure 13.3. implies. Nevertheless, this diagram provides a useful framework within which to introduce the basic concepts.

The first step is to identify the specific science question, or problem, that is to be addressed and then to establish both whether and how a model will help to answer this question (Wainwright and Mulligan 2004). The problem should be sufficiently well defined and focused so that it is amenable to solution using the knowledge, skills and resources at hand (these factors influence the tractability of the problem), but it should also be sufficiently generic so that it is of more than just parochial interest (this implies that a compromise is negotiated between the specificity and the generality of the model). If the problem is poorly defined at the outset, the model-building process is likely to be more difficult, more time-consuming and more complex. Worse still, the resultant model may not be appropriate to the task for which it was originally intended.

Table 13.1. Four main phases of systems analysis (after Huggett 1980).

Phase	Actions
Lexical	Define the system boundaries (closure). Choose the system components, i.e., state variables (entitation). Estimate the values (i.e., the state) of the state variables (quntitation).
Parsing	Define verbally, statistically or analytically the relatinoships between the state variables.
Modeling	Model construction. Model operationalization (i.e., running the model).
Analysis	Model validation and verification (i.e., compare the results of the model with observations of the target system).

A related consideration is the scope of the model, in terms of those elements of this science question that the model is, and is not, intended to address. The scope of the model may have to be limited in various ways to produce a tractable solution. For instance, the model may need to be designed so that it represents a selected part of the target environmental system, a particular spatial domain, a specified period of time, or perhaps a combination of all three.
After specifying the science question, the next step is to develop a conceptual model of the problem. The term conceptual model is used here to refer to a model that is expressed verbally or in written or diagrammatic form (i.e., concepts), as distinct from one that is represented in terms of mathematical formulae (i.e., a mathematical model) or one that is constructed from physical materials (i.e., a physical model).
The development of a conceptual model necessarily involves a comprehensive analysis of the target phenomenon, process or system with the aim of identifying its component parts, their respective inputs and outputs, the relationships between them, and the processes and structures that govern their interaction. This stage in the model building process is therefore closely related to the lexical and parsing phases of systems analysis, a branch of science concerned with the study of complex systems, including their composition, structure, function and operation (Huggett 1980, Table 13.1) In each case, it is assumed that the “real world” can be divided into a number of more or less discrete systems, which can be further sub-divided into their component parts and processes, identified by careful analysis and detailed observation (Hardisty et al. 1993).

Table 13.2. Important definitions in environmental modelling

Element	Definition	Example
Constant	Quantity whose value does not vary in the	Speed of light

	target system.	
Parameter	Quantity whose value is constant in the case considered, but may vary in different cases.	Total solar radiation at the top of Earth's atmosphere.
Variable	Quantity whose value may change freely in response to the functioning of the system.	Amount of precipitation.
Relation	Functional connection or correspondence between two or more system elements.	Rainfall, run-off and soil erosion.
Relationship	State of being related.	-
Process	Operation or event, operating over time (temporal process) or space (spatial process) or both, which changes a quantity in the target system.	Evapotranspiration.
Scale	Relative dimension, in space and time, over which processes operate and measurements are made.	Local, regional, global; diurnal, seasonal, annual.
Structure	Manner in which component parts of a system are organized.	-
System	Set of related elements (e.g., constants, parameters and variables), the relations between them, the functions or processes that govern these relations and the structure by which they are organized.	Forest ecosystem, drainage basin, global carbon cycle, Earth's climate.

The component elements of an environmental system typically include inputs, outputs, constants, parameters, variables (also known as stocks, stores, pools and reservoirs), processes (flows), relations (links or connectors) and structures (Edwards and Hamson 1989); see Table 13.2. for definitions. The boundaries, or limits, of the target environmental system must also be specified. In this context, environmental systems are sometimes classified in terms of their degree of openness: open systems, also known as forced systems, have exogenous (or forcing) variables; closed systems, also known as unforced systems, have no exogenous variables (i.e., all of the variables are endogenous to the system) (Hardisty et al. 1993).

13.2.3. Transport model

Environmental assessment approach

1) Stochastic method
2) Deterministic method
3) Holistic method

Stochastic method – classical approach

Aims at the repeated survey and recording of the elements of the environment (soil, water, wildlife etc.) and the complex elements (landscape and settlements).
Changes can be detected by comparing two succeeding data of recording.
Major disadvantage: there is no way to identify the causes responsible for the changes → not (or very limited) suitable for environmental prognoses.

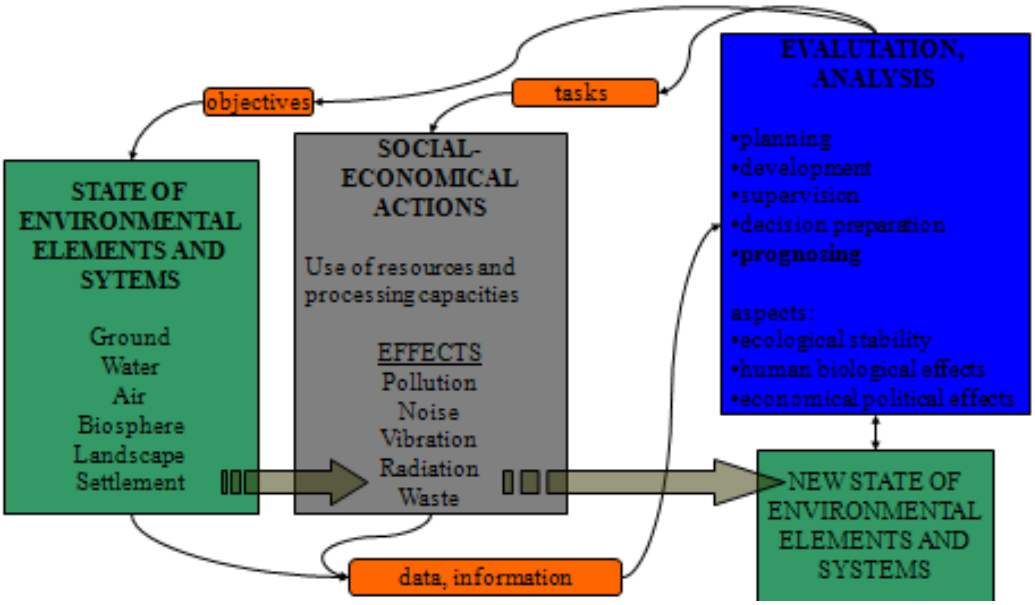
Deterministic method

Drawback of the pervious method can be eliminated by exploring the external effects, paths and effects of polluting materials, noise and radiation in the environment.

