CENEAST

Reformation of the Curricula on Built Environment in the Eastern Neighbouring Area

Market Need Analysis for Built Environment Higher Education (Summary Report)

April 2013

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Tempus

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1 Introduction

It has been observed that majority of the European citizens spend over 90% of their time within buildings and over 40% of the people who live in such closed spaces complain of their health and comfort. In the former Soviet Union built environment was mostly considered as the necessity of implementation of the construction at affordable costs. Generally, the interests of the tenants who occupy these buildings were not taken into consideration. Furthermore, the energetically and ecologically sustainable, affordable and healthy built environment policy was not considered essential by the Russian, Ukrainian and Byelorussian universities. As such energetically and ecologically sustainable, affordable and healthy built environment policy has not been incorporated in the curricula of BSc/specialists, MSc and PhD programmes for building and civil engineering students. In this context, one of the key problems faced by Russian, Ukrainian and Byelorussian universities are the lack of the high-level educational and research literature in energetically and ecologically sustainable, affordable and healthy built environment. Due to insufficient demand for the energetically and ecologically sustainable, affordable and healthy built environment in these countries, graduates lack the multidisciplinary character of knowledge in built environment, including technical, technological, organizational, management, social, environmental, economic, cultural, psychological, political and other aspects.

Further, insufficient communication between universities and labour market organizations has also been observed. In order to solve the above mentioned problems, the EU funded CENEAST (Reformation of the Curricula on Built Environment in the Eastern Neighbouring Area) research project aimed at upgrading the curricula on built environment in the universities of Belarus, Russia and Ukraine according to Bologna practices in order to increase their capacity to continually modernise, enhance the quality and relevance of education of the building and civil engineering students to the labour market needs and to ensure international cooperation. The project will achieve this aim in five objectives as detailed below.

- To upgrade curricula of BSc/specialists, MSc and PhD programmes with new modules on energetically and ecologically sustainable, affordable and healthy built environment in universities of Belarus, Russia and Ukraine in order to enhance the quality and relevance of education in PC universities to labour market needs;
- To transfer the Bologna practices in education (curriculum development, ECTS, innovative learning, etc.) from EU universities to PC universities;
- To develop a virtual interuniversity networked educational system (intelligent library, intelligent tutoring system, intelligent knowledge assessment system, access to the e-sources of the research and educational information) in order to ensure cooperation among the EU and PC universities in education and research;
- To assist the competence development of staff within the PC universities.
- To train at least 240 students during the pilot project.

As part of this project, this report intends to analyse the market needs of the built environment higher education. In doing so, the report will first provide an introduction to the built environment and highlight the evolving market needs while emphasising the need for energetically and ecologically sustainable, affordable and healthy built environment. To identify the evolving skill needs in the built environment market the “Vision for Civil Engineering in 2025” published by the American Society of Civil Engineers has been considered. It has been used as a guide to determine the skills a civil engineer will have to possess in 2025. The report then summarises the findings of an analysis conducted by various partner institutions on existing built environment related BSc/specialists, MSc and PhD programmes and identify modules promoting energetically and ecologically sustainable, affordable and healthy built environment. The report will propose a list of themes for BSc/specialists, MSc and PhD programmes to be implemented in the universities of Belarus, Russia and Ukraine. The findings were presented in 4 different contexts: global context; UK context; Italian context; and Russian, Belarusian and Ukraine context.

2 Evolving needs in the built environment market

2.1 Built environment

The built environment is an abstract concept used in some of the literature to describe the products of human building activity (Lawrence and Low, 1990). The built environment is created to fulfil human needs and therefore each component of the built environment emerges from human needs, thoughts, and actions (Bartuska, 2007). Some of the main components of the built environment are buildings, automobiles, roads, bridges, the landscaped areas, parks, and the surrounding city. Thus, it is understood that the built environment consists of products and processes of human creation. Bartuska (2007) has defined four interrelated characteristics of the built environment which help in understanding the nature of the built environment. Firstly, it is extensive and includes everything that humanly created, modified, or constructed, humanly made, arranged, or maintained. Secondly, it is intended to serve human needs, wants, and values. Thirdly, it assists in comfort and wellbeing of the human beings. Finally, each and all of the individual elements of the built environment contribute either positively or negatively to the overall quality of environments both built and natural and to human-environment relationships. The final characteristic indicated by Bartuska (2007) is considered extremely important as the built environment can contribute both positively and negatively to the overall quality of the built and natural environment. As such, proper design and planning is necessary in designing, construction, operation and maintenance of the built environment in order to reduce the potential risk to the natural environment.

