

TECHNICAL UNIVERSITY IN SOCIETY: A FACTOR OF SUSTAINABILITY

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Abstract ^{3/4} The future and the very possibility to survive for every nation and the whole humankind depend on sustainability. Sustainability is what we need in the Ukraine struggling now along her difficult and wavering way of political and economic transition. This paper aims to show that universities are natural centres of sustainability in societies. Universities can play this important role due to their highly qualified, professional and dedicated faculty members. The faculty are competent and skilled not only to teach and disseminate the principles of sustainable development but also, using their growing influence on and links with businesses, governmental and public organisations, to implement real projects directed towards increasing sustainability in a society. Using this central concept, the paper studies the role of sustainability principles in both curricula and practical activities of Donetsk National Technical University in implementing technical, scientific and social innovations; globalisation and integration of Ukrainian higher engineering establishments into the European and world system of engineering education.

Index Terms ^{3/4} Sustainable development, role of technical universities, curricula, project implementation.

INTRODUCTION

Our quickly changing world appeals for sustainability. The tragedy of terrorist attack on 11 September has demonstrated that once again, that time with the horrifying force.

Sustainability is what people need in the Ukraine struggling now along her difficult and wavering way of political and economic transition. Lack of sustainability in this process threatens with a disaster and the very aim of the transition is to improve political organisation and economic performance on a sustainable basis.

At present, sustainable development is the most important condition on which depend the fate and the very possibility to survive for a nation and the whole humankind.

Being a very popular word nowadays, the concept of sustainability comes from considerations in natural sciences, particularly biology. It did not take much time before the term was carried to the humanities. However, it took the Meadows' [1] and Brundtland's [2] reports and especially 1992 United Nations Conference on Environment and Development in Rio-de-Janeiro [3] for the problem of sustainable development to achieve its current high level of

concern and discussion for governments, scientific communities, and common public.

IS THE SUSTAINABLE WORLD AN UTOPIA?

The ideal model of sustainable development encounters conflicts in three main spheres of our real world: environment, economy, and society [4,5]. The World Business Council for Sustainable Development (WBCSD) has coined the term "the 3 Es", meaning environment, economy and everyone as a shorthand way of explaining what needs to be balanced to achieve sustainable development [6].

In short, environmental aspects of sustainability mean recognition of the necessity to use environmentally friendly production processes and services, coordination of produced wastes with the carrying capacity of our planet to preserve it suitable for life.

Economic aspects of sustainability are related to the problem of an effective distribution of limited resources, goods and services to satisfy the needs of all people living now both in developed and less developed countries as well as of all people of future generations.

In social and political terms, sustainable development demands a large scale of social justice and safety, the possibility for all people to realise their rights to freedom, equal opportunities and political independence.

The sharp collisions of interests involved with the ideal model of sustainability are obvious. Even inside a given country or community the disparity of income and consumption in many cases is immense. In contrast to luxury-oriented life style of the rich elite, for the poor development means satisfying the basic human needs: jobs, food, housing, health services, education. The lack of access to such services gives rise to hopelessness and despair that lead to political unrest, terrorism, revolution, emigration to high-income countries in search of a better future.

In this way, the ideology of sustainable development encounters the eternal human contradictions between right and wrong, good and evil, forbearance and violence, the rich and poor. The whole history of mankind demonstrates that these contradictions could not be cancelled.

Does that mean that our vision of sustainable future describes an unattainable utopia? No. Never in the ages the Ten Commandments were strictly followed by everyone. (In fact, the same relates to any ideology in a human society). But who can deny the definitive role of Christian morality in forming the modern world?

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To create the sustainable world in future, we will need a huge change in mindset, values, and action. For Ukraine and other NIS, the cardinal change in views on progress, development and growth in a human society means, in particular, the integration of sustainability principles with other policies dealing with economic development, market reform, privatisation, legal reform, and total democratisation of society.

UNIVERSITIES ROLE IN THE TRANSITION TO A SUSTAINABLE FUTURE

To form and grow a perfect crystal, we need good nuclei, centres of crystallisation. Where can we find such centres to crystallise so desperately wanted sustainability?

These are universities that have the power to lead in making the sustainability ideals a future reality. Universities may become the natural centres of sustainability in societies, playing successively this profound and pivotal role due to their highly qualified, professional and dedicated faculty members. The faculty are competent and skilled not only *to teach and disseminate* the principles of sustainable development but also, using their growing influence on and links with businesses, governmental and public organisations, *to implement real projects* orientated towards increasing sustainability in a society.

Universities prepare future professionals who develop, manage, lead, influence, work and teach in society's institutions.

