



INTRODUCING SUSTAINABLE DEVELOPMENT PHILOSOPHY INTO ENGINEERING EDUCATION *ILGTSPĒJĪGĀS ATTĪSTĪBAS FILOZOFIJAS INTEGRĀCIJA EKOLOĢISKAJĀ IZGLĪTĪBĀ*

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Abstract. *The paper presents an effort to single out the basic issues of sustainability that could make it applicable for the relevant changes in engineering education. The universities are regarded as change agents and key actors in charge of promoting and achieving sustainable future because of their ability to promote importance of sustainable development (SD) through their scholarly work and public service.*

Keywords: *sustainability challenges, engineering curriculum, transdisciplinary approach.*

We should confess that societies have so often chosen unsustainable paths of resource depletion and consumption. As a result nowadays they are faced with enormous environmental and societal challenges. To face those challenges, the mankind has to find more sustainable ways of living. Though we have at our disposal a number of definitions of what sustainability is, the majority of them include the time dimension, and that in a way means that sustainability encompasses an inherent goal of being able to persist, sustain, and endure [1].

It can be considered that the sustainability problems that humanity is addressing at the present moment should be related to three types of changes and challenges: those in environment change; in society; and in technology, because they result from those changes and challenges and in the last century the rates those changes achieve in all these three types have been rapidly multiplied [2].

The first documented efforts to identify goals for education that address environmental and sustainability challenges can be found in the late 1970s, when the intergovernmental conference on environmental education took place in Tbilisi, Georgia, in 1977. The Tbilisi declaration addresses education at all levels, even outside the formal school system. The declaration is seen as the first attempt to formulate LOs (learning outcomes) of this kind. At that time, the concept of SD (sustainable development) had only begun to develop and efforts in education to reach a more holistic view were normally discussed in terms of environmental education. Still, societal and economic aspects were emphasized as well as the interconnectedness between the different dimensions. The insight into the educational challenges indicated by the text in the Tbilisi declaration is remarkable and it is discomfoting to notice how slowly progress has been made in education. Still, few educational efforts have managed to properly address these goals that were formulated already.

One of the outcomes of the 1992 United Nations conference in Rio de Janeiro was Agenda 21, a collection of measures to achieve SD, which is generally rested on three basic concepts – ecology, economy, and society, and economic growth is believed to be achieved by limiting negative impact on environment and increasing positive impact on social issues. As part of the effort towards sustainability, the United Nations General Assembly recommended adopting the idea of the Decade of Education for Sustainable Development (DESD), which began on January 1, 2005 [3]. United Nations established the Decade of

Education for Sustainable Development (DESD) (2005-2015) to promote integration of sustainability into courses and curricular worldwide or the goal of the decade is “to integrate the principles, values, and practices of sustainable development into all aspects of education and learning” [1].

Zadorsky [3] outlined the key elements of ESD (education for sustainable development as the following:

- The integration of sustainable development into the education systems at all levels.
- Assistance to the development of education as a basis of a sustainable society.
- Strengthening of the international cooperation for the development of innovative policies, programs and practices (p. 64).

Institutions of higher education are critically important places of knowledge production, knowledge perpetuation, and knowledge dissemination. Higher education plays an enormously important role not only in formal schooling, i.e., teaching specialized subjects and assisting in developing skills necessary to learn these subjects, but also in moving beyond these purely professional areas and educating future leaders and professionals about the world we are living and about the pressing issues in the external environment affecting our lives. As such, critically evaluating and transforming existing higher educational curriculum to have it address current environmental problems should become one of the key priorities for higher education institutions that are striving not just to “school” their students but to educate them about core environmental concerns and help them become responsible citizens of the world. To facilitate the Regional Centre for Expertise on Education for Sustainable Development (RCE Samara) was established in Samara and it was acknowledged by the United Nations University. The case study of the Institute of Ecology and Engineering Systems (IEES) at Samara State University of Architecture and Civil Engineering (SSUACE), which is one of the founding partners of RCE Samara could be a good example for the topic discussed. Through a detailed description of the ecological curriculum developed and taught at IEES, the historical background of how this curriculum was developed and introduced into SSAUCE educational process, as well as the prospects for further development of ecological education at this institution are treated as a rationale for “ecologizing” campuses, particularly of those engineering institutions

As society faces unprecedented and increasingly urgent challenges associated with accelerating environmental change, resource scarcity, increasing inequality and injustice, as well as rapid technological change, new opportunities for higher education are emerging. With regard to a societal transition toward sustainability, the primary role of institutions of higher education can be viewed in two ways: universities can be perceived as an institution that needs to be changed or universities can be perceived as a potential change agent [1].

