Knowledge transfer from university in Digital Europe

Y. Kess, J. Martin

Euroacademy, Estonia

Abstract

The bases of this study are global strategies of European Union, including sustainable development and knowledge society. Digital ecosystem is conceptually defined as a network of knowledge and knowledge workers supported by technological infrastructure including knowledge treasuries. Educational and labour ecosystems are structurally specified for future digital Europe.

European labour market developments should be to create the European Professional Education Network providing full scale of education modules including tools for re-skilling and sustainable professional development. Entrepreneurial universities in this network are the main suppliers with labour education and enterprise knowledge. European Labour Network is unavoidable future in sustainable development of labour, where entrepreneurial universities are creative actors.

A knowledge management system in university contains educational knowledge base and e-learning modules. Specified for entrepreneurship the university knowledge contains useful modules for business. Then one of the outputs of entrepreneurial knowledge of university is Portal to business environment transferring educational knowledge.

Driving force for educational technology is a model network describing knowledge management system in university. Set of models covering educational knowledge modules are useful-friendly for creators and owners, teachers and students using knowledge. Educational knowledge technology operates on model networks, as a tool for creation, handling and sharing of knowledge modules.

Keywords: knowledge, university, ecosystem, education, model.

Introduction

This paper was inspired by European strategies and current studies in Euroacademy. The bases of our study are global strategies of European Union, including sustainable development and knowledge society. Theoretical concepts are sourced from knowledge management and modelling.

The aim of the research is to find effective way for knowledge transfer from universities in Digital Europe. The structure of paper contains the concepts and definitions in first part, description of educational and labour ecosystems in digital future of Europe in second part, and respectively associated knowledge management in universities in third part of presentation.

We will find that global knowledge collected by universities would be more intensive used by European enterprises in educational and labour ecosystems.

Conceptual framework

Education for sustainable development

The concept of environmental education was first formulated by William Stapp, professor at the University of Michigan in the first issue of «*Journal of Environmental Education*»:

«*Environmental education is aimed at producing a citizenry that is knowledgeable concerning the bio-physical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution*» (Stapp *et al.*, 1969).

Problems of environmental education were internationally recognised at the United Nations Convention on the Human Environment, held in Stockholm in 1972. Recommendation 96 of the conference clearly states the need for an international program of environmental education, in-

terdisciplinary in approach, in and out of school, directed towards the general public, the ordinary citizen notwithstanding the age (United Nations Conference, 1972).

In 1974, W. B. Stapp and D.A. Cox (1974) published the model of environmental education stressing the aim of the environmental education program — to assist the learner in understanding the basic ideas of 'Spaceship Earth' philosophy that should serve as the 'umbrella' of thought and ethic for the entire program. Spaceship Earth philosophy was divided into five basic concepts: ecosystems, population, economics and technology, environmental decisions and environmental ethics.

Special attention should be paid to the social, economic, political and aesthetic influences of the population, the need for and the process of decision-making, and the development of environmental ethic motivating the learner to adapt his lifestyle to the environmental quality

In 1980 «World Conservation Strategy» was published by IUCN, UNEP and WWF (1980). It was this document that coined the concept of 'sustainable development'. Three objectives were stressed in the given strategy:

● ecological processes and life supporting systems must be sustained;

● genetic resources must be maintained;

● any use of species and ecosystems must be sustainable.

After the publication of the Report of World Commission «Our Common Future» in 1987, indicating the necessity for global sustainable development, environmental education came to be primarily associated with the new approach. It is stated in the report that sustainable development *«meets the needs of the present without comprising the ability of future generations to meet their own needs»* (World Commission..., 1987).

The concept of sustainable development became the primary concern for the United Nations Conference on Environment and Development in Rio de Janeiro in 1992 and the basis for the Agenda 21(1998) and the respective regional orientation documents (for example, the agenda for action signed at the summit of the Prime Ministers of the Baltic Sea states in 1996).

In 1991, three organisations concerned — IUCN, UNEP, WWF — published an extensive document entitled «A Strategy for Sustainable Living» defining sustainable development as «improving the

quality of human life while living within the carrying capacity of supporting ecosystems», which formally somewhat differs from the definition given by the World Commission, however, resembles it philosophically. Many chapters of «A Strategy for Sustainable Living» stress the importance of environmental information and the role of both formal and non-formal education in shaping people's attitudes. It is important to incorporate environmental ethics into educational process and develop environmental education at all educational stages, governments are encouraged to analyse the state of environmental education (including social education) and include the subject in all academic specialities and educational levels.

