

**SOLUTION TO THE PROBLEMS OF THE SUSTAINABLE
DEVELOPMENT MANAGEMENT**

Miroslav RUSKO ¹, Dana PROCHÁZKOVÁ ²

Abstract

The paper shows that environment is one of the basic public assets of a human system, and it must be therefore specially protected. According to our present knowledge, the sustainability is necessary for all human systems and it is necessary to invoke the sustainable development principles in all human system assets. Sustainable development is understood as a development that does not erode ecological, social or politic systems on which it depends, but it explicitly approves ecological limitation under the economic activity frame and it has full comprehension for support of human needs. The paper summarises the conditions for sustainable development, tools, methods and techniques to solve the environmental problems and the tasks of executive governance in the environmental segment.

Key words

Environment. Human System. Sustainability. Sustainability Management. Methods and Tools

Introduction

The paper summarizes the results of the systematic study of environment in the recent 30 years. It starts from cognition of the studied subject on the present level and summarizes the conditions and limits of sustainable development, as well as the tools, methods and techniques used to solve the environment problems and tasks of executive governance in the environmental segment.

¹ Miroslav Rusko, Ph.D. - Slovak University of Technology in Bratislava, Faculty of Materials Science and Technology, Institute of Safety and Environmental Engineering, Botanická 49, 917 24 Trnava, Slovak Republic, e-mail: >miroslav.rusko@stuba.sk<

² Dana Procházková, Assoc. Prof., Ph.D., D.Sc – Institute of Security Technologies and Engineering, Faculty of Transport Sciences, Czech Technical University, Praha, Czech Republic, e-mail: >prochazkova@fd.cvut.cz<

The environment itself is a system of systems that, from the viewpoint of human existence and development, is a part of the superior system of systems, the human system (1). From the given fact that it is evidently impossible to elevate the environment existence and return to original state under the interests connected with human existence and development, but, simultaneously, it is impossible to damage the environment irresponsibly, because it creates the medium necessary for human existence itself. Therefore, we have to introduce the compromises that respect human needs and environment into the practice, based on our knowledge and experience. Their impact and benefits are monitored in the way that allows carrying out the corrective measures if they seem to be necessary.

Based on recent cognition, sustainability (sustainable development), is not only related to the environment, but also to the entire human system and its basic assets (i.e. public assets) on which the human lives are dependent. Basic human system assets are human lives, health and security; environment; property and public welfare; infrastructures and technologies, in particular those that belong to the critical ones (2). The sustainability assessment in general sense is the formalised process for identification, prediction and assessment of potential impact of arbitrary inputs including the variants for society sustainable development (e.g. legal rules, ordinances, regulations, political intent, plan, program, and project). From the viewpoint of present cognition of human system and its assets, the mentioned assessment might be performed always at good governance of territory (2).

Conditions for sustainable development

From the system viewpoint, the sustainable system has attributes as productivity, resilience, adaptability and vulnerability, and therefore, sometimes it is not easy to find a suitable reference state or conditions:

- The reference point of sustainability is a demanded future state (scenarios, techniques and foresight).
- The reference points are, on the one hand, inputs and, on the other hand, outputs of system processes (ecological trace, product life times etc.).

We can thus assume the context given in Figure 1. Since these attributes are mutually tied up, in the relation to the existence of system, the sustainability is on the peak. The decision-making on system adaptive capacity is defined by the relation given in the decision matrix in table 1 (3).

Sustainability is often misinterpreted as the goal that we all strive for. In fact, sustainability is not an achievable final state, since it is rather the basic characteristics of a dynamically developed system. Thus, ***sustainability is permanent adaptation to changing conditions***. This adaptive property is natural to all ecosystems. It is only a question of education to introduce the adaptive procedures to the public administration decision-making on human, i.e. socio-ecologic-technical system (3). For the implementation in practice it holds several pieces of knowledge:

