

## **EDUCATION, RESEARCH AND DEVELOPMENT TASKS OF ENVIRONMENTAL PROTECTION**

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**Abstract:** Education, Research and Development Tasks of Environmental Protection. In the last decades considerable results of research was induced by environment protection; new areas of science were shaped and several technologies were introduced to economy. On the one hand, science receives challenges, on the other hand, it offers possibilities for sections. The increased demand for knowledge has grown at the same time considerably the social responsibility of the representatives of science, which comes from the fact that greater role is falling on scientists to ensure prosperous future to us. The environment's sciences have indisputable close connection with the spirituality, and the innovation of the environmental technologies are one of the most significant domain of the spirituality. The environment protection R&D activities of production organizations typically reflect this picture. The corporate research and technological development activities in environment protection are not limited to the independent R&D departments of the companies, but their relations are not clarified. It is also obvious that only these units could represent a guarantee for continuing any innovation activity. Consequently the production organisations also have a market interest in not to wind up or discontinue their activities to be carried out in order to ensure a long term sustainable development.

**Key words:** education, research, technological development, sustainable development, spirituality, challenge for sciences.

### **1. HISTORICAL BACKGROUND**

In the early 1960s, when the issue of environment protection emerged intensively in the USA even many of the distinguished representatives of sciences believed that this intensive activity related to the decrease of assignments to NASA in several places and dismissed researchers „strike back” to the government through this environment protection issue. Certainly it has not proved to be true as not the idea either that mankind has started to pay attention to environment protection only in the second half of the twentieth century. As an example it is enough to mention the worries about smog in England and the economic and technological intentions aiming at the compensation of the same. In this time C.P.Snow, a scientist and writer, published a paper under the title „The Two Cultures and the Scientific Revolution”. He identifies the

cause of the fading of the technical sciences in the separation of classical education and sciences a deformation in the creative mentality (Petroski, 2005).

Many people are unlikely to know that the citizens of the Dual (Austro-Hungarian) Monarchy were already dealing with water pollution at the beginning of the nineteenth century and laws had been adopted as well in this regard. This problem certainly emerged in many European countries even at that time. Scientific evolution has been focusing partly on the development and application of new technology. Namely, relations between environment and human being, environment and society go back to the past of thousand years. In the meantime it is also obvious that the aggressive nature of intervention by human being in environment on one hand and the extent of cognizability of the effects on the other have been increasing so considerably during the recent decades that completely new dimensions of the issue have risen to the surface. From this point of view it is worth to review, even if briefly, the changes of environmental approach of mankind.

The evolution of the relationship of the humans and environment can be divided into four characteristic etaps during their history.

The first „turning back to the nature” had started spontaneously but as real process on the field of ideology and art either in the age of Enlightenment. The second significant etap from the point of view of the environment protection had started in the last decades of the 19th century. The mark element of this etap had been the „conquest of nature”, the significant contrentation of the production, the acceleration of the urbanisation, the technical development of the transport, and the increase the production of the industry. The consequences of this etap had been the profitoriented wasteful management of natural sources, which had led to the prosperous economy forming insufferable environmental circumstances. The culmination this etaps was the First World War, and the some decades after the war.

The well developed winner countries realized the opportunities of preparing measurements to stop the significant environmental damages after the Second World War. These measurements had dealt with the traditional industrial sectors primarily steel-industry and partly textile-industry and mining as well. The coordinated measurements for environment protection have started since the middle of the 60s. The essence of this etap are sinthetization of the natural, soial and economical processes with the idea of sustainable development in view up till to days.

In ex-communist countries, the change of regime and the political preparations for this course coincided with the processes of environmental development, the appearance of the age of information, the change of scientific outlooks, and a new intellectual challenge. It has also meant a change in attitudes. New synthetizing systems of thought have emerged, undergone radical transformation, and now continue to transform the system of scholarship, strategies, economy and society. Some disciplines get a new point and scientific proofs get new foundations.

## **2. SCIENCE AND SPIRITUALITY**

According to Cairns (1994) often, the long-term sequences that result in a major transformation of the environment appear to be unique and unlikely to be repeated. This is true for natural, ecological and social sequences. The natural and

ecological sequences are unlikely to be repeated in the order in which they occurred, even if components of the sequence may occur in a cyclic or sporadic fashion. What appear to be fragmented, small social decisions and the environmental events, in fact, often have a synergistic or aggregate effect unlikely to be reversible, in the sense that if one removes all of the stresses, the system will return to the condition existing before the sequence began. This is the first challenge for the science, and the R&D activity.