The resolution 57/254 «United Nations Decade of Education for Sustainable Development 2005-2014» (2003) adopted by the UN General Assembly in December 2002 stresses that «...*education is an indispensable element for achieving sustainable development»*. Section 2 (13-18) of the given document is concerned with the integration of education and sustainable development and section 2.1 designates the key spheres of sustainable development: society, environment and economy. Section 2.2 is entirely dedicated to the explication of the importance of education in sustainable development stressing the following:

● Education must inspire the belief that each of us has both the power and the responsibility to effect positive change on a global scale.

● Education is the primary agent of transformation towards sustainable development, increasing people's capacities to transform their visions for society into reality.

● Education fosters the values, behaviour and lifestyles required for a sustainable future.

● Education for sustainable development is a process of learning how to make decisions that consider the long-term future of the equity, economy and ecology of all communities.

● Education builds the capacity for such future-oriented thinking.

Global Development Research Centre (GDRC) supports the UN Decade of Education for Sustainable Development based on the Agenda 21, Chapter 36 'Promoting Education, Public Awareness and Training. The given document enlists the following spheres: reorienting education to sustainable development, enhancing public awareness, supporting training. It is also pointed out that countries need to

develop practical study programmes on various education levels, including universities (36:18).

The meeting of Environment and Education Ministries concerned with the UNECE strategy for education for sustainable development (CEP/AC.13/2005/3/Rev.1) took place in Vilnius, March 2005. The aims of the strategy were the following:

● to ensure that policy, regulatory and operational frameworks support education for sustainable development;

● to promote sustainable development through formal, non-formal and informal learning;

● to equip educators with the competence to include sustainable development in their teaching;

● to ensure that adequate tools and materials for education for sustainable development are accessible;

● to promote research on and development of education for sustainable development;

● to strengthen cooperation on education for sustainable development at all levels within the UNECE region.

The Baltic University programme «A Sustainable Baltic Region» coordinated by Uppsala University was initiated in 1997 (Sörlin, 1997) and altogether 10 teaching materials have been published. The aim of the course is to give the students an overview of sustainable development and demonstrate the implementation of the new approach and economic models in various sectors. In 2011 the Baltic University Programme celebrated 20th anniversary with the Rectors Academic Conference. One of the keynote speeches delivered by the Prof H. Van Ginkel Rector of Utrecht University was dedicated to the Decade of Education for Sustainable Development.

We consider that it is important and time is ready to discuss problems «Education for and education of sustainable development» in the context of Rio+20. In recent years we conducted research on content and structure of environmental education in Estonian higher education establishments and some results have been published (Martin, Seppel-Hyvonen, 2010; Seppel-Hyvonen, Martin, 2011).

Education in knowledge society

European Union announced the principles of knowledge economy by Lisbon strategy in 2000. The enlargement of this concept follows to the knowledge society. Latest visions in this area connect the green development with the knowledge society (Green Knowledge Society, 2009).

Main feature of knowledge society is free assessing to the global knowledge by every citizen, especially to the educational knowledge. On the way to knowledge freedom the purposeful collection and structuring of educational knowledge is necessary. Current situation in educational knowledge shows some local concentration signs of educational knowledge on the institutional level, partly on national level. Now it is time to the next step to the European education and knowledge society.

The future trends in education are oriented to the individuality, because it is the only way for opening of abilities of personality. In knowledge society teacher is mainly a mentor who shows to learner the way to acquire the knowledge. For that, the system of rich educational knowledge sources is needed.

Digital educational ecosystem

Ecosystem concept has so far been used mainly in the natural environment. Ecosystem is the derivative of the Greek *Oikos* – habitat. Recently, the concept of ecosystem is thriving to information society and related sciences.

In that perspective, the digital ecosystem is a network of knowledge and knowledge workers supported by integrated digital set of knowledge treasuries and technological infrastructure. Knowledge treasury is a collection of knowledge treasures. Knowledge treasure is a collected, stored and valued piece of knowledge.

The architecture of large digital ecosystem is hierarchical and distributed, this comprises a multi-faceted components. Inviolable properties of ecosystem are systematic and integration. Ecosystem means a common conceptual basis, functionality and integrity of the system as a whole. Ecosystem is the integration of all system components working together.

New digital ecosystems have the best features of information systems such as user-friendly, expressiveness and ease of use. The ecosystemic approach has a conceptual difference from management information systems – that is the centrality of human. The actors of ecosystem are not only as end-users, they are living and working in ecosystem. The actor of ecosystem is also the decisive designer of architecture of ecosystem.

The concept of the ecosystem modifies in various fields. Educational ecosystem is a network of learners and teachers supported by the e-learning systems and educational repositories. Digital Eu-

rope, on this base, is a high-level ecosystem, which is the composition of the health, education, business and other ecosystems. The digital educational common market is part of ecosystem where educational products are shared, delivered, exchanged and marketed. Researchers, educators and learners of all levels schools are users of e-learning services provided on the common market of the educational ecosystem.