Surely, by many, universities are viewed as change agent and key actors in charge of promoting and achieving sustainable future because of their ability to promote importance of sustainable development (SD) through their scholarly work and public service. Universities can serve as role models for others in the community as sustainable organizations and provide graduates who are trained and acquired necessary skills to become responsible citizens [4]

B.J. Machen, President of the University of Florida, saying “I graduate 15,000 students a year. If I could turn out half of them with sensitivity to sustainability and turn them loose on the world, that’s a hell of a contribution”. In sync with President Machen, Chalkley (2006) commented “...Higher Education’s most valuable contribution to sustainability lies in providing large numbers of graduates with the knowledge, skills and values that enable business, government and society as a whole to progress towards more sustainable ways of living and working” (as cited in [5]).

Many different perspectives and expectations on the role, value and potential of the university in society translate into many different perceptions of opportunities for the university as a

change agent in a transition toward sustainability, who outlined four categories or perceptions on how higher education may contribute to building a sustainable future. “First, higher education can model sustainable practices for society; this view is based on the premise that sustainable behavior should start with oneself and by promoting sustainable practices in the campus environment, learning related to how society can maximize sustainable behavior is accomplished. Second, higher education teaches students the skills of integration, synthesis, and systems-thinking and how to cope with complex problems that are required to confront sustainability challenges. Third, higher education can conduct use-inspired, real-world problem-based research that is targeted to addressing the urgent sustainability challenges facing society. And lastly higher education can promote and enhance engagement between individuals and institutions both within and outside higher education to resituate universities as transdisciplinary agents, highly integrated with and interwoven into other societal institutions [1].

On the other hand, institutions are also the places that need to get changed themselves. There are different ways in which the university can demonstrate its commitment to sustainable development: by “greening” campuses, by introducing special courses on sustainability, and by engaging in various collaborative research projects [4].

There are internal (culture and structure of a university) and external barriers (no demand from the society for a different crop of graduates) that may prevent the university from becoming a sustainable institution. Drivers for change may also be internal and external. Internal drivers are the visionary leadership or financial incentives and external drivers may be pressure from peer institutions or financial bonuses from industries and organizations willing to support sustainability efforts.

Let us address the issue of sustainability in engineering curriculum. Universities, throughout history, have always held a critical place in society for advancing science. Given the current urgent societal challenges associated with environmental degradation and human health, the university role of advancing science in very practical and applicable ways is growing. This is particularly true about engineering universities, where science is indeed created and then shared with humanity. “As pedagogy, environmental sustainability is concerned with transforming students’ patterns of thinking so that humanity can live meaningfully and harmoniously in the natural world” [6, p. 114].

“The Tbilisi and DESD initiatives address educational efforts in society as a whole, but there are also many initiatives that target higher education, sometimes directed towards specific professions. One example is the Declaration of Barcelona that was formulated during the Engineering Education for Sustainable Development conference in 2004, specifically dealing with higher education for engineers (the Barcelona Declaration). For the last 15 years, a set of concerned businesses have addressed sustainability issues that have become relevant for their future in what is known as the World Business Council for Sustainable Development (WBCSD - www.wbcd.org). The Council is particularly expressing a concern for providing future professionals with adequate learning for their future professional decision making and has been laying a strong foundation to foster sustainable development learning.

The example of DESD initiatives is the example of how sustainability should be generally addressed in the society. In the Declaration of Barcelona it is stated that today's engineers must be able to work in multidisciplinary teams and that social sciences and humanities should be incorporated in teaching for engineers; at this point it is relevant to quote J.D. Bernal's point of view regarding the latter "In the great creative periods of science the artists and the scientists worked very closely together and were in many cases the same people (Leonardo da Vinci could serve as one of the best examples). The result of this separation [i.e. science and art] has been the most incredible mutual ignorance. [1].

Changes need to be made in the way engineering education is conceived and delivered, so that graduating engineers can become proponents for the implementation of sustainable practices in their organisations [7]. The Declaration of Barcelona wants engineers to help redirect society and want to train engineers who are motivated to participate and who are able to take responsible decisions

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