Complex type of survey, doesn't separate media of the biosphere, tries to trace the whole transformation process on the limits of measurement and analysis capabilities.
Still analytical, but only one factor can be observed at a time. Theoretically possible to sum up this threads, this is not sufficient to describe the real changes in state of the system.

Holistic method

Examines the interference of various activities, measures as well as the systems consisting of one or all environmental media.
Integrating measurement, data management and processing, analysis and evaluation phases into a common technology makes prognosis making possible.
Development measures can be worked out on the basis of alternatives with known consequences.

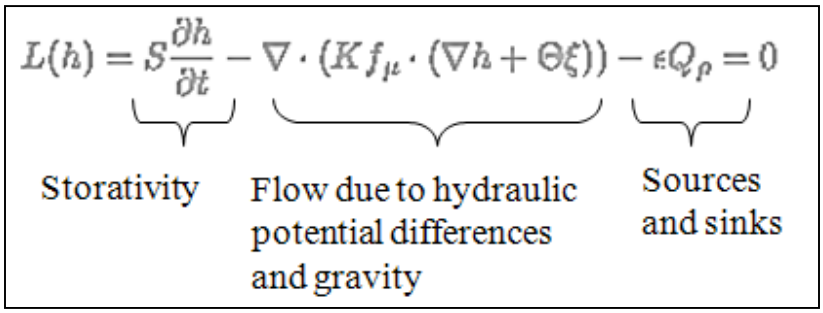


13.4. figure The structure of environmental state evaluation (Bulla, M. 2004)

Basic principles and demands in informatics:

- decentralised information systems
- information system based on regional principle
- multi-purpose utilisation
- friendly decision support information (and analysing) system

The transport equation from the water and inertia balance, with slow flow:



13.5. figure Transport equation (Bulla, M. 2004)

In the next chapters three interrelated techniques will be briefly introduced, which will be suitable for modelling and controlling the above mentioned processes, and this way serving as tools for the construction of the policy supporting system. They are all soft computing techniques: cellular neural networks, fuzzy logic based rules and cellular automata. They are applicable separately and in combinations as well.

Evaluation of the model results

Transport processes

- physical processes
- chemical processes
- biological processes
- radiations

are extremely very complex, non-linear and non-deterministic phenomena.

5.2.4. Application of CNN (Cellular Neural Networks) for modelling environmental processes

The CNN paradigm has been playing an important role in digital signal and image processing during the past decade. CNN is a special technology within the broader field of neural networks [1, 2].

Any physical implementation of the CNN can be considered as a multidimensional array of processors, in which the processing units are connected only to their neighbouring processors. So the communication of the processors is limited to their immediate neighbours.

The weights of the coupling between the neighbouring processors are expressed by the elements of so called template matrices. In the case of a classic rectangular grid where the radius of neighbourhood is defined as one unit, the template matrix contains 9 weight elements.

The state equation of the state-output in the so called full range CNN and the expression of the limitation which follows each integration step is given in the following equations:

$$\dot{x}_{ij}(t) = -x_{ij}(t) + \sum_{W^x_{rij}} \mathbf{A}_{kl} x_{ij}(t) + \sum_{W^u_{rij}} \mathbf{B}_{kl} u_{ij} + z_{ij}$$

$$x'_{ij}(t) = \frac{1}{2}\left(|x_{ij}(t)+1|\right) - \left(|x_{ij}(t)-1|\right)$$

Here $x_{ij}(t)$ is the time-dependent state-variable, $x'_{ij}(t)$ is the limited state, u_{ij} is the input variable, z_{ij} is a constant, which does not depend on time. **A** and **B** are the *template matrices*. The domains of summing W_{rxij} and W_{rui} represent the *r* radius neighbourhood of x_{ij} and u_{ij} respectively.

One of the most promising directions of the application of CNN models is the numerical integration of partial differential equations of physics. Since the transport processes in the environment protection are described by spatio-temporal equations, a multilayer CNN approach is proposed for model generation, recombination and transport processes, such as drift and diffusion.

As an example, consider the continuity equation for a pollutant, in a single layer CNN model. The continuity equation describes the time dependence on the concentration of a given pollutant in a particular point of space, assuming generation, recombination, drifting in a given direction and diffusion.

$$\dot{c} = g - r + h\, div\mathbf{D} + k\, div\mathbf{grad}c$$

c is the concentration, *g* is *the* generation rate, *r* is the recombination rate of the pollutant, **D** is the drift vector moving the pollutant, *h, k* are constants.

On a grid of a two-dimensional plane the components lead to spatial discretisation. The expressions describing drift and diffusion of the right side of the equation can be expressed by two template matrices as follows:

$$h\ div\ \boldsymbol{D} \rightarrow T_{ij}^{D},\ k\ div\ \boldsymbol{grad}\ c \rightarrow T_{ij}^{c}$$

where

$$T_{ij}^{D} = \begin{matrix} h & 0 & 0 \\ 0 & -h & 0 \\ 0 & 0 & 0 \end{matrix},\ T_{ij}^{c} = \begin{matrix} k & k & k \\ k & -8k & k \\ k & k & k \end{matrix}$$

Using these templates, the CNN-like form of the continuity equation is as follows:

$$\dot{c}_{ij} = g_{ij} - r_{ij} + \sum_{w_{ij}} T_{kl}^{D} c_{kl} + \sum_{w_{ij}} T_{kl}^{c} c_{kl}$$