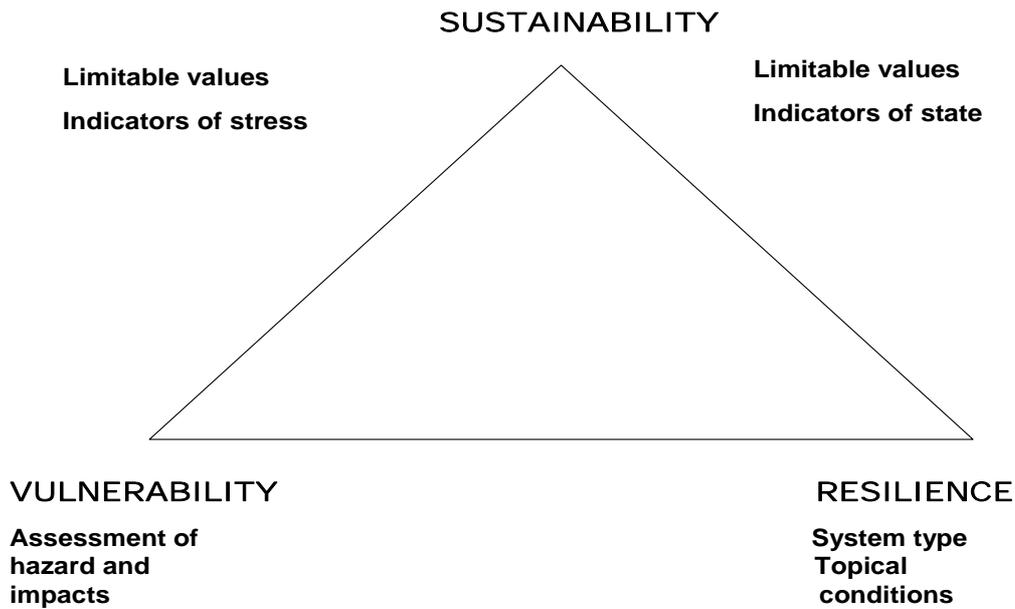


Fig. 1 Relation among sustainability, vulnerability and resilience

SYSTEM ADAPTIVE CAPACITY

Table 1

Impacts	Adaptive capacity	
	<i>Low</i>	<i>High</i>
<i>High</i>	<i>Vulnerability</i>	Chance of development
<i>Low</i>	Rest risks	<i>Sustainability</i>

1. Criticality is directed to failures and hazards, while sustainability deals with the existence. Therefore, more and more important are the approaches and procedures that deal with the sustainable infrastructure, namely both, the grey one and the green one. The procedure for searching the sustainable elements is the following:
 - list of activities,
 - key impacts induced by human activities,
 - identification of receptors,
 - identification of ways of impacts spread,
 - identification of the secondary and further order impacts on main and other receptors.
 This approach can be used only for grey (i.e. by human created) infrastructure, whereas the green infrastructure cannot be investigated in the way that its parts are separately analysed, since landscape and ecosystems create a complex super system, i.e. system of systems (1).
2. The landscape sustainability is also connected with its sensitivity; the assessment is done by scoring, i.e. decision matrix in Table 2.

3. The human needs, however, depend mostly on functions of ecosystems, and therefore, it is necessary to understand the ecosystem functions, because:
 - the ecosystem functions vary and thus influence the human health,
 - responses of ecosystems to human activity (intended or non-intended) are not always immediate, they can cumulate, affect vicariously or retrospectively, and through the retrogressive links to create emergency up to critical situations.
 Therefore, the procedure in which we define firstly the grey/engineering infrastructure for human settlements and, after that, the proposal is transformed into the landscape is incorrect as it completely ignores possible cumulative, long term and delayed impacts on environment sources and ecosystems services. Therefore, it is necessary to search for the solution suitable for local conditions; i.e. it is site specifications.
4. The orientation to the interface of grey and green infrastructures relays on technologies that might solve present and future problems. New technologies, however, bring in uncertainty and vagueness into green infrastructure, because the technology impacts on environment are hard to forecast. Therefore, it is necessary to use and process the methodology of foresight not only on technological level, but also on societal level, i.e. societal foresight aimed at the trends of behaviour of grey infrastructure (i.e. theory of normal accident, highly reliable organisation, industrial ecology) and green infrastructure (adaptive environmental management, industrial ecology etc.) (3).

DECISION MATRIX ON LANDSCAPE SUSTAINABILITY

Table 2

Land- scape type	Sensitivity of land- scape features	Sensitivity of partial elements of landscape	Sensitivity of aesthetic viewpoints of landscape	Visual sensitivity of landscape	Total sensitivity of landscape	Value of landscape	Acceptable landscape Capacity
Type 1	High	Medium	Medium	High			
Type 2	Low	Medium	Low	Low			
etc.							

Tools, methods and techniques for solutions to environmental problems

The humans did not come in the environment with intent to subvert the nature. The problems started at the time when humans tried to separate themselves from the nature, and they placed technology / engineering between themselves and the nature. Initially, it was not evident, the biosphere has kept its reserves and it contrived to equilibrate with a range of activities. However, the human activity has been progressively taking on the intensity and in some directions the biosphere has been globally affected (4, 5).