Europe 2020 and Digital Agenda

Europe 2020 strategy set up the targets in Agenda for new skills and jobs. The aim is «...*the strategic framework for cooperation in education and training involving all stakeholders. This should notably result in the implementation of life-long learning principles (in cooperation with Member States, social partners, experts) including through flexible learning pathways between different education and training sectors and levels and by reinforcing the attractiveness of vocational education and training*».

Digital Agenda declares the lack of skills and enforces the activities: *«Make digital literacy and skills a priority of the "New skills for new jobs» Flagship»*.

Is the education a national problem in every member state? We all have the common part — knowledge. Knowledge is global; differences are in languages, teachers, and educational technologies. Therefore we need the joint actions by all European universities.

Ecosystems in Digital Europe

Labour ecosystem of Europe

The fundamentals of knowledge economy by Lisbon strategy are to invest in human capital as the main resource for social and economic wealth ware. Human capital is the result of investments in improving skills and knowledge of the labour force (World Bank, 2006).

The biggest problems in Europe are employment and labour market. The labour market remains structural unemployment - the conflict between the unsatisfied demands for qualified labour and qualification disability of unemployed. The existing labour market is unable to adequately respond to the economic volatility.

Educational ecosystem in digital Europe is embracing the all levels of schools, vocational training and employment. The aim is to establish the real life-long education and vocational training. Educa-

tional ecosystem is able for relevant adaptation and flexibility in common labour market. The adaptation of educational ecosystem to demands of rapidly changing and developing labour market means the fast re-education of labour force in educational ecosystem.

The European digital labour market connects employees and employers, and the digital e-market is an important part of professional education. E-learning is a large opportunity on the professional training for labour market. The content of digital knowledge system for labour market are digital e-learning modules for all possible occupations of the unemployed allowing any time and everywhere to learn marketable career. Purposeful development of a knowledge system for occupational training can provide benefits for knowledge-intensive disciplines, and thereby enhance the value of labour and his knowledge potential, reduce structural unemployment. A large invasion of information technology in Estonian vocational education demonstrates the effectiveness of such a strategy.

The digital job market is the digital part of the common digital market in Europe. The European Digital Agenda promotes the important position of digital literacy. Educational ecosystem contributes to social development and employees, as well to the digital society as a whole.

Educational ecosystem of Europe

E-education in today's Europe is developing with problems. E-learning has lost its positions in the European Union's development programs.

The strategic goal for European Union education would be to create an integrated Education Ecosystem. Architectural components in the European Education Ecosystem are:

● Actors of ecosystem: learners, teachers, educational organizations (schools, universities) and businesses, NGOs, national educational ecosystems.

● Functional parts of the ecosystem are e-learning systems networking teachers, students, and educational organizations.

● In infrastructure of ecosystem are information systems, networks, knowledge treasuries (digital libraries, repositories). Technological support structure is a coherent whole, where every participant has direct access to all the functional components of the system according to their rights.

● Education as a national ecosystem is managed by governmental organization responsible for

the operation of a single information system technology. European Education Ecosystem would be governed by special European IT enterprise − Education Management. It should be a very high professional level organisation.

● The digital education ecosystem is based on the professional e-training for labour market. Covering all disciplines nationwide e-learning system is freely available for everybody in this digital market. E-learning is integrated by the European Knowledge Treasury, where everybody has free access to all professional e-learning modules, e-textbooks, instructions for work processes, labour market regulations.

How to build the integrated ecosystems in Europe?

Main structural parts of the architecture of digital Europe are digital ecosystems and the digital common market. Ecosystems in the areas of social and economic activity are connected by digital markets form a coherent whole. Digital ecosystems in Europe intersect, overlap, and interact with the common digital market. The health and education ecosystems are administered by the states, and therefore actually performed under the eGovernment developments. The future of industrial and service ecosystems in digital Europe is fuzzy, and depends on general common market developments for the goods and services in Europe (The 2nd European Summit on the Future Internet). Considering the European development programs in 2011, greatest opportunities for convergence has the European transport sector, since it is essentially a highly integrated system.

Estonia has developed e-learning successfully at all levels of education. Estonian e-learning materials include free access to the Repository consisting thousands of units. A significant boost in recent years received a vocational e-training. At the same time, e-learning has not a dominant role in professional training and employment, significant values of collected knowledge are unused and sealed within Estonian educational area. Situation would be same in the other member states.

The European Education Ecosystem may be dominated on employment and education system in 2020. The project would be based on the European Union's strategy of developing the «Europe 2020», and its development in the Digital Agenda. The project may be set out as an education pilot project for European Union.

Universities in educational ecosystem

Knowledge management in universities

Looking at the universities as a knowledge organization, creating, saving and transferring their own and outsourced knowledge, knowledge management is their main organisational form.