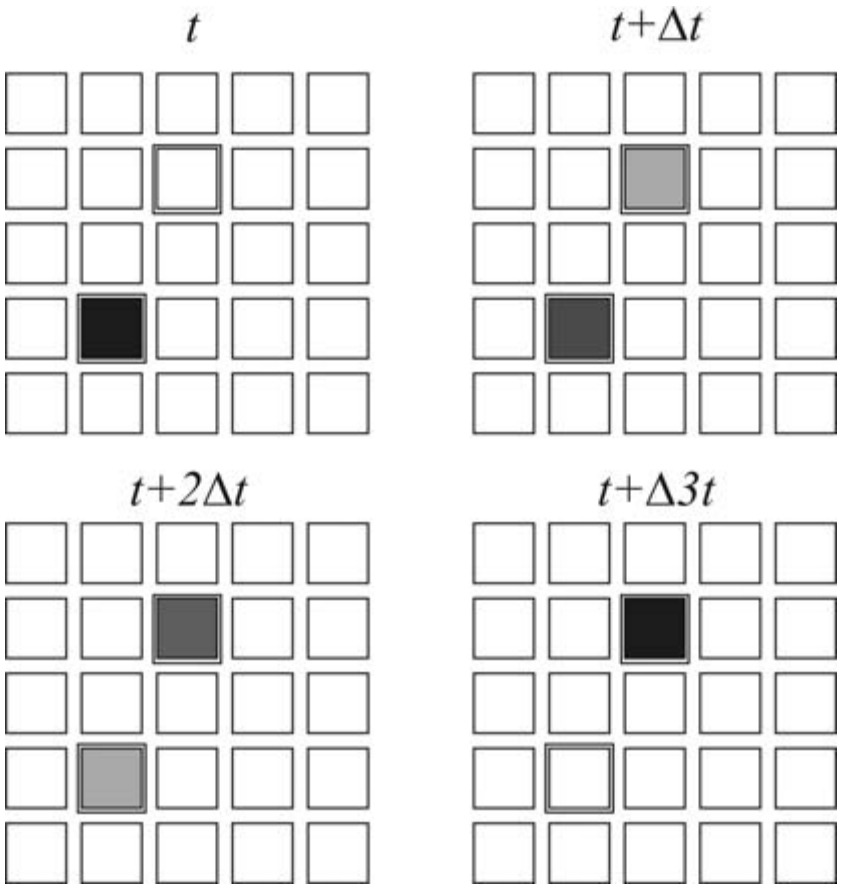
Here w_{ij} is the unity radius environment of point *ij* which assigns the following matrix:

$$\begin{matrix} c_{(i-1)(j+1)} & c_{i(j+1)} & c_{(i+1)(j+1)} \\ c_{(i-1)j} & c_{ij} & c_{(i+1)j} \\ c_{(i-1)(j-1)} & c_{i(j-1)} & c_{(i-1)(j-1)} \end{matrix}$$

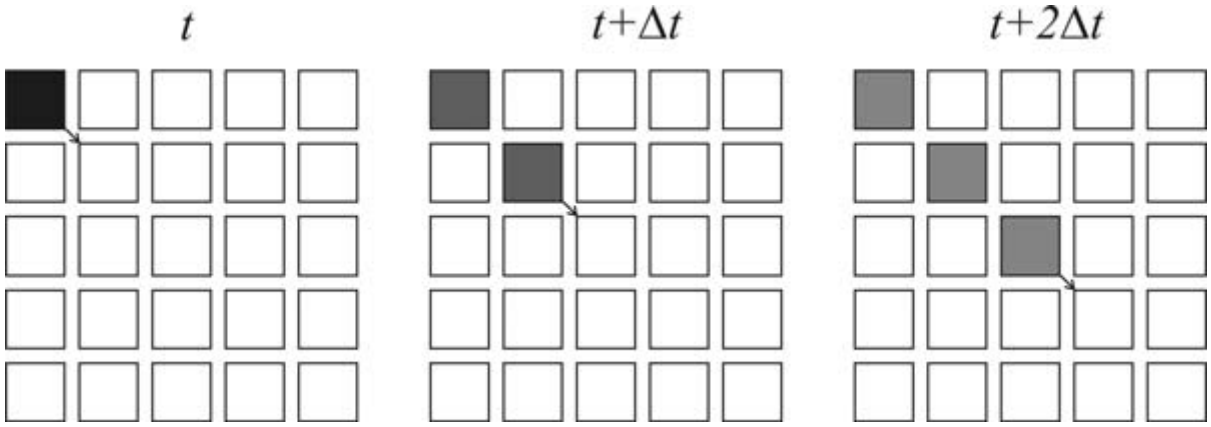
The simplest numerical integration in time of the CNN form of the continuity equation is the forward Euler:

$$c_{ij}(t+\Delta t) = c_{ij}(t) + \Delta t \left(g_{ij} - r_{ij} + \sum_{w_{ij}} T^{D}_{kl} c_{kl}(t) + \sum_{w_{ij}} T^{c}_{kl} c_{kl}(t) \right)$$

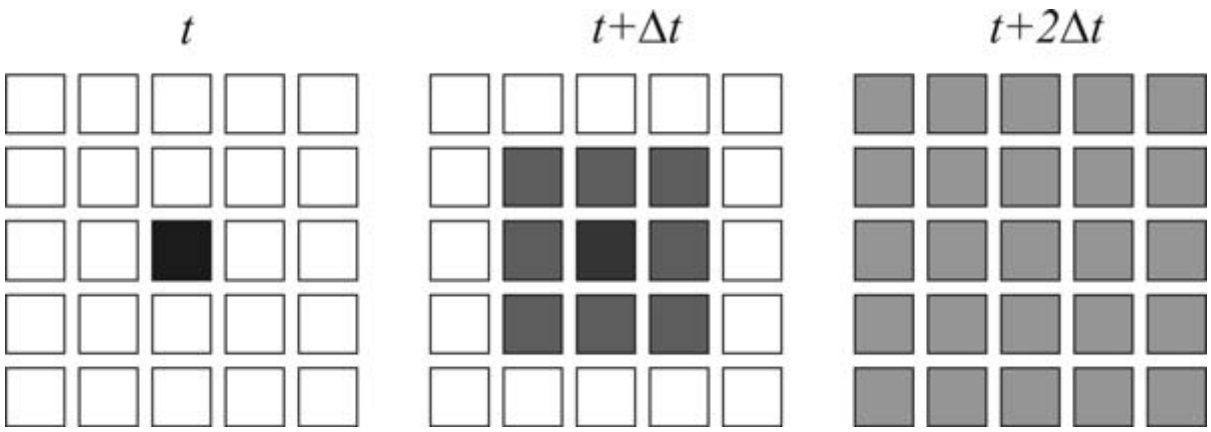
Illustrations:



*Generation and recombination. Generation: the grey points of the grid in time **t** will be darker from time to time. Recombination: The dark (black) points of the grid in time **t** will be lighter from time to time.*