The second challenge is the appearance of the age of information. Human society has entered the information age and has the technology to cope with masses of information unmanageable just a few years ago. The perception of the global changes have heightened the awareness of the society toward to the environment. This processes are strengthened the close connection between the science and spirituality.

Human activity has many different forms, modes of manifestation. It is not easy to qualify them, not speaking of their classification. It is dangerous to make orders of sequence or importance among them; we know from history that the set-up of rigid structures in this field may have tragic consequences. Yet, believable and true, that the highest level of human activity is represented, meant by spiritual activity. This of course has many levels because it may be expressed through arts, philosophy and science. Speaking about science, it is an obvious need to examine permanently and continuously where the limits of arts and phylosophy. While the human being is rational, it is a sign of his irrationalism that he does not resign himself to this fact. He is starting again and again, and try to conquer the unknown fields of science, to „open newer and newer gates of science”. Though, the human being knows that five – ten newer locks well be found behind each and every gate, he is motivated by the special irrationalism of curiosity as well as the desire to conquere new previously unknown „territories”. The contradiction seeming to be irreconcilable between the limits of sense as well as the unlimited prospects of cognition is reconciled by psyche more or less successfully; the go-called pure „thinking” tries to find responds to those questions which can not be answered by science. The results naturally can not be examined by scientific means, methods in thiese cases; they can be discussed in philosophical categories at most and logic can help to get us somewhere where we can not get empirically.

In the earlier centuries of natural science there were such ideas according to which the acquirement of scientific knowledge does not have limits and we can get to know ewerything around and inside us.

Obviously so many doors were opened by science meanwhile that this thesis in no more valid. Metaphysics is going beyond the acquisition of knowledge of science. Therefore, the dualism of science and spirit are the same as that of material and spirit. So, the environment’s sciences have indisputable close connection with the spiritualaty, and the innovation of the environmental technologies are one of the most significant domain of the spirituality.

### **3. ENVIRONMENTAL CONSTRAINTS: NEW RESEARCH AND DEVELOPMENT TRENDS**

Because of the mayorcharacter of science there is close connection between

human activity and research. Examining the experiences of the last decades it may be established that this trend becomes stronger and stronger, those scientific activities in environmental protection decrease which are far from or connect indirectly only to the creative and/or destructive human activity. No doubt that the history of mankind is practically the history of constant and permanent intervention to nature, which makes trial of the operation of a stable system step by step. All impulses cause changes in a well-balanced system, which may generate reversible or irreversible effects. This means that a such kind of system can be said stable but never static. At a certain level of these changes the question may be arisen if the stability of the system is in danger. However, parallel to that another question may also be arisen. Through its nature science always conquers newer and newer unknown areas, i.e. approaches such levels through which the given system can be plagued with questions – not known before, and thus such replies are given which may shake the views – till then – on the stability of the whole system. These two approaches do not differ too much from the point of view of fact-finding but may differ already from the point of view of the elaboration of a solution based on longer processes analysis.

Pungor (1995) in his article wanted to indicate in the introductory that the evaluation, the examination of the negative phenomena observed in the ecological stability of the Earth, as a system, require great care from governments, from the public, but particularly from scientists. Namely, both publicity campaign full of exaggeration and the hiding of phenomena may cause serious damage. Limitation, or a partial stop of basic human activities is obviously not a good reaction to the existing, observed problems, therefore as an essential condition we should accept that the intervention of human being to nature is going on and most probably with an ever increasing intensity. For this end the main task is to harmonize and control this activity so that it would not endanger the stability of the system.. Science has decisive importance in this process. On the one hand, it words questions through study, the cognizing the system, on the other hand, it searches appropriate solutions to these questions.

Consequently human activity generates scientific targets but the results of science react on the given activity itself. When decades ago the problems of environmental protection were raised intensively, researches had to be organized primarily for the measurement and analysis of water pollution, with special attention to the improvement of measuring techniques. Later on this was followed by similar steps in the fields of air pollution, waste-management, soil-pollution and other questions.