A digital knowledge management system in university contains knowledge treasury, educational knowledge base and e-learning modules. Specified for entrepreneurship the university knowledge contains useful modules for business. Then one of the outputs of entrepreneurial knowledge of university is the Portal to business environment transferring educational knowledge to entrepreneurship.

The knowledge technology as a part of knowledge management in university is a set of procedures over knowledge objects aiming to create and develop interactive system connecting e-portfolios of teachers and learners and e-learning. Driving force for educational technology is a model network describing knowledge management system. Set of models covering educational knowledge modules are useful-friendly for creators and owners, teachers and students using knowledge. Educational knowledge technology operates on model networks, as a tool for creation, handling the development and sharing of knowledge modules.

Architecture of knowledge

The main structural components of digital knowledge system in university are knowledge treasury, educational knowledge base, e-learning and external modules. At the heart of system is knowledge treasury collecting all the knowledge from inside of university and also outsourced from environment. Content module is the elementary part of the knowledge − knowledge module.

Educational knowledge base extracts content modules from treasury for e-study. E-study course consists of study modules; a study module is either a copy of the content module or its modification. Educational knowledge base has the network structure with hierarchical internal structure; that structure is described by the architecture model.

We considered the architectural knowledge as knowledge about components of modular system and relations between them (Baldwin, 2010). Modularity as a property of complex system provides the opportunities for knowledge handling and modelling. Formalization of knowledge models is presented as

framework (Kess, 2008). The model of knowledge module is presented as a frame f = (k,d), where k is a frame of knowledge, d is a frame of data. Frame is an elementary part of the knowledge model. Knowledge model is network of frames, while modules are tied into the network by relation frames. On meta-level the knowledge model of treasury is described by architecture model.

Analysis. Procedures of analysis to design the educational knowledge base are:

- Structural analysis of the content of the subject materials in treasury
- Design of the respective model of proto-frames
- Compilation of content modules in knowledge base.

The outcome of the analysis will be the model of knowledge base, consisting of proto-frames of modules.

Synthesis. Knowledge base modules are the source for designing the e-study course. Procedures for creating the course are:

- Design the architecture model of course
- Selection of respective proto-frames and modifying them into ex-frames of study modules
- Composing the course model as a network of ex-frames for study modules
- Compilation the course of study modules.

Knowledge transfer from university

How to transfer knowledge from universities to enterprises? Direct way for transfer is from university knowledge treasury to the educational ecosystem. To have something for transfer, university should collect their knowledge in purposeful and useful form. Here the digital knowledge management system of university is required.

The first transfer track is from university through educational ecosystem to the labour education. Universities are suppliers for educational ecosystem, delivering professional educational modules to the knowledge market. Management of educational ecosystem bays the best learning modules and delivers them to enterprises, professional educators, training organisations of labour markets. There is the way to the European digital common knowledge market.

Entrepreneurial university is creator and collector of professional knowledge in all activities of entrepreneurship. For example, the design of learning course «European economy» in our Euroacademy shows the overall lack of knowledge about entrepreneurship and economy in Europe, including Estonian enterprises. Then the second way for knowledge transfer is Business Portal of university. On the input of Portal for business environment is Inverter as a selector and adaptor from knowledge treasury to business knowledge. As an implication of obtained results, we are developing a prototype of Business Portal transferring university knowledge to Estonian business.

Toward the European Network

The strategic aim for developing of European labour market would be to create the European Professional Education Network as an organisation for realisation of digital educational ecosystem model. Network provides full scale of education modules to labour including tools for re-skilling and sustainable professional development. Networked entrepreneurial universities are there as the main suppliers with labour education and enterprise knowledge. Network is a knowledge organisation owned and governed by member states. Network includes the European Knowledge Treasury, covers and integrates the national educational ecosystems and European universities.

Networking over educational systems of universities creates problems with intellectual properties. Then the knowledge exchange between creators and owners of knowledge leads to the common knowledge market, where Education Network provides technological and organisational platform for marketing.

Conclusions

We have discussed the knowledge management technologies in university especially useful for entrepreneurship. Knowledge of university is presented in structure, where knowledge treasury is main collector, providing e-learning systems by modules, and distributes selected knowledge useful in entrepreneurship. Architecture of knowledge is described as framework of knowledge modules, this model covers main technologies in knowledge management of university.

Rapid development of digital technologies in education, business and governance has created a need for more efficient use of global knowledge in Digital Europe. The concepts of digital ecosystems allow designing some future models like the digital education ecosystem connecting European universities. European Labour Network as a full-integrated system is unavoidable future in sustainable develop-

ment of labour, where entrepreneurial universities are creative actors. Business portals connect university knowledge to entrepreneurship through European Education Network.

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