2.2 Evolving needs in the built environment

The impact of the built environment on the wider environment has not received much thought until recently (Sexton, 2011). The built environment makes a significant impact to the environment throughout its life cycle. Given this situation, challenges for a quality and sustainable built environment have now been widely discussed as the society is becoming more and more aware of environmental issues. As such, sustainability in all aspects of life is rising on the agenda (Sexton, 2011). It has been identified that approximately 43% of the U.S. carbon dioxide (CO2) emissions are produced by the residential, commercial, and industrial buildings (Brown et al., 2005). According to Sexton (2011) in the United Kingdom, buildings are responsible for 45% of total carbon emissions. In addition 32% of all landfill waste comes from the construction and demolition of the built environment, and also households alone account for 58% of all public water consumption. Further, many of the houses in UK are old and energy inefficient while buildings, transport and other infrastructure have not been designed to meet the projected changes in climate. Given this situation many studies have been conducted on technologies and policies that promote efficient use of energy in buildings. The need has arisen for different sustainable built environments which require a radical change in the construction and property sectors (Sexton, 2011). As such it is important to focus on the effects of alternative urban designs; the potential for on-site power generation; and the lifecycle GHG emissions from building construction, materials, and equipment (Brown et al., 2005).

Transition to more sustainable built environment will require a radical change in various sectors such as energy, design, construction and property. In other words, it is a high multidisciplinary area of study which requires efforts from various industries. Thus, multiple stakeholders and decision-makers in the building industry and their interactions are required (Brown et al., 2005). It is not only the industries; the responsibility also lies with the end-user who can play an important role in reducing the energy consumption. Further, moving towards sustainable built environment will require massive investment. Also sustainable built environment is where the built environment has been designed and constructed to high environmental standards and thereby minimise energy requirements; reduce water consumption; use materials which are of low environmental impact, low embodied energy and resource efficient; reduce wastage; conserve and enhance the natural environment; and safeguard human health and wellbeing (http://www.towards-sustainability.co.uk). Affordability, aesthetics, and usefulness have

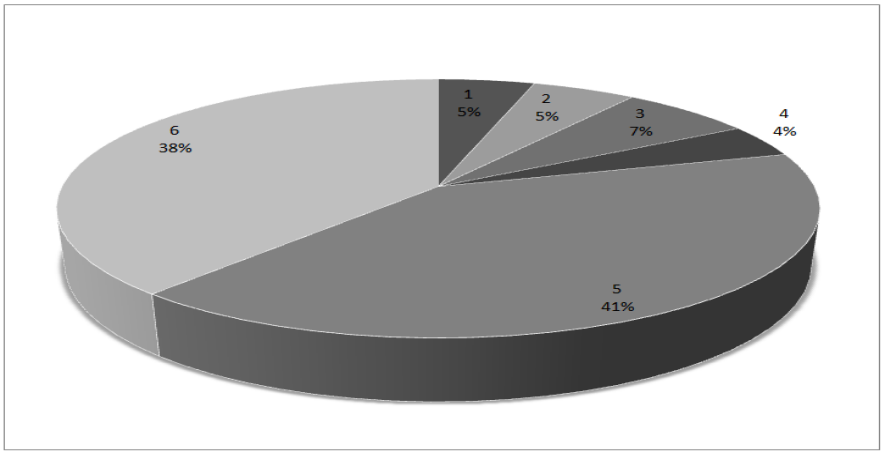
traditionally been major drivers of building construction, occupancy, and renovation (Brown et al., 2005). For example, when buying a house, value for money and location are considered as important parameters by majority of population when compared to sustainability (Sexton, 2011). As such, existing housing, buildings and infrastructure need to be upgraded to meet the wider concept of climate-friendly built environment. High fee structures in building design and engineering, electricity pricing practices, and the limited availability of climate-friendly technologies and products do affect the ability to bring GHG-reducing technologies into practice (Brown et al., 2005). Despite these challenges, numerous efforts have been taken to introduce sustainable practices into the industry. For example the UK has committed to reducing carbon emissions by 80% by 2050 (Climate Change Act, 2008).