Naturally, we can evaluate the measurements as a basic point of a process only because they are after all for drawing conclusions on the basis of them, and that proper actions can be taken afterwards. Both conclusions and actions produce newer challenge to science. For example it became very important to establish how the different components influence the different parts of living organism. Therefore the examination of problems being in close connection with environment protection has influenced biological researches considerably. The examination of biological, chemical and other effects have developed considerably in the last few decades. But we do't want to neglect those environmental damages which originate from non-chemical pollution and whose examination has also come to the limelight. Like e.g. the acoustic effect, the

infra- and ultrasound effects, the different light effects as well as organic pollution.

Economic regulation system becomes an efficient means of environmental protection by which the state undertakes compensating role among environment damaging, environment loading activity of economy, endangered human environment as well as the human being himself. An efficient regulation system means compromise, minimum on short-term basis between two usually absolutely contradictory targets: to maximize income as well as to minimize environmental damage. It is current that environment protection is the privilege of the rich and the poor can not afford the luxury to restrict economic growth by strict regulations. In the highly industrialized countries the environment-saving way of thinking had become important just in the period of stagnation and recession, and almost parallel to that the regulations of the authorities were made stricter and environment protecting campaigns developed.

#### **4. ONE STEP TO THE REALIZATION**

Our countries in Europe raise the need for urgent actions to be taken in the field of environment protection. So there is a strategic need for research and technical development to provide all the necessary knowledge, procedures, methods, technologies which are required for this purpose.

For the time being the environment oriented R&D activities have had three main directions:

- development of so-called „end of pipe” environment protection, environment protection procedures,
- development of environment-saving, so called „clean” technologies, and
- development of technologies in connection with the elimination of unexpected harmful environmental events, potential sources of danger.

It is our basic interest to participate actively in international cooperation for the solution of global environmental problems. Research and development has also important tasks to work out the conditions and methods of the application of standards and quality control. Most of the tasks that can be solved properly and efficiently in the frame of comprehensive, interdisciplinary and international programs, projects. The environmental management, and the engineers of environmental protection can play significant role in that partly as a partner, partly as a market, in cooperation with several countries and engineers of the given region.

In this activity, in the forming of contemplation, teach the new generations in the conditions and insurance of the sustainable development has the engineering education a big responsibility.

#### **5. WHAT SHOULD BE DONE FOR SUPPORTING SUSTAINABILITY?**

Prof. H. Häberle reply to this question. „Normally, if we have such difficult questions, we ask our scientists. They are experts for forecasting. They should initiate profound studies. They should find the answers. However, considering what we have learned about complex systems, I can only say: Forget it! Our natural scientists are educated only to give answers in they are sure at least with a certain probability. In

complex systems we never can be sure" (Häberle, 1992).

A better way how to understand these complex systems is to learn from traditional knowledge, from our cultures and world religions. They teach rules for our behaviour which may very well lead to sustainability, even if we do not understand it. From these rules we can learn very practical advices how to behave towards complex systems:

- increasing the number of options, thus we have more opportunities to chose if we get in trouble;
- keeping and increasing flexibility, because higher flexibility increases our adaptability and thus sustainability;
- actions in a decentralized, distributed manner, if onepart will be destroyed, it will never be the whole system;
- the actions should take into account, that we never will exactly know, what will happen;
- actions according the natural principle of trial and error;
- allowance the necessary time and patience in order to observe the development of the different options and to draw the right conclusions.

With these rules in mind, however, big doubts and questions are arising: Do the scientists have enough time to play this game so relaxed, and, with this trial and error-game, do not we run into catastrophys? The answer from Prof. H. Häberle is: „Our chances to win this game this way are better than to run full-speed into the wrong direction. Even catastrophys, if they are not too big, may lead us better into the right direction, than we could do it by rational reflections.”

## **6. R&D ACTIVITIES FOR ENVIRONMENTAL PROTECTION**

And what is the practikal experience at the business organozations in Hungary?

Concerning the extent of environment protection R&D activitied, the survey proved the picture which has developed so far. As much as 25-30 % of the endeavours aimed at eliminatig environment polluting activities are realized in he form of R&D activities. For example, up to one third of the ventures emitting sewage have research and development aimed at doing away with such environment deteriorating activities. The measaures taken for the sake of energy saving reperesent R&D activities at a lower extent, approximately 24–26 % on the average. This ratio is very low in the field of decreasing waste, on the average in the sectors that could be evaluated this was around 6 % (starting-data from years 2002-2004).