The present worldwide problems are of a global character. Apart from the environment contamination, other major global problems involve the questions of peace and war, the differences between developed and developing countries, providing the food for future population, energy demand, lack of water, soil, sources, as well as the questions of health care, culture and education. THEREFORE, it is necessary to introduce STRATEGIC, SYSTEM AND PROACTIVE MANAGEMENT (6, 7), based on a realistic, systematic and proactive view of human system and its problems. The given view is necessary from the following reasons:

- Humans have been getting to a certain life standard that they do not repudiate; this standard is conditioned by interventions to nature.
- The environment is an adaptable system. During their development, the humans have accumulated much knowledge and experience, and therefore, they are supposed to know the ways to limit the interventions to a system, so that to ensure the system development in the direction supporting the mankind's development.
- For many humans, the environment today represents a stylish stalking horse which makes them take up the actions that have nothing in common with real environment (e.g. the reality that the soil is left unexploited does not prosper to environment).

For decision-making, a model of environment that is restricted to human medium has been used, because the aim of human strive is to ensure the human society development, i.e. by recent words said the such development trajectory of whole environment system that onward enables humankind development.

Based on the present knowledge (6, 7), each quality management, including environmental management, must carry out the decision-making process with respect to the following goals:

- to prevent emergency situations and to localize emergency situations (the accidents can origin in the frame of both, individual components or even in the frame of the whole environment system),
- to ensure the healthy development of human society,
- to implement ecological programmes in the socio-economic sphere.

The management must monitor (4-7):

- impacts of anthropogenic activities into the environment that can be divided into:
 - pollution of environment component (may be either of the material character, manifested by concentrations of agents or of physical origin manifested by noise, heat, electromagnetic oscillation etc.,
 - biologic diversity, i.e. reduction of number of species, change of species composition etc.,
 - deterioration of health state of human population,
- pressure of antropogenic sphere on environment that is divided to:
 - emissions of agents (or better wastes of human activities) into natural medium,
 - consumption of renewable sources.

Administration management and its tasks on environment sector

Since its origin, the basic function of state has been to ensure the protection and development of a given human society which is impossible without ensuring the safe space in that the human society has been living. The management of state includes generally the concepts of government, control and office hearing of the public affairs. It represents the conscious activity that is directed to the determination and control of course of topical processes for achievement of appointed goals. It puts individual activities in harmony and it fulfils general functions of the whole, i.e. the state / territory / object / organisation etc. The governance is the form of activity of authorities, particularly executive ones that consists in organizing and practical implementation of tasks given by managing team / state management / territory / object / organisation in harmony with laws and the other legal rules.

According to (6, 7), the basic tools of state for management directed to sustainability are:

- management (strategic, tactical, operational) based on qualified data, knowledge, professional assessments, qualified decision-making methods, land-use planning, correct sitting, designing, building, operation, maintenance, reparation and renovation of buildings, technologies and infrastructures,
- citizen's education, schooling and training,
- specific education of technical and management workers,
- technical, health, ecological, cyber and other standards, norms and rules including the best practice procedures, i.e. tools for control/regulation of processes that may or might lead to disaster occurrence or to the increase of its impact,
- inspections and audits,
- executive security forces for qualified response to emergency and critical situations,
- systems for critical situations defeating,
- security (land-use and spatial), emergency, continuity, crisis and contingency planning,
- specific system for defeating the critical situations - safety, emergency, continuity and crisis management.

The analysis of the development of environment and the development of political, social and economic situation worldwide shows that it is necessary to solve the cases and actions that by their intensity induce the critical situations leading to relevant crises of the type denoted as a humanitarian catastrophe or social crisis.

Therefore, from the viewpoint of human security, human system development, conservation of quality environment, existence, stability and development of state must comprise a safety concept connected with the concepts of development codified and implemented by safety management (2). On the basic (usual) level of management, the target is security and sustainable development, thus connecting emergency and crisis management.

The goal of human society management is to ensure the protection of: human lives, health and security; property, welfare; environment; infrastructures and technologies, which are inevitable for human survival, i.e. the mobilisation and co-ordination of utilization of national sources (energy, labour force, production capability, food and agriculture, resources, telecommunications etc.), the co-ordination of such activities as they are notification system, rescue system and medical services that reduce impacts of natural or other disasters and ensures the continuity of activity of public administration, the adherence of legislation and also generate the conditions for start of development (4-8).

The land and regional development is manifested by the construction of industrial regions coming closer and closer to the residential zones. Possibility of harm thus increases, and society (community) is not willing to accept all risks. This is the reason for the necessity of risk management and consecutively risk engineering that includes risk assessment, risk reduction and harm explanation. In short, the risk engineering is connected with technical systems (only in advanced forms, the human factor influence on complex process safety is considered) and in the broader sense, it is possible to generalize it to renewal of landscape with utilization of engineering approaches. Therefore, the risk engineering plays such an important role. Its target, on the one hand, is the optimum protection of humans, property and environment, and, on the other hand, the optimum renewal of damaged landscape with utilization of engineering procedures and findings (9). Both concepts require structured a

system approach and qualified utilization of planning the scenarios for decision-making support.