Creating a low carbon built environment requires an in-depth understanding of energy consumption in buildings and its mitigation and adaptation through proper built environment design and management (Yao, 2011). All these sustainability efforts require extensive knowledge on climate-friendly technologies and products; knowledge on environmental standards and practices, use of low carbon materials and construction methods; sustainable design, construction and operation; reduction of embodied energy; resource efficiency; and efficient construction processes with minimal construction waste. Thus, it is important to equip built environment students with adequate knowledge and skills on sustainability practices in order to promote energetically and ecologically sustainable, affordable and healthy built environment. Traditionally, architecture, engineering and surveying have been identified as the main built environment disciplines (Muir and Rance, 1995). The built environment discipline has developed further in the recent years to encompass other professionals such as landscape architects, interior designers and town planners, engineers including service engineers, structural engineers and electrical engineers and also estate managers (Muir and Rance, 1995). It is therefore of paramount importance to include separate modules to promote energetically and ecologically sustainable, affordable and healthy built environment to BSc/specialists, MSc and PhD programmes. This will offer built environment students the opportunity to enhance their knowledge and skills through their university degree programmes. Together, these will help in shaping the sustainability agenda and providing industry with the right skills for achieving an energetically and ecologically sustainable, affordable and healthy built environment.

2.3 Built environment skill needs

To identify the evolving needs in the market of built environment and the need for energetically and ecologically sustainable, affordable and healthy built environment, the “Vision for Civil Engineering in 2025” published by the American Society of Civil Engineers has been considered. It has been used as a guide to determine the skills a civil engineer will have to possess in 2025. A detailed analysis was carried out taking into account the following statements:

1) **The graduates shall have sufficient knowledge and skills for the implementation of the following projects** (ASCE Curriculum …, 2007, ASCE Task …, 2007, Jha and Lynch, 2007, Lynch, et al. 2007)



1 - Investigation and definition of the issue, determination of limits set for external environment, balance, health, safety, risk of the Project

2 - Understanding of costumers' needs, importance of esthetical and other qualitative parameters

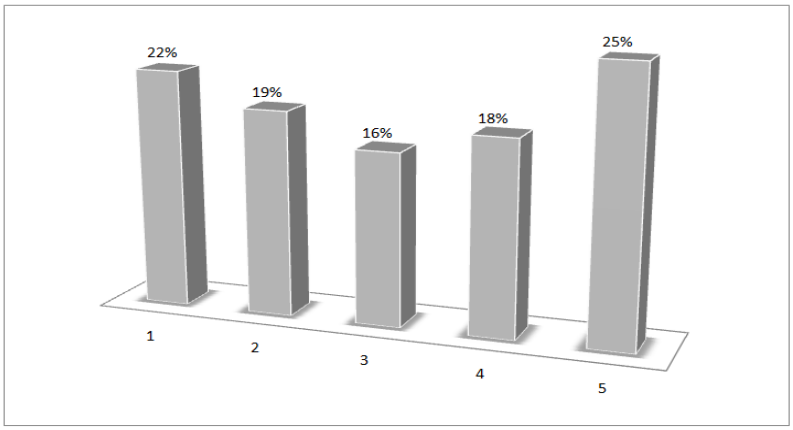
3 - Determination and management of costs and expenditures

4 - Creative determination of modern decisions

5 - Ensuring effective implementation of team goals within the whole life cycle of the project (production, management, supervision, disposal, etc.)

6 - Management of Project development process and assessment of the results gained

2) **The Graduates shall be able to assess economical, social and environmental context** (ASCE Curriculum …, 2007, ASCE Task …, 2007, Jha and Lynch, 2007, Lynch, et al. 2007)



1 - Understanding of commercial and economical context of engineering process

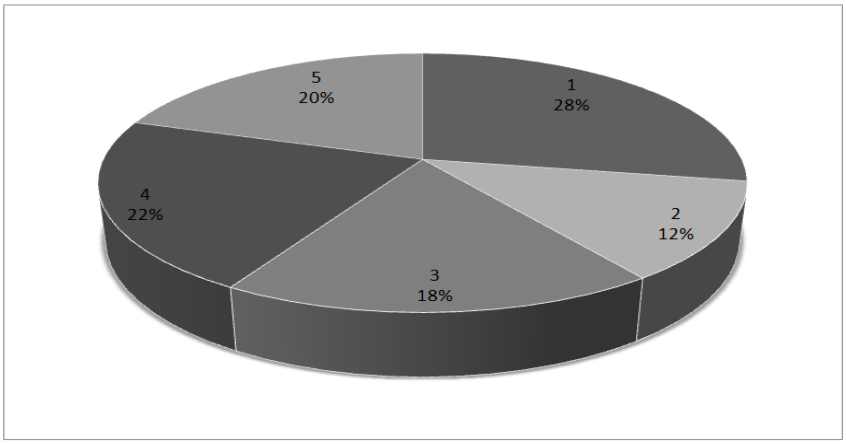
2 - Knowledge about management methods, in order to gain engineering goals within the particular context