Universities play a decisive role in creating and disseminating knowledge, skills and values for society.

Universities have unique academic freedom and the diversity of skills to originate new ideas and develop innovations, to meet new challenges, to experiment, find and implement new solutions to arising problems.

University is a large enterprise that might transform and present itself as a model for future sustainable community.

All these factors permit universities and their faculties to take a leading role on a path to a just and sustainable society.

In the following we describe the activities of Donetsk National Technical University aimed to increase sustainability in the Ukraine, a country with a transitional economy.

DONNTU AS A CENTRE OF SUSTAINABILITY IDEOLOGY IN UKRAINE

Teaching sustainability

A course in sustainable development is now a compulsory part of training provided for many engineering students at Donetsk National Technical University (DonNTU). Such courses were introduced in 1993-1995, after the 1992 United Nations Conference on Environment and Development in Rio de Janeiro.

The aim is to provide ideology, concepts and approaches of sustainable development to our students - those who will perform engineering tasks and create material basis of development in the near future.

The objectives of courses in sustainable development provided at DonNTU have been formulated in the following way:

- The primary objective of the course is to enhance positive attitude towards sustainable development and environment protection. It corresponds to strategic aim of continual environmental education as it is accepted at DonNTU.
- The second objective is to provide the needed working knowledge to apply sustainability approach in engineering practice, in particular, technology assessment based not only on technical functionality and safety but also on environmental quality and quality of life.
- The third objective is to give comprehension of economic, social and political aspects of sustainability and total environmental management.
- The fourth objective is to prepare and develop in students personal, professional and organisational skills necessary to implement practically the principles of sustainable development.

A typical curriculum as it is usually presented at DonNTU [8,9] is given in the following.

Curriculum

The course in sustainable development at DonNTU comprises lecture sessions and seminars. Typically, it consists of three major parts described in the following.

The course starts with introduction to the main concepts and the history of sustainable development. The term "sustainability" can be followed back at least to the XVIII century when it was first introduced in forestry. Another important event was introduction of sustainability to fishery at the start of the XX century [5].

Scientific basis of sustainability was laid down in biology. Life in ecological communities shows what neat and accurate adjustments are necessary for sustainability.

The conflicting interests related with realisation of sustainable development must constantly be taken into consideration.

After an introducing lecture, students discuss at seminars the problems associated with three major constituents which should be harmonised under the ideal model of sustainability:

- *Environment* - until now progress of human society (especially industrial) has been bringing about unchangeable damage to the environment, destroying its natural sustainable selforganisation. Is it possible to find an alternative to this connection?
- *Economy* - what is a just order in global distribution of world resources? How should they be distributed

between the developed and developing countries? Between present and coming generations? Is the accelerating research and innovation race consistent with sustainability?

- *Society* - does economic growth always lead to increasing *welfare*, quality of life?

Here attention of the students is drawn to the problem of appropriate indicator for prosperity and welfare of a society. The Gross National Product (GNP) or Gross Domestic Product (GDP) can no longer be considered as universal measurements for prosperity. The Conference in Rio put forward the necessity to develop more suitable indicators for the ideal model of sustainability. As possible examples, Index of Sustainable Economic Welfare (ISEW) and the Human Development Index (HDI) are considered. Using statistical data, students calculate HDI and find out its correlation with other indicators of country development.

Then the threats to sustainability are discussed at seminars. First-year students often chose the threats to sustainability as a subject for writing their essays.

The next part of the course aims to give understanding on what should and can be done on the way to more sustainable development. The humankind is standing before a trilemma: how to unite and harmonise lasting and reasonable economic development, limited resources (energy, minerals, food, water, air) and preservation of the environment.

Possible ways to the ideal model of sustainability include broad range of measures in science and technology, education, politics and economics.

Wide *environmental education* for manifold categories of population is needed to crystallise an understanding of inevitable changes in social values, lifestyle, behaviour, consumer orientation.

Scientific progress and new technological developments is believed by many people to be the main source of optimism and the main means to achieve the ideals of sustainable development. However, we cannot count on science and technology as a miracle stick always at hand. For several decades physicists are expecting the approaching in near future use of thermonuclear energy but even now the perspectives of this technical accomplishment are not clear.

Promoting the use of renewable sources of energy (solar, wind, tide, biomass) can greatly contribute to sustainability, but, unfortunately, the feasibility of large-scale introduction of renewables in near future, although highly desirable, is doubtful because of lack of competitiveness with conventional energy sources.

The new technology should be made environmentally friendly and socially sustainable. The very assessment of new engineering solutions should change. Traditionally, engineers evaluated new technological achievements from three measurements: functional effectiveness, safety and economic viability. Modern technological assessment must include the issues of environmental compatibility and quality of life.