Two conclusions can be drawn basically from these figures. Environment protection R&D activities are basically performed by only those businesses who claim voluntarily or under compulsion that they also carry out polluting and environment deteriorating activities. Again, only a fraction of the tasks are solved by R&D activities. The other conclusion is that own R&D activities are only carried out in the environment pollution areas where solutions could be found so far basically in-plant (e.g. sewage, energy, etc.). Waste disposal, handling and depositing are not part of the R&D duties of business organizations basically (Tamás, 1995).

Even within those dealing with R&D activities, the proportion of those who tackle their R&D tasks from their own resources is low. In general it can be stated that the closer the environment protection technology is to the production technology, the more own resources are used to perform environment protection duties.

I don't see a realistic picture about participation in the international R&D activities, as a result of the low number of respondents.

Taking into consideration the types of pollution, the R&D activities lag behind the necessary rates in all areas. The gap is the largest in the area of wastes, with the reason being probably that they are hardly any R&D activities aimed at material and energy saving or at the so-called clean technologies.

The proportions also indicate that much more emphasis is placed on sewage treatment than on the development of water-saving technologies. The R&D aimed at improving air purity basically dominates in the infrastructure sectors, although the truth is that the power industry has achieved substantial results also in this area.

## **7. EVOLVING TRENDS OF INNOVATION ACTIVITIES CARRIED OUT BY BUSINESS**

It is expected that in near future the role of technological development as a factor of economic competition will grow further. The elaboration and dissemination of new techniques and technologies are of decisive importance from the aspect of increasing production and productivity (Tamás). Because:

- technical progress has become the most important factor of economic growth, and this also makes an impact on stepping up the innovation activities of environment protection. The innovation and economic performances of various countries are in close interrelation;

- the social benefit of new technologies and technical development achievements is higher than the direct profits of the ventures performing the development. This especially applies to the environment protection R&D tasks and to the utilization of their achievements;

- the most rapidly developing sectors of the world economy and the products that increase their shares most in world trade are qualification – and technology – intensive. The environment protection industry must also progress in this direction.

The investigation covered the research/development innovation activities, R&D resource management, environment pollution and environment protection endeavours of business organisations and their services related to quality assurance and information technology. On the basis of the empirical survey, it is generally more difficult to obtain a picture about the realistic weight of the environment protection problem than about the corporate development efforts. In spite of that, in the course of assessing this snap-shot, many findings worthy of attention were made concerning also the research and technological development activities in environment protection.

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Az **Abstract** magyar fordítása:

**A környezetvédelem oktatási, kutatási és műszaki fejlesztési feladatai.**

Az utóbbi évtizedekben a környezetvédelem a kutatás területén is kimagasló eredményeket hozott, a tudomány új szakterületei jöttek létre, és a gazdaságban is új technológiák alkalmazására került sor. Egyrészt a tudomány eleget tett a kihívásoknak, másrészt csak ez kínálkozott egyedüli lehetőségnek. A tudás növekvő igénye a tudomány képviselőitől is növekvő társadalmi felelősséget kíván, mivel egyre nagyobb szerep jut a tudásnak a jövő alakításában. A környezettudományok elvitathatatlanul szoros kapcsolatban állnak a spirituális tevékenységgel, a környezetvédelmi innováció pedig jellemző területe a szellemiségnek. A termelő szervezetek környezetvédelmi K+F tevékenysége tipikus válasz a kor kihívásaira. A környezetvédelmi alkalmazott kutatási és műszaki fejlesztési tevékenységek nem korlátozódnak speciális független K+F részlegekre, vagy intézetekre. A K+F letéteményesei a termelő egységek is, de kapcsolataik még nem tisztázódtak. Nyilvánvaló, hogy az innováció folyamatosságát ezek a termelő egységek tudják csak garantálni. A termelő egységek ugyanakkor piaci érdekeltséggel is bírnak, hiszen saját létükkel, működésükkel kell biztosítaniuk, hogy részesei legyenek a hosszú távú fenntartható fejlődési folyamatoknak.