3 - Understanding of the requirements set for engineering activity required in order to stimulate balanced development

4 - Understanding of legislative requirements, regulating engineering activity (regarding personnel, health and risks issues)

5 - Understanding of the importance of high level professional and ethical behaviour for civil engineering

3) The graduates shall have particular practical skills (ASCE Curriculum …, 2007, ASCE Task …, 2007, Jha and Lynch, 2007, Lynch, et al. 2007)



1 - Knowledge about precise materials, products, tools, processes, and technologies

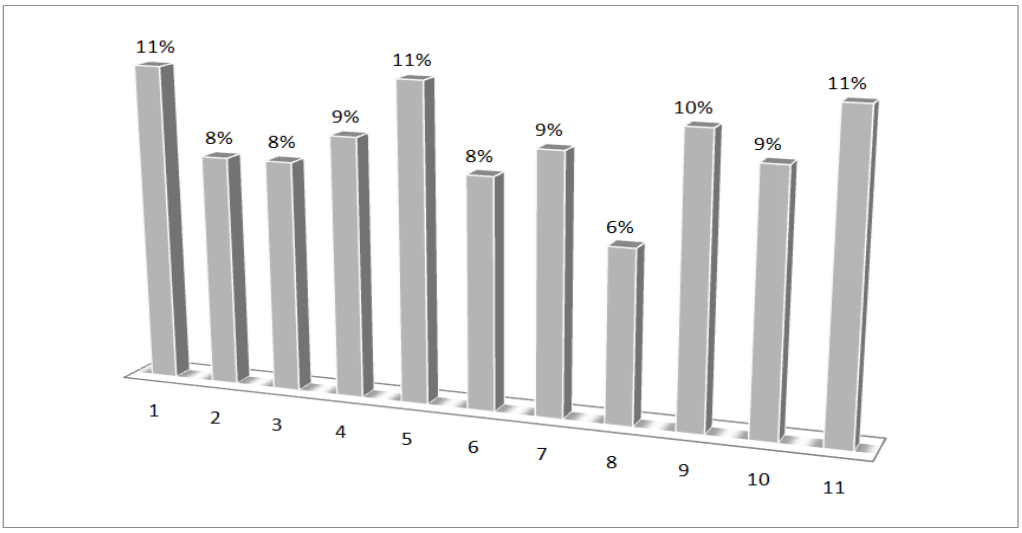
2 - Experience got from activities in laboratories or seminars

3 - Ability to apply knowledge about engineering (operations and management, development of technologies) for particular spheres

4 - Knowledge about effective application of technical literature or other information sources

5 - Understanding of legislative acts and industrial standards, regulating engineering activity

4) Engineering programmes shall train students in the following subjects (ASCE Curriculum …, 2007, ASCE Task …, 2007, Jha and Lynch, 2007, Lynch, et al. 2007)



1 - Ability to apply knowledge of mathematics, natural science and engineering

2 - Ability to design and execute experiments, analyze and interpret/explain obtained results

3 - Ability to design systems, components or processes in accordance with the results to achieve, in order to meet real economical, environmental, social, political, ethical, health and safety, production and stability limitations