Drift from a dark (heavily polluted) point to south-east direction

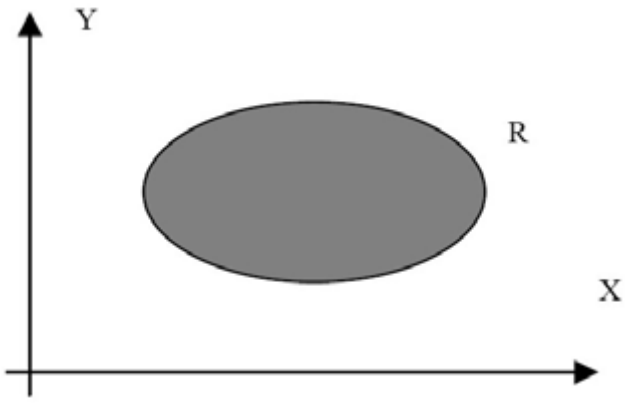


Diffusion from the black (heavily polluted) point of the grid to all directions

13.2.4. Fuzzy logic rule bases

Another very powerful approach for modelling very complex, non-linear and non-deterministic phenomena is the application of fuzzy logic based **If…then…** rules and various algorithms for obtaining conclusions for facts/observations. The starting idea for these techniques was the crucial paper by Zadeh [6], where he suggested the combination of that time classic expert systems rule bases with the idea of linguistic variables and values represented by fuzzy sets over the universes of discourse corresponding to input and output state variables for describing very complex systems. The new element in this approach was that rather than using symbolic logic and discretised state space representation, the ordered and continuous metric structure of the state space allowed the reduction of the actual symbols and terms, which could produce by their partial overlapping an interpolation type approximative calculation technique. Soon Mamdani [7] completed the idea by introducing a projection based representation for fuzzy sets and relations and so he and his collaborators succeeded with a very powerful and efficient controller for a highly non-linear steam engine system. The main idea is that if given an input universe of discourse

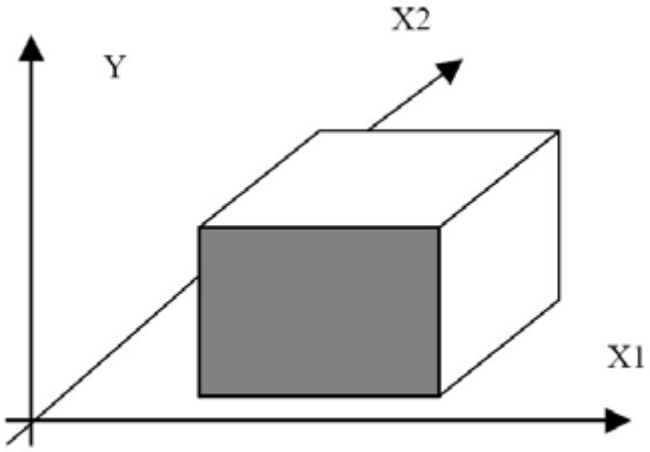
$X = \prod_{i=1}^{k} X_i$, where X_i are the input state variables, and Y is the output universe, any rule in the form **If** x **is** A **then** y **is** B can be represented as a relation R of the XxY space, cf. The figure.



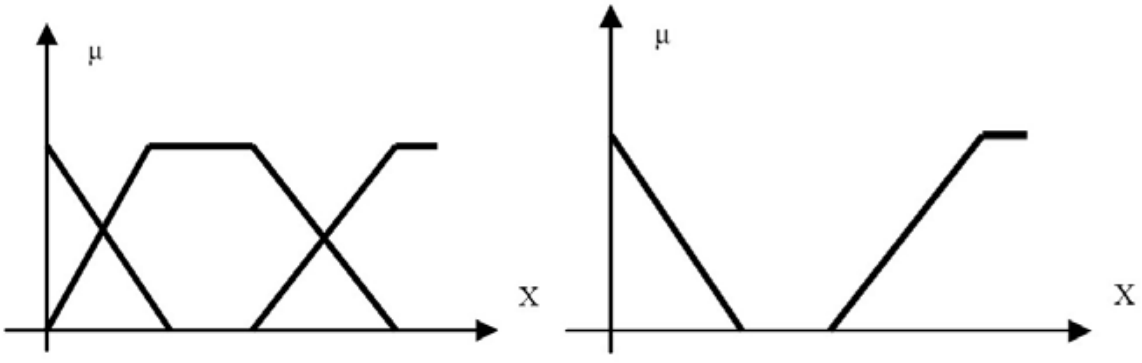
In Mamdani's approach the structure of the possible fuzzy relations is more restricted as only those that can be generated as the Cartesian products of orthogonal projections are allowed – on the other hand however, this restriction allows a much better computational complexity. The rule base in this approach has the following structure:

If x_1 **is** A_1 **and** x_2 **is** A_2 **and … and** x_k **is** A_k **then** y **is** B.

The figure presents a simple two-dimensional case



Based on Mamdani's algorithm a series of commercial applications were implemented and the so called „fuzzy boom" started especially in Japan. However, it turned out soon that no real implementation was possible for more than 5-10 input dimensions because of the high computational complexity of the model: (t^k) , where t denotes the (maximum) number of terms for each dimension. Further advance towards larger dimensionality was offered by the rule interpolation algorithm introduced in [5] and finally by the combination of hierarchical structuring the rule base combined with the sparse approach in the rule interpolation technique [6]. The figure presents the difference between the Mamdani-approach and the interpolative sparse technique.



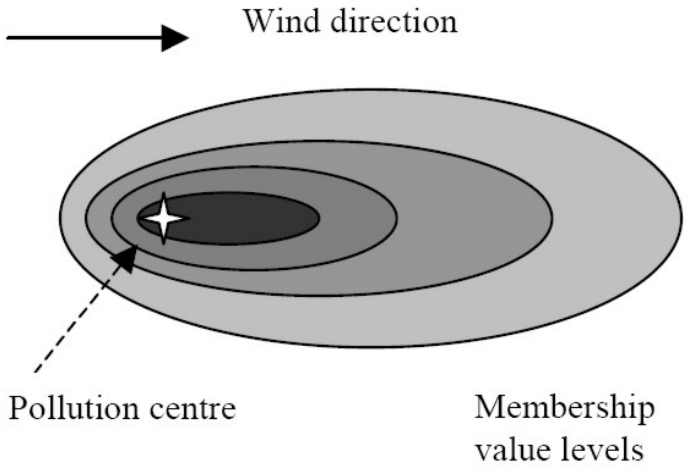
The hierarchical method deals with a multilevel rule structure where meta-level rules have symbolic output:

R_0: **{ If** z_0 **is** A_i **then** R_i **}.**

Where each R_i is of the type

$$R_i: \{ \textbf{If } x_i \textbf{ is } A_{ij} \textbf{ then } y \textbf{ is } B_j \}.$$

This latter type of rule base allows dealing with very complex systems with a reasonable accuracy. We suggest that pollution drift, expansion, etc. is dealt with by applying the last, more complex but more effective technique. If there is a reasonable way to group variables according to one or more key variables (z_i), it will be possible to segment the model and this way effectively reduce the value of k locally. The extension of various pollutants in a geographic area will be well described by fuzzy sets whose time behaviour can be modelled by the rule bases as suggested above.



