# SOME ASPECTS OF MANAGEMENT OF SUSTAINABILITY IN ENGINEERING

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**Abstract**

The study is concentrated on some aspects of sustainability in engineering and the social dimensions of sustainability of some related processes in the Czech Republic. The discussion on the issue of sustainable development and social dimensions is important for the contemporary society. It reflects a lot of problems in social sphere. At the CTU Prague we implement the interdisciplinary research of the social aspects of sustainable development within the framework of social sciences, economy, construction industry, urbanism and architecture; we focus on the needs of inhabitants, the values that they profess and the education of engineers within the engineering educational strategies based upon the Bologna process.

## 1. Introduction

The issue of sustainable development is nowadays actual and important. We witness it in the field of science, research, production and even management. It impacts on the life of every individual as well as the state policy and the economic objectives of companies. The sustainability of the society is a long-term programme that influences all its spheres, i.e. political, economic, social and cultural ones. For sustainable

development the co-operation of all branches of science, i.e. technology, economy, humanities and natural sciences, as well as politics and economics, is important. Moreover, every individual should implant the principles of sustainability in his lifestyle and work. The key role in this complex process is played by education and upbringing. That is why UNESCO proclaimed the period 2005-2015 a decade of sustainable development focused on education and upbringing.

In the Department of Economics of the Faculty of Civil Engineering of the Czech Technical University the research project relating to the management of sustainable development of the life cycle of buildings, building enterprises and territories, we deal with the topics of social, philosophical, legal and economic aspects of civil engineering impacts on the environment and the problems of social conditions of technological innovations, which belong to the necessary targets of the program of sustainable development in the European Union. One part of research is concentrated on the problems of sustainable developments in terms of philosophical, legal, social, ethical and economic aspects, on the conception of risks, communication with the general public and on the knowledge of the graduate of the Faculty of Civil Engineering in terms of the sustainable development.

The social dimensions of sustainability include both individual and global responsibility and perspectives, politics etc. It is stated that thanks to its traditions it is Europe that would be responsible for revolutionary changes. In the field of education such approaches reflect in different views of the collective responsibility for decision-making. This process has not only technological and economic but also social, ethical, ecological and cultural dimensions that should be conceived as a whole.

## 2. Management of sustainability at Czech Technical University in Prague

Since 1990 the Czech Republic has been going through the transformation of social and economic conditions. Further to it also educational programes at technical universities have changed. The changes are aimed at the education of experts with broader knowledge in the field of social sciences that will enable them to solve build-up problems not only partially - i.e. technically - but also comprehensively. Such a comprehensive approach is important, because building industry influences the environment and people in general.

Interdisciplinary and trans-disciplinary approaches represent another part of the education of engineers. They fill out professional education with the aspect of ethical and social responsibility. On the basis of these approaches the qualification of a graduate of the faculties of engineering includes the ability of communication with colleagues, other companies and citizens, the skills relating to cooperation, team work and processing information on the opinions of the public, the awareness of cultural relationships and particularly the knowledge of “sustainable future”.

In the course of teaching it is appropriate to provide engineers both with technical knowledge and basic information about humanities and make them familiar with social, economic and legislative problems, financing, communication with the public. This knowledge relates to the problem of sustainable development (i.e. balance among three basic fields of our life - economy, social aspects and environment). In addition to the above knowledge it is necessary to increase the organizational and managerial skills of students and graduates, as well as their sense for team work.

## 3. Life long education of the field on sustainable development

In 2005 was realised on the basis of the grant of the Ministry of Education, Youth and Sports of the Czech Republic grant of the preparation programme of Life long education of the field on Sustainable development in the building industry. It was realised first course of 70 hours lectures and workshops, interactive teamwork. The necessary knowledge of a graduate of Faculty of Civil Engineering CTU in humanities should be included in the life - long education of civil engineers:

1. The knowledge of relations among science, technology and society.

2. The knowledge of sustainable development. This term is now applied in many fields of human activity and associated with its evaluation. Mostly it is comprehended as a potential socially, economically and technologically sustainable development, during which every generation satisfies its needs in a way that does not threat the satisfaction of needs of following generations. One of definitions as follows: „permanent sustainable development is a complex of strategies that enable by economic means and technologies to satisfy human material, spiritual and cultural needs and at the same time respect environmental limits; to make it possible in the contemporary global world means to re-define necessarily their social and political institutions and processes at local, regional and global levels“.

3. The knowledge of characteristics of the contemporary society and its gradually changing social structure. The main trend is to decrease the number of people working in industry, increase the number of people in the middle class and amplify the wealth of the limited number of the richest. The question is the change of urban areas and the development of the urban society, as well as the change and development of rural settlements.