4 - Ability to carry out interdisciplinary team work

5 - Ability to recognize, formulate and solve engineering issues

6 - Understand professional and ethical liability

7 - Ability to communicate effectively

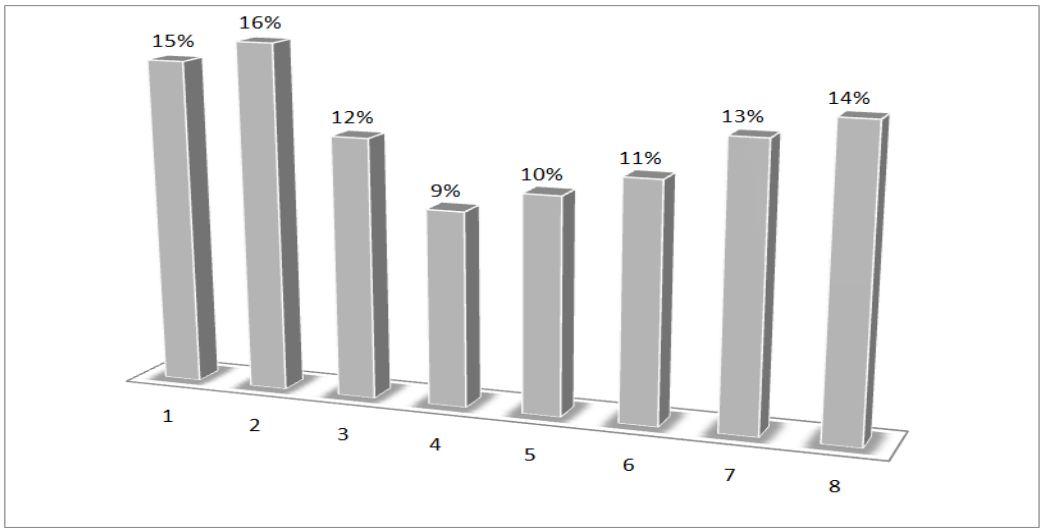
8 - Have wide education in order to understand the influence of engineering solutions within international, economical, natural and public context

9 - Wish and recognition of the importance of the education lasting the whole life

10 - Knowledge about modern problems

11 - Ability to apply modern engineering technique, technologies, skills for engineering practice

5) Engineering programmes shall train students for competent execution of research tasks (ASCE Curriculum …, 2007, ASCE Task …, 2007, Jha and Lynch, 2007, Lynch, et al. 2007)



1 - Reformulation of poorly formulated research tasks. Pays attention to limits of the system. Justifies new interpretations and alternatives for concerned parties

2 - Students shall be attentive and observant, creative and able to solve every day engineering issues in accordance with the requirements of the concerned parties

3 - Students shall be able to execute research researches under supervision

4 - Students shall be able to work at various abstraction levels

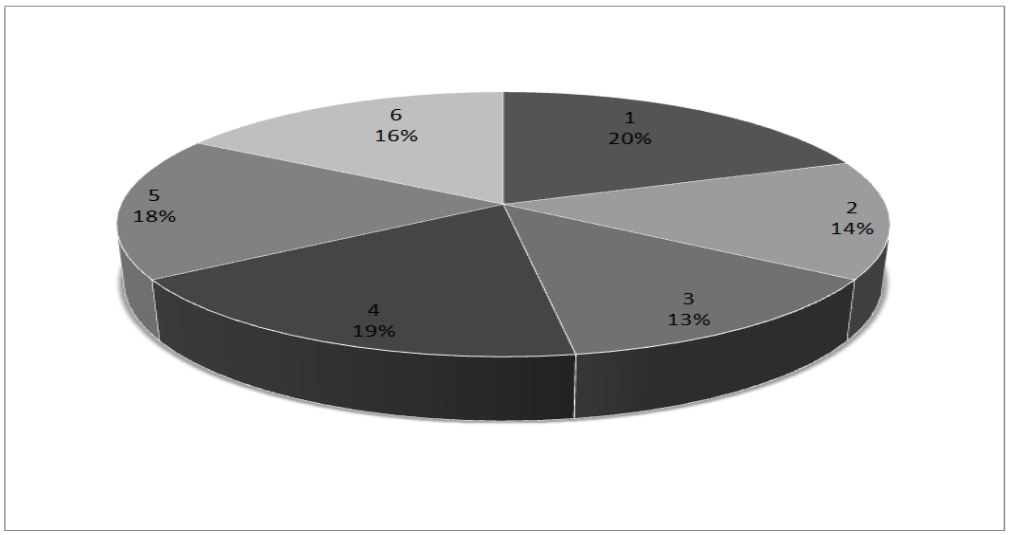
5 - Students shall understand the importance of interdisciplinary knowledge and knows how to apply it

6 - Students shall understand varying direction of research researches induced by external factors or improved understanding

7 - Students shall be able to evaluate the availability of particular research researches