13.3. The REQUIRED ENVIRONMENTAL RESEARCH INFRASTRUCTURE and required ICT infrastructure

Introduction: This document presents the opinion of several ENV projects. The environmental sciences are increasingly data rich and they are also developing into a data driven science. Environmental research infrastructures are large data resources and have to include innovative ICT and e-infrastructure services. The common priorities are summarized below.

Environmental systems are inherently complex. They are characterized by a multitude of interrelations at various temporal and spatial scales and sometimes by self-organization resulting in a high variety of diversity and complexity. The systems are diverse: Earth deformation processes and plate tectonics; physical and chemical dynamics of the atmosphere; the marine systems covering two/thirds of our planet, and living world on this substrate from single proteins up to ecological communities. Understanding these system is not possible by simply extrapolating from the single units which constitute these systems. A different methodological approach by analysing the correlation properties of all (ensembles of) units with modelling and simulation methods assists in detecting patters of strong correlations, the underlying processes and sometimes evidence for collective organisations. This methodological approach assumes the availability of sufficient observatories and sensors, large-scale databases with observations and measurements on the components of the biodiversity system together with advanced analytical and modelling software. In addition it requires computational capacity in the order to run the demanding statistical work flows on the huge data sets. These requirements together define an infrastructure environment which brings together the observatories, sensors, data, software and computation facilities at an appropriate integrated large scale.

The laboratory for research on our planet's environment is the whole planet. Such research is inherently multidisciplinary and scientific data are of various kinds. Scientific questions drive a variety of experimental and data driven analytical methodologies. Data are generated with a related variety of instrumentation and observations. A specific requirement is that historical environmental data gain in value through time and must be preserved and curated to secure their future value for research. The same holds for analytical capabilities and research workflows to support knowledge development. Workflows constitute a special data category in environmental research. Frontier research will exploit the wealth of all environmental data and workflows. This landscape presents important implications for data management, data access and data preservation. A landscape that integrates supporting technology for data generation, and capabilities to access data through analytical and modelling tools framed in virtual environments.

The required ICT infrastructure at the data level (for primary, processed and workflow data) must provide (automated) mechanisms for transferring data to any storage systems, together with identifiers and generation of metadata to support semantic interoperability for a variety of user communities. In addition, the organisation and architecture of data services has to meet the typical demands of users in environmental research (which are humans, other facilities or machines). This holds for flexible authentication and access rights for users outside NRENs or in remote areas, for pre-processing data into usable formats, for the management of complex data records (data uncertainty, fuzzy data, data calibration, data validation, data transformation, data fusion, privacy issues), for workflow enhancement and scalability, for fast access to and processing of selected distributed and large heterogeneous data sets and tools, and finally for knowledge development. But also the essential policies to govern, manage and operate the data services for environmental research infrastructures and their users. This includes elucidating the roles of public and private bodies and associated business plans for sustained operations.

The organisation and architecture of data services has to accommodate the ways how users (not only researchers, but also public and private organisations) will deploy these services. Users want to "see" data through their preferred application services, and they want to interact in virtual environments in order to study environmental models and test model parameters. Any researcher or distributed researchers group should be able to find or construct preferred application services in personalized environments. Associated super fast data transfer and HPC capabilities are crucial to allow for new e-science approaches in environmental research.

A three-way dialogue between the communities of environmental research infrastructures, the e-infrastructures providers and with the Grid services in necessary to specify the common requirements and solutions. User involvement and engagement is a key to promote early adoption of new developments in the daily research practice. This must go hand in hand with outreach activities to secure the best and cost-efficient use of the capabilities and to foster technology transfer. This holds internally for the scientific users community by creating awareness, to motivate, train and teach them to benefit for the whole cycle from data generation up to open access publications. This should go together with education and training in utilizing the (evolving) e-infrastructure capabilities. Externally, outside the scientific community, there are also public authorities, NGOs and the private sector who can better benefit from the environmental research councils for decision-making or for new products and services. ICT capabilities and outreach activities have to take this into consideration. This also holds for new finance mechanisms. Technology transfer amongst stakeholders in public and private sectors is important to share and promote innovation.

In respect of the ESFRI Preparatory Phase projects, it is essentials that these requirements are addressed by close co-operation between the new infrastructures themselves. The communities which generated the PP proposals contain the people who are best aware of the importance of

the data from each new facility and the potential possibilities for their exploitation, and they also have the best overview of user requirements. Each of the current and planned environmental PP projects has some strengths in a few of the above mentioned ICT areas, but a broad collaborative effort is the only way to ensure that each of them can fully benefit from integrated new ICT capabilities. In addition it will strengthen the European contributions to GEOSS the Global Earth Observation System of Systems. As such it is recommended that these development activities are identified as top priorities in the Framework Programme.

13.4. **Discussing and Concluding Remarks**

(1) The main processes of social and economic life (production, consumption, transport, etc.) fall on the environment, existential interests and way of living is closely related to it and powerful organizations support it. But environmental interests are difficult to recognize, they do not seem of vital importance at first. With restricted resources, the deteriorization of renewable ones, their impoverishment and growing pollution it is obvious that economical development is subject to production increase which cannot be the desired alternative.

The continuous decay of the environment indicates that the efforts already taken are not satisfactory, it is not convenient even for the stability of the condition. Year by year the polluted environment can increase the losses and damages. Owing to the social, economical and international importance of environment protection this practice should be stopped.

Fundamental changes and an intensive ecological strategy is needed which besides moderating the losses and highlight prevention.