The territory management understood as strategic and proactive territory safety management differs from normal environment management in the following items:

- It is directed to the long-term sustainability.
- The aim is the system integrity (including the so called ecological integrity) because ecosystem services/utilities (i.e. utilities that environment offers to humans) promotes live supporting functions.
- It considers the human as an element of system and it integrates human activity with environment protection.
- It sentient reacts to human needs in the system contexts.

It includes quality environment management (10-12).

Conclusion

From the viewpoint of society needs, it is necessary to ensure the further development of economy on the one hand, and, on the other hand, to reduce the environment contamination and to ensure the environment protection.

The artistic creation is the high degree of proficiency. The complex problems of the human/nature relation are based on certain philosophical foundations in each historical era. The present period can be characterized as the era in which the humans incessantly start turning the higher merry-go-round of substances and energies in order to satisfy their needs, with reality that the bulk of these substances is growing much faster than the human needs. On one side it displays deficiencies of resources and energy (resource stocks have been stretched) and on the other side it wastes with resources and with energy.

Sustainability considers the nature and human from the viewpoint of optimum development of the whole biosphere. The ecological behaviour should not be reduced to the riotous discussions around the nuclear power plants and water structures or industrial complexes. We must plan and build big structures. At the same time, we must consider the impacts of these constructions on the environment and human health.

References:

1. PROCHÁZKOVÁ, D. *Principles of Sustainable Development*. Manuscript, 200 p. [In Czech].
2. PROCHÁZKOVÁ, D. *Strategic Safety Management of Territory and Organisation*. Praha: Karolinum, 2011, 399 p., in print. [In Czech]. ISBN 978-80-01-04844-3
3. PROCHÁZKOVÁ, D. *5 Research Reports to Ministry of Agriculture project IR56002 „Auxiliary Multi-Criteria System for Decision-making Supporting the Sustainable development of Land and Human Seats“*. Praha: MZe ČR, 2005-2007, 1023 p. [In Czech].
4. PROCHÁZKOVÁ, D. (ed.): *Environmental Monitoring and Adjacent Problems*. Praha: ČEÚ and MŽP ČR, 1993, 356 p.
5. PROCHÁZKOVÁ, D. *Environmental Monitoring the Czech Republic. I. Conception*. Praha: Study for MŽP ČR. ČEÚ, 1993, 465 p. [In Czech].

6. PROCHÁZKOVÁ, D. *Safety, Crisis Management and Sustainable Development*. Praha: UJAK, 2010, 243 p. [In Czech]. ISBN 978-80-86723-97-6
7. PROCHÁZKOVÁ, D. *Strategy of Management of Safety and Sustainable Development of Territory*. Praha: PA ČR, 2007, 203p. [In Czech]. ISBN 978-80-7251-243-0
8. PROCHÁZKOVÁ, D. *Security Planning (Land-use, Emergency and Crisis Planning)*. České Budějovice: VŠERS o.p.s., 2009, 200 p. [In Czech]. ISBN 978-80-86708-80-5
9. PROCHÁZKOVÁ, D. *Risk Analysis and Risk Management*. Praha: Karolinum, 2011, 400 p., in print. [In Czech]. ISBN 978-80-01-04841-2
10. KRÁLIKOVÁ, R., MIHÁLIKOVÁ, R. Product life cycle management applications. In *RIM 2009: Development and modernization of production; 7th international scientific conference*. Cairo, Egypt, 2009, pp. 207-208. ISBN 978-9958-624-29-2
11. RUSKO, M., CHOVANCOVÁ, J., DUCHOŇ, M. Spectrum of voluntary tools used in application of environmental policy in organization's practice. In *Machines, technologies, materiále*, Sofia: 2007, Iss. 6-7, pp. 28-31. ISSN 1313-0226
12. RUSKO, M., KREČMEROVÁ, T. Environmental supporting tools used in enterprises. In *Environmental Management for Education and Edification*, 2006, Vol.III, No. 1, p. 13-20. ISSN 1336-5762

Reviewers:

Vojtech Kollár, Professor, Ph.D. - Central High School in Skalica

Ervin Lumnitzer, Professor, Ph.D. – Faculty of Mechanical Engineering, TU, Košice

Ivana Tureková, Assoc. Professor, Ph.D. – Institute of Safety and Environmental Engineering, Faculty of Materials Science and Technology, SUT Bratislava