4. The characteristics of individual classes are linked with their inhabitation needs. The inhabitation needs of children, people in working age and post-working age differ. Therefore it is important to have basic knowledge about the needs and behaviour of these classes and their comprehension of space, materials and colours that contribute to their better feeling.

5. The awareness of the continuity of the build-up process and the long-term existence of constructions and communications from the angle of their historical retrospective and future (i.e. their social and cultural context). The continuity of the utilisation of urban areas is very important for construction changes, reconstructions and especially the application of new methods of the utilisation of space, for example making use of so-called brownfields.

6. Legal and social aspects of EIA procedure further to Act on Environment and the issue of public interest. The problem of the application of EIA procedure is solved on the basis of Act No.100/2001 Coll. on the assessment of impact on the environment. EIA is a formalised and publicly controllable process of the evaluation (identification and predication) of the impact of planned human activities (i.e. industrial, agricultural, transport and other constructions) on the environment, human health, good humour, cultural and historical monuments, landscape, infrastructure etc. In addition, EIA aims to inform the public in an understandable, matter-of-fact and brief way about the results of the evaluation process. EIA is an international process, having its basis in laws. It enables the public to participate in the initial phases of preparation in order that the construction plan will comply with the specific conditions of respective locality.

7. Brownfields. Civil engineers and architects now consider the utilisation of these areas for both reconstructions and new constructions with the perspective of

new investments. On the other hand, sociologists - and often psychologists as well - evaluate these areas from the angle of their social, psychological and cultural aspects. According to a socially oriented approach these new built-up areas will give new production and sales opportunities, ensure inhabitation in downtowns and cultural activities of inhabitants, provide spaces of land for the continually increasing number of administrative buildings and improve social communication among people. The cultural solution of this problem will provide a space with new identity and an aesthetic approach will ensure that new built-up areas will be attractive. All proposals should take account of respective historical heritage.

8. One of possibilities of collecting information about individual impacts is a sociological research, finding out the opinions and attitudes of respective inhabitants. Its results give valuable information and instigations that are important for experts. An applied research is utilised in various forms. While opinion polls are focused on what people feel or think of concrete problems and on social and economic tendencies, evaluation is concentrated on the success or failure of respective projects or programmes with respect to relations with the public and compares them with intended objectives. This research applies several main methods. 9. An economic approach to this problem relates to the solution of economic and social crises and the problem of transaction expenses - in this case those of building companies. The important role in this respect is played by institutional economy that consolidates economic and human (social) attitudes.

The proposal of the lifelong education of graduates of FCE is based on requirements that I have mentioned in previous text. As UNESCO considers the conception of sustainable development so important that it called the following

decade (2005-2010) „a decade of sustainable development“, this fact should reflect itself flexibly in the programmes of lifelong education at universities.

## 4. Ethics, Sustainability and Business

Ethical principles in business are at present a very actual issue, above all in connexion with abiding and not-abiding by the ethical norms. Business ethics are connected with the problem of the sustainable development of the human civilization. This treatise spares a thought for connexion among ethics, ethical principles and the problem of sustainability in business and enterprises. The social dimension of sustainability is represented both by a society and its culture, traditions, values, norms and ethics, and a man as an individual. The economic dimension is connected with political and juridical measures taken by the society - because political, economic and juridical consciousness influence one another - as well as with the development of technology. The ecological dimension of sustainability is concentrated on both the nature and the environment.

The term of „the sustainability of human civilization“ reflects its more and more destructive impact on the environment, culture and man. The human civilization is destroying itself under the flag of technological progress. The issue includes the large scale of problems from globalization, consumption society, economic and financial decisions of financial oligarchies and political decisions of governments to the everyday style of life.

Ethics „lag behind“ technology. They are integrated sufficiently neither in it nor in economy and scientific methods. Science as well as practical life have to take account of the nature and ethics. Every discipline must include its ethical codex with respect to sustainability. The problem can be solved inter alia by transdisciplinary approach to

ethical values. Business without ethical principles and principles of sustainability is - in a long-term perspective - unsustainable. It can be sustainable only on the assumption that ethical norms are respected.

## 5. Urban Revitalization and Possibilities of Public Participation

Urban revitalization is an issue both for town-planners and architects and economists and sociologists. Each of experts has his own angle. The sociologists are interested above all in the social impact of revitalization on the public, the increase of employment and the improvement of the quality of life, influence on inhabitants and the cultural renewal of the environment. This is based upon the knowledge of urban changes, the development of urban and rural societies and their development. The participation of the public or the citizens has a positive impact on the life of a community. The most important contribution consists in the stimulation of the interest and activity of citizens. The upbringing of the part of the population changes thought, approaches to the environment and the way and quality of life for the benefit of the sustainability of the society. Participation reflects positively in the opinion of people of the quality of life and influences the values among which individualism, lack of interest in public affairs, passivity, intolerance and indifference to development in the future prevail in the period of the transformation of the Czech society.