(2) The effectiveness of environmental protection depend on objective natural and social conditions. These can be and should be transformed. Therefore a social background is necessary, which explores the regularities (that is, the effects arising from the utility of environment, and the causes that bring about the effects). These should be utilized and applied by environmental protection and resource supervision, namely the management of the environmental economy.

The problem, therefore is manifold: firstly, the way the various environmental elements and resources are utilized and related to each other should be identified. Secondly, the conclusions, requirements and political intentions should be formulated. Thirdly, the relevant legal, economic and administrative rules should be worked out.

In short: the alternatives of “what can we expect to achieve and how”. The next task should be institutionalizing all these, supervising and controlling the ongoing process.

Thus, our aims concerning environmental protection and sate improvement can be realized only within the sphere of social and economic development. In order to achieve them, we need regulators that are based on the exploration of their relationship and are capable of affecting it.

(3) When formulating the aims of environmental policy, we need to break away from the method which proposes to continue present trends, since these trends will lead to a crisis. We need change in the relationship of economics, society and environment. In order to fully exploit the perishing natural resources, at first we need to set the aims to be achieved, and then decide upon the possible ways and means of how to achieve them. (Future planning)

It is impossible to develop an environmental policy which aspires majority furtherance without a trustworthy and detailed evaluation of state as well as its social awareness.

(4) Naturally, it is not an unprecedented task to assess the state of environment. There exist a number of methods or "technologies" to actually qualify the state and unveil the (deleterious) processes and effects.

They can be grouped according to their governing ideas:

The "classical" approach characterises the changes by means of disclosing the difference between two consecutive states through gauging and recording the elements of environment (earth, water, air, flora and fauna) and the complex formation (area, settlements) on a regular basis. The fundamental defect of this approach is that it does not specify the causes of the changes, giving us very limited, if any, possibilities for prognostication, thus it does not allow for planned development or prevention.

It is essential that the analysis and evaluation necessary to realize environmental management examine, within their sphere of action, the interactions of different activities and interventions, as well as, those of environmental systems consisting of individual or the total of environmental elements. In order to do so, we need measuring-observing, data-connecting and transmitting, information-creating and processing, analysing and evaluating phases to be created and organized to be technological. All these will make prognostication possible, enabling us to elaborate alternatives with predictable effects, as well as, regulating and developmental interventions so that the alternatives can be realized.

(5) Both the system of standpoints for evaluation and the selection of the qualifying criteria are questions of decision on selected values, which depend on the desirable aim. Without standpoints it is impossible it qualify, only the description of the state is possible, without the knowledge of what can be done about it.

The standpoints can be diverse but at the same time they can be organised into a system as follows,

(i.) Of natural science (oecological)

The endurance, stability and regeneration of environmental elements and systems are to be examined, since they provide the conditions for the biological and social being of man.

(ii.) Of public health (humanocological)

Biological endurance of men. If seen as a different standpoint (from the previous one) it raises a difficult philosophical issue, namely, the selfishness of men towards his environment. However, this standpoint needs to be addressed, because at places intervention has reached such an extent where protection of environmental elements and systems – in obedience to (i) – is not enough in itself to protect mankind and to meet the conditions of healthy life.

(iii.) Economic

As well as biological needs, possible ways to satisfy needs of man as a social being have to be considered. Accordingly, when qualifying the state, we need to interpret the environmental elements and, mainly, the systems area, settlement) as an economically handlable change in use-value.

(6) The interventions, which are based on conclusions gained from state analysis – with the exception of regenerative interventions – do not have to be aimed directly at the environmental elements and systems, since they change slowly, much slower than the changes in the effects and activities that cause the alterations. Consequently, our aims have to be defined with regard to the state of environment but it is the activities that have to be regulated. Our tasks will arise

while elaborating on the technical, legal and economic interventions and regulations. It is essential that efficiency be considered and predicted while interventions are being planned. In order to do so we need to estimate and compare

a) the scale of the effect to be influenced or regulated; the extent of the damage to be warded off and the pollution sources to be dislocated

b) the amount of money and equipment needed to exempt, elicit or regulate; their availability and the efficiency of their use.

Their priorities of environmental economy – with regard to the size of the area – can be set by means of comparing the orders designed through state evaluation, qualification and effectiveness-analysis of interventions.

(7) Until the perfection of environmental economy, a transitional period is needed during which we have to continue parallelly:

– the protection against occurring damages

– elimination and prevention of pollutions

– doing away with existing pollutions, clearing the polluted areas.

The elimination of the pollution accumulated in our environment and the damages so far occurring continuously and inevitably, requires years of coordinated and conscious effort (according to international example, too) in order to achieve such an environmental state, which ensures healthy living conditions, the stability of the ecological system, provides a basis for a steadily sustainable development.

13.5. **Conclusions**

(i) Characterization as well as prediction of the changes in the status of environment essential for realization of the sustainable development

(ii) Just then the environmental processes are complex, highly non-linear, secondary and subsequent reactions occur also consideration only of the causal physical –chemical – biological transmissions would even not be enough, if they could be exactly well known due to computational complexity of the task

(iii) Consequently/accordingly modelling is necessary where not only the results of changes but regulaties are generated by the model-algorithms themselves

(iv) In our opinion the soft computing methods, in this case the application of GRID based CNN as well as FUZZY RULES seem to be promisable for modelling the environmental processes

(v) As a consequence the targeted aim of research would make by our is: building up a tool-kit for supporting the environmental decision making.

14. Question

Historical overview of the development of management systems

1., Weber developed a model of bureaucratic organization, in which the leading power of the leader is based on the rules of the organization, i.e. the written standards ensure the legitime role. According to Weber the professionalism, the impersonality and the predictability are the most important to the rationality. In this model no longer the person, but the rules must be obeyed.

2., Choose the contingency models!

a., Fayol and Schmidt's scale for the decision-making style, the normative model of Vroom and Yetta, the contingency-theory of Fiedler, Hersey and Blanchard's theory, the style interpretation of Weber

b., Fayol and Schmidt's scale for the decision-making style, the normative model of Vroom and Yetta, the contingency-theory of Fiedler, Hersey and Blanc theory, the style interpretation of Weber

c., Fayol and Schmidt's scale for the decision-making style, the normative model of Vroom and Yetta, the contingency-theory of Fiedler, Hersey and Blanchard's theory, the style interpretation of Weber

d., Tannenbaum-Schmidt's scale for the decision-making style, the normative model of Vroomand Yetta, the contingency-theory of Fiedler, Hersey and Blanchard's theory, the style interpretation of Lebel

e., Fayol and Schmidt's scale for the decision-making style, the normative model of Vroom and Yetta, the contingency-theory of Fiedler, Hersey and Blanchard's theory, the style interpretation of Lebel

3., The initial assumption of the normative model of Vroom and Yetta for the management's behavior should be chosen according to the task structure. Their normative model guides the decision-maker through a decision tree, and makes a proposal for the extent of the participation in the decision-making process to the staff. (decision-centric approach).