Political and economical measures must include a pointed governmental and companies' policy in certification and licensing, priority subsidising of sustainable technologies, tax reform with lowering taxes on labour and production factors and increasing them for resource consumption.

Think globally, act locally. This slogan is often mentioned by students at DonNTU when they carry out their environmentally oriented projects for enterprises in Donetsk industrial region. "Proficient engineers must also be ready to take responsibility for global decisions", their teachers may answer them.

Students are also invited to study and discuss at seminars the role of different parties in promoting the cause of sustainable development: individuals (the best way to start is often at home); voluntary and nongovernmental public organisations (social, ethical, greenpeace); local authorities; small and medium sized enterprises; large businesses and multinational companies; national governments.

Disseminating sustainability

As an example, we consider here train-the-trainer courses on ISO 14,000 environmental management systems provided for representatives of industrial enterprises and local administration.

Participants learn to train management and staff at all organisational levels to implement all the elements of an ISO 14,000 programme and to establish an environmental management system (EMS). This course enables the trainer to raise the levels of knowledge, skills and work attitude necessary to make the ISO 14,000 EMS work effectively.

Much of this training involves orientation and gaining working familiarity with ISO 14,000 EMS guidelines. Through completion of the workshop exercises and experiencing the lecture sessions, the participant acquires the needed knowledge and training skills. At the courses, participants begin to formulate their own EMS programme to take into account organisational differences with respect to:

- products and services offered;
- size and structure of organisation;
- environmental, health and safety history;
- communication capabilities;
- operational risks for environmental, health and safety incidents;
- available financial resources to effect EMS programmes;
- level of organisational policy commitment to effect an action plan for EMS implementation and willingness to respond to ISO 14,000 EMS performance and auditing criteria.

Seminars and workshops on subjects related to sustainability for representatives of businesses and industry, administration, environmental public organisations are often provided in coordination with such nongovernmental

organisations as the Union of Ukrainian Employers, Centre for the Support of Progressive Reforms.

Implementing sustainability

The principles of sustainability are not only taught and disseminated by DonNTU faculty. They are used as a guide in their practical activities.

The faculty is taking an active part in developing the strategy for Donbass economic and social development, solving its environmental problems in the process of economic transition. Donetsk industrial region (Donbass) has inherited many serious problems of economic development and environment protection. That requires significant improvement in environmental management and the integration of environmental policy with other policies dealing with economic development.

Together with the State administration in Donetsk region and other organisations, DonNTU faculty took an active part in developing "Complex programme for social and economic development in Donetsk industrial region (Donbass)". Sustainable development was a basic idea put into these documents.

A special programme was developed for environmental education: "Concepts and system of measures for rebuilding environmental education". Under this programme, both teaching and research is directed to the needs of Donetsk region:

- more effective use of all energy sources;
- treatment and disposal of industrial and agricultural wastes;
- recuperation and recurrent use of materials;
- recirculation of industrial wastes;
- environmental review and assessment of all new technologies and engineering solutions.

Several concrete projects were performed by DonNTU faculty in the frames of bilateral Program to Promote Sustainable Development in Ukraine sponsored by the US Agency for International Development.

Now the faculty are involved into diverse activities related to realisation of the projects in the frames of Special (Free) Economic Zone. In 1998 the Law was adopted by Ukrainian government according to which the status of special economic zone was given to specified territories in Donetsk region.

For practical realisation of new possibilities opening by that Law, Council on Special Economic Zone was organised at DonNTU. Its functions include:

- providing training on specific business and engineering activities in special economic zones;
- review and assessment of investment projects that are proposed;
- assessment and approval of measures to attract financial resources;
- conduction of Ukrainian and international tenders for investment projects;

- consideration and approval of new technological and engineering projects developed at the university for enterprises in the Special economic zone;
- expert assessments of investment projects.

Important contribution into sustainable development of New Independent States is their integration into international community and, at the same time, development of their traditional relations. In this respect, foundation by DonNTU and Taganrog Radiotechnical University of a joint educational institution called Russian-Ukrainian University provides a good example. Five-year period that passed after formation of the Joint University has already proved its effectiveness.

CONCLUSIONS

Sustainable development is a priority goal for international community. Universities are natural centres for broad education and wide dissemination of the principles and ideology of sustainability. Moreover, acting together with business companies, industrial enterprises, public and governmental organisations, universities are also centres for practical implementation of sustainability principles. Sustainability is a guiding principle in practical activities of DonNTU faculty in performing actual projects aiming to increase sustainability in Donetsk industrial region and throughout Ukraine.

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