If we speak about participation, we always take account of a fact that the participation of people in any process increases their interest in an implemented project, on the assumption that they are ready to co-operate and dispose of necessary information, abilities, skills (social competencies) and expertise for the solution of respective problem. Participation increases quality, improves decision-making and aids in the identification of men, citizens (employees workers) with their business, locality and

community, as well as initiates efforts to achieve better results. Participation is very important for satisfying the social needs of people, especially those of communication, respect etc.

Nowadays the solution of the problem of needs mostly leans on the hierarchic system elaborated by American psychologist A.H. Maslow who defines a need as a precondition for keeping physical and mental health. Mental needs represent the last (i.e. psychologically non-analysable) goals of human behaviour. That is why needs explain the behaviour of man. They are classified in a hierarchy according to their urgency with which they are felt as inner impulses to action. Maslow´s hierarchic classification of needs from the lowest, „basic“ to the highest ones is a s follows:

**A. Basic need**

a) **physiological needs** (hunger, thirst, sex)

b) **needs of security** (those in situations that cause the loss of security, in situations of danger or economic breakdown)

**B. Psychological needs**

a) **needs of appurtenance and love** (need to be loved and accepted by the others and to pertain to somebody)

b) **needs of respect** (needs of performance, competency, respect, trust and approval)

**C. Needs of self-actualization** (needs to apply one´ s abilities (i.e. one´ s „mental potential“- „to be who one is able to be“- and needs of individual development including cognitive and aesthetic ones - i.e. needs to discover, create and classify)

The higher needs do not become driving motives before the lower ones are not satisfied.

Urban revitalization should not be implemented at present without the participation of local inhabitants. Although it is not possible to envisage the participation of the majority of citizens whether in small or larger communities, it is necessary for development in the future. It is a precondition for the development of a democratic society that is not capable to function well without the activity of citizens. In revitalization a lot of positive aspects are interconnected. They contribute to improvement of the environment and the quality of life, as well as its ecological aspects that can facilitate mutual communication among people and increase employment and enterprise in a space concerned. In addition, it can increase its attractiveness and attendance rate.

## 6. The research of students´ opinions of the issue of sustainable development in construction industry

For finding the opinions of students of the Faculty of Civil Engineering of the problem of sustainable development the research among the students of the 3$^{rd}$, 4$^{th}$ and 5$^{th}$ grades was carried out in November 2006. It was a part of the comprehensive research named “Sustainable Construction Industry”. The questionnaire included the responses of 518 students who represented 20 per cent of the total number of students of the above grades. The research was focused on the student´ s knowledge of sustainable development and its application in construction industry (the role of construction industry in sustainable development, the types of constructions and their technological, economic and ecological aspects, the advantages and disadvantages of “sustainable construction industry”, ecological constructions etc.) on one hand and values that they profess, their behaviour and lifestyle, as well as “considerate relation” to the environment both in private life and at work, i.e. in the course of decision-

making, on the other. During the research many questions were asked – both confidential (if needed) and open (in which students expressed publicly their points of view). In this study I would like to present some conclusions resulting from the above research. The students of the Faculty of Civil Engineering perceive sustainable development as the equilibrium of social, economic and ecological dimensions. They define it as a well-balanced and ecologically considerate way of life and consider the equilibrium of social, economic and ecological factors and their continuous growth to be the heart of the matter. They are aware of the importance of social dimensions of the sustainable development of the society and its bond with the economic one, as well as the political and legal approaches of the society. Practically, political, economic and legal aspects impact not only on one another, but also on technology. As for the ecological dimension, the students apply it both to the nature and the environment as a whole. Management ability and personal responsibility interpenetrate all these dimensions.

## 7. Conclusion

Technical universities and CTU too analyse sustainable development above all within practical subjects. The interdisciplinary knowledge of the issue of sustainable development can help practical decision-making and creating the equilibrium of three basic spheres of our life – economic, social and ecological. In accordance with the research of the environment social sciences have been engaging in more detail in the problem of sustainable development for the last decade; as to its application to technology, it is in the centre of general attention no more than a few years.

For this reason it is useful to provide engineers not only with professional education, but also elementary information about the humanities, as well as make them familiar

with the social, economic and legislative problems in construction industry, financing, management and communication with the public. This knowledge is helpful also to understanding the problem of sustainability. The aim of the humanities is to study these issues and their mutual relations at local, regional, national and global levels. Approaches to these problems are of interdisciplinary character within the framework of social sciences (sociology, psychology, ethics, philosophy, law, economy), construction industry, architecture and urbanism.

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