4., The TQM is a leading process, which alloys different disciplines, and has the aim to make all the activities of the organization continuously correct, improved, and totally committed towards the quality on the part of the employees, in order to reach the full satisfaction of the customer in the using of the product or service.

5., Choose the elements of the TQM!

a., leader role, education and training, additional structures, communication, rewards and recognition, measurement

b., leader role, education and training, additional patterns, leadership, rewards and recognition, measurement

c., leader role, education and training, additional patterns, communication, reward and principle, measurement

d., leader role, education and training, additional patterns, communication, reward and principle, measurement

e., leader role, education and training, additional patterns, leadership, rewards, and principle, measurement

6., The concept of the „scientific management" is invented by Taylor, he laid it down in his most famous work. Taylor regarded the accurate, almost scientific-based organization of the work as the key task of the leadership. He divided the technological process from the material's handling, and has created a system for measuring and regulating of the work process. According to Taylor the detailed rules are required therefore, because the workers do not know exactly themselves what they have to do.

Integrated management systems

1., The integrated management systems are called multi-band management systems, which do not operate independently of each other, but closely related, interrelated, integrated with each other.
2., Choose the elements of an integrated management system!

a., MSZ EN ISO 14002:2005, MSZ 27001:2006, MSZ EN ISO 9001:2009

b., MSZ EN ISO 14001:2005, MSZ 28001:2008, MSZ EN ISO 9001:2001

c., MSZ EN ISO 14002:2005, MSZ 27001:2005, MSZ EN ISO 9001:2009

d., MSZ EN ISO 14001:2005, MSZ 28001:2005, MSZ EN ISO 9001:2009

e., MSZ EN ISO 14002:2005, MSZ 28001:2008, MSZ EN ISO 9001:2009

Quality management system (QMS)

1., Choose the principles of the MSZ EN ISO 9001:2008!

a., process-based approach, management-centric, leadership, involvement of the people, system approach and management, decision-making based on the facts, mutually advantageous transport relationships

b., process-based approach, customer-centric, leadership, involvement of the people, system approach and management, decision-making based on the principles, mutually advantageous transport relationships
c., process-based approach, management-centric, leadership, involvement of the people, system approach and management, decision-making based on the principles, mutually advantageous transport relationship

d., process-based approach, management-centric, involvement of the suppliers, system approach and management, decision-making based on the principles, mutually advantageous transport relationship

e., process-based approach, customer-centric, leadership, involvement of the people, systems approach and management, decision-making based on the facts, mutually advantageous transport relationship

2., The ISO 9001:2008 quality management system defines requirements, which can be used within the organization for application, or certification, or contractual purposes. In the center of the quality management system are the fulfilling of the customers' requirements.

3., Choose the components of the documentation system of the quality management system!
a., valid laws, administrative regulations; quality policy, quality objectives, strategic plans; quality manual; Handbook of the Quality Procedures; regulations, job descriptions; valid forms, certification album

b., valid laws, administrative requirements; quality policy, quality objectives, strategic plans; quality manual; Handbook of the Quality Procedures; regulations, job descriptions; valid forms, certification file

c., valid laws, administrative requirements; quality policy, quality objectives, strategic plans; quality manual; Handbook of the Quality Procedures; regulations, job descriptions; valid forms, certification album

d., valid laws, administrative requirements; quality policy, quality objectives, strategic plans; quality manual; Handbook of the Quality Procedures; regulations, job descriptions; valid forms, certification album

e., valid laws, administrative requirements; quality policy, quality objectives, strategic plans; quality manual; Handbook of the Quality Procedures; regulations, job descriptions; valid forms, certification file

4., The WHS policy sets out the general direction and the principles for the functioning of the organization. It determines the objectives of the WHS regarding to the responsibilities and the operation of the WHS. It demonstrates the organization's official commitment, particularly to the top leadership of the organization toward the good management of the WHS.

5., Choose the aspects of policy-making of the WHS!

a., the policy and objectives towards the whole of the organization's business policy, the risks of the WHS of the organization, the legal and other requirements, the organization's past and current operation of the PMI

b., the policy and objectives towards the whole of the organization's manufactury policy, the risks of the WHS of the organization, the legal and other requirements, the organization's past and current operation of the PMI

c., the policy and objectives towards the whole of the organization's manufactury policy, the sources of the WHS of the organization, the legal and other requirements, the organization's past and current operation of the PMI

d., the policy and objectives towards the whole of the organization's manufactury policy, the sources of the WHS of the organization, the legal and other requirements, the organization's past and future operation of the PMI

e., the policy and objectives towards the whole of the organization's manufactury policy, the sources of the WHS of the organization, the legal and other requirements, the organization's past and future operation of the WHS.

The questions to the chapter of the development of environmental management:

1., Select the most important environmental problems!

a., greenhouse effect, conservation of the diversity of the species, conservation of the waters and the aquatic wildlife, the pests and the effects of the chemical methods applied against them

b., greenhouse effect, conservation of the diversity of the species, conservation of the waters and the aquatic wildlife, the pests and the effects of the chemical methods applied against them

c., globalization, conservation of the diversity of the species, conservation of the waters and the aquatic wildlife, the pests and the effects of the chemical methods applied against them

d., greenhouse effect, conservation of the diversity of the species, conservation of the waters and the aquatic wildlife, the bugs and the effects of the chemical methods applied against them

e., greenhouse effect, conservation of the biodiversity, conservation of the waters and the aquatic wildlife, the pests and the effects of the chemical methods applied against them

2., Choose the most important basic concepts regarding to the environment!

a., preventive protection, intensity of the environmental aspects, polluter-pays-principle, public responsibility and commitment, individual and collective participation, sustainable development, principle of the purposeful environmental protection, maximal protection, cooperation, international cooperation, principle of the long-term thinking, subsidiarity, principle of the shaping of the p purposeful environment

b., preventive protection, intensity of the environmental aspects, polluter-pays-principle, public responsibility and commitment, individual and collective participation, sustainable development, principle of the purposeful environmental protection, maximal protection, cooperation, international cooperation, principle of the long-range thinking, subsidiarity, element of the shaping of the p purposeful environment

c., preventive protection, intensity of the environmental aspects, polluter-pays-principle, public responsibility and commitment, individual and collective participation, sustainable development, principle of the purposeful environmental protection, maximal protection, cooperation, international cooperation, principle of the long-term thinking, subsidiarity, principle of the shaping of the purposeful environment

d., preventive protection, intensity of the environmental aspects, polluter-pays-principle, public responsibility and commitment, individual and collective participation, sustainable development, principle of the purposeful environmental protection, minimal protection, cooperation, international cooperation, principle of the long-term thinking, subsidiarity, principle of the shaping of the purposeful environment

e., preventive protection, intensity of the environmental aspects, polluter-pays-principle, public responsibility and commitment, individual and collective participation, sustainable development, principle of the purposeful environmental protection, minimal protection, cooperation, international cooperation, principle of the long-term thinking, subsidiarity, element of the shaping of the purposeful environment.

Environmental Management System (EMS)

1., Environmental Management System (EMS) is understood as the joining of the organization's activities, which may affect on the environment. It is designed to protect the natural resources, reduce the pollution and the risks, the protection of the health of the workers and local residents.

2., Environmental Performance Evaluation (EPE) is a constant internal management process and tool, which uses environmental indicators to compare the organization's past and current environmental performance with regard to the criteria of the organization relating to the environmental performance.

3., Choose the elements of the EMS documentation system!

a., valid laws; administrative policy, administrative objectives; Handbook of the Environmental Management; Handbook of the Environmental Management Methods; work account; valid forms, certification album

b., valid laws; administrative policy, administrative objectives; Handbook of the Environmental Management; Handbook of the Environmental Management Methods; work instructions; valid forms, certification bills

c., valid laws; environmental policy, environmental objectives; Handbook of the Environmental Management; Handbook of the Environmental Management Methods; work instructions; valid forms, certification album

d., valid legal declarations; administrative policy, administrative objectives; Handbook of the Environmental Management; Handbook of the Environmental Management Methods; work instructions; valid forms, certification bills

e., valid laws; environmental policy, environmental objectives; Handbook of the Environmental Management; Handbook of the Environmental Management Methods; work instructions; valid forms, certification bills

The means of the environmental management

1., The means of the environmental management should apply therefore, that the company may be able to deal with its environmental conditions properly, and to influence them. In this approach the means of the environmental management are imaginable as an endless, ever-expanding cluster.

2., Select the aspects of the Balanced ScoreCard!

a., Financial performance; customers; mission; operational processes; teaching and development

b., Financial performance; customers; mission; operational trends; learning and development

c., Financial performance; customers; mission; operational trends; teaching and development

d., Financial performance; customers; mission and strategy; operational processes, learning and development

e., Financial performance; customers; mission; operational trends; teaching and development

The means of the environmental evaluation

1., The eco-mapping is a simple, intuitive and practical method that is based on visual inspection.
The environmental mapping is a graphical process, that begins with the preparation of the plan view map of the examined area.

2., Choose the factors which should be covered during the exploration of the setting's location!

a., neighbors, public administration, the size of the available space and the usefulness of its setting, the consistence of the buildings and their occupancy

b., neighbors, traffic, the size of the available space and the usefulness of its setting, the condition of the buildings and their occupancy

c., neighbors, public administration, the size of the available space and the expedience of its setting, the condition of the buildings and their occupancy

d., neighbors, traffic, the size of the available space and the expediency of its setting, the consistence of the buildings and their occupancy

e., neighbors, traffic, the size of the available space and the expediency of its setting, the consistence of the buildings and their usability.

3., Choose the eight maps of the eco-mapping!

a., location of the settlement, disturbances, water, soil, air, waste, risks

b., location of the settlement, noise, water, soil, air, waste, risks

c., location of the settlement, noise, water, soil, air, garbage, risks

d., location of the settlement, noise, water, soil, air, garbage, risks

e., location of the settlement, disturbances, water, soil, air, waste, risks

Life-cycle assessment

1., The life-cycle assessment drives the environmental aspects and the potential environmental impacts (eg. the use of resources and the environmental consequences of the circulation) through the product's life-cycle, from the purchasing of the raw material to the production, from the processing through the reuse until the dropping („from the cradle to the grave").

2., Choose the steps of the evaluation of the life-cycle assessment!

a., Designation of the system boundaries, inventory, impact assessment, interpretation of the results

b., Designation of the system boundaries, inventory analysis, impact assessment, interpretation of the results

c., Designation of the system boundaries, inventory, estimation of the boundaries, interpretation of the events

d., Designation of the system boundaries, inventory, calculation of the boundaries, interpretation of the events

e., Designation of the system boundaries, inventory, calculation of the boundaries, interpretation of the events

3., The ISO 14040:2006 standard involves two tests: life-cycle assessment studies (LCA studies): and life-cycle inventory analysis (LCIA). The LCI studies are similar to the LCA without the LCIA-section.

4., Life cycle: the linked stages of a production system, from the acquisition of the raw materials or the creation of the natural resources to the final removal.

Function units, effect categories, methods

1., The IMPACT 2002 + analyzes the impacts between the initial and the end points. The characteristic factor of the intermediate values is based on the principle of the equivalence, which expressed by the equivalence value compared to the reference component. Long-term studies have been applied in each effect categories. In general, the effect factor was determined by the modeling of the average effects.

The presentation of the GaBi software pack

1., The most frequently asked question about an LCA-software is related to the available databases. These databases include the environmental balance of the industrial processes: the list of raw materials needed for the process is on a side of the balance, with the consumption volume (eg. minerals, energy resources, water, etc..), on the other side are the products, the waste and emissions of the process (air, water, soil). The more rich is the software of industrial processes, it is more helpful for the life-cycle modeling.

2., The function of the Life Cycle Working Time (LCWT) workplace provides an opportunity to the examination of the work place conditions, with the application of suitable indicators for the characterization of the social conditions (eg. qualification of the work-force, the sharing of the womanpower, the number of accidents etc.)

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