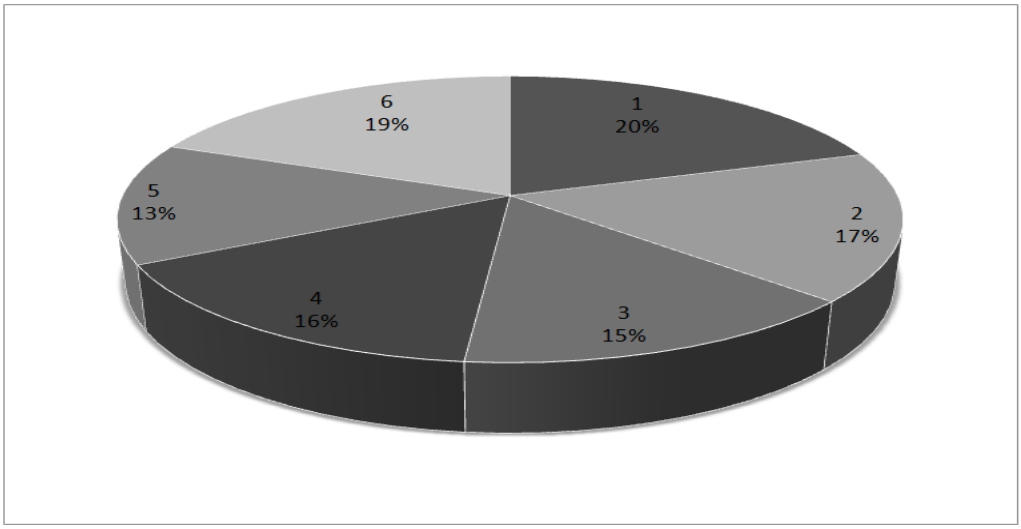
8 - Students shall be able to participate in the development of research knowledge of one or several related engineering spheres

6) **All students shall assimilate principles of research during studies** (ASCE Curriculum …, 2007, ASCE Task …, 2007, Jha and Lynch, 2007, Lynch, et al. 2007)



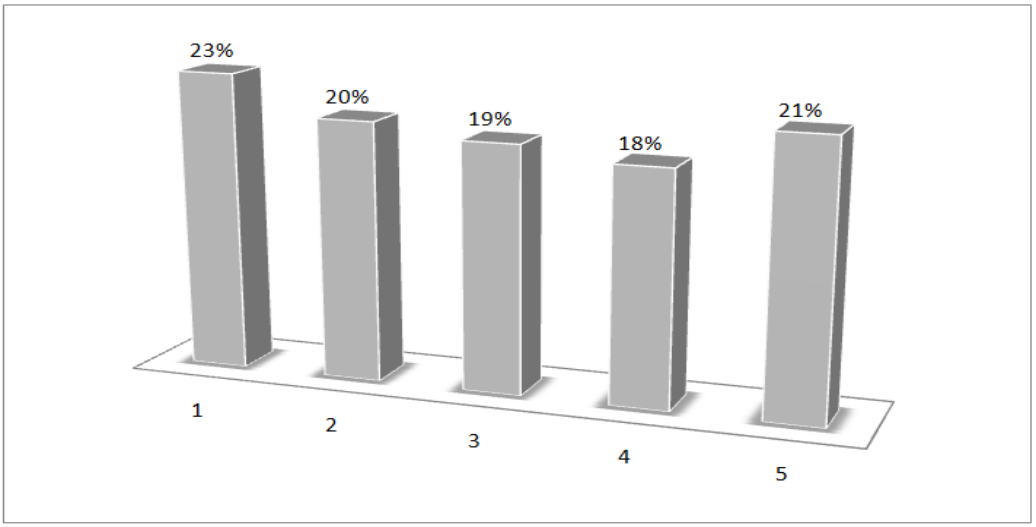
1	-	Students shall be curious and biased towards continuous study
2	-	Students shall solve tasks applying theories, models and interpretations of system approach
3	-	Students shall be able to apply practically different models
4	-	Students shall understand the basis of engineering science and technologies (essence, methods, differences and similarities of research spheres, nature of laws, theories, descriptions, objectivity, role of the experiment)
5	-	Students shall understand research practice (research systems, relations with clients, information systems, integration importance)
6	-	Students shall be able to document research and project results, take part in the development of engineering knowledge base

7) Students shall have the following general intellectual skills (ASCE Curriculum …, 2007, ASCE Task …, 2007, Jha and Lynch, 2007, Lynch, et al. 2007)



1	-	Students shall be able to evaluate own thinking, decision making and activity critically under supervision and change the above attitudes in accordance with the internal and external deviations of the activity
2	-	Students shall be able to think logically and answer questions „What if“ and „Why“ raised for own and related engineering spheres
3	-	Students shall know how to apply inductive, deductive, analogy methods for their activity
4	-	Students shall ask particular questions, shall have critical and constructive point of view for task analyzing and solving
5	-	Students shall be able to form reasonable point of view in case of uncompleted or indirect information
6	-	Students shall be able to take part in research discussions of related topic effectively

8) **Graduates shall have skills to be applied for other spheres** (ASCE Curriculum …, 2007, ASCE Task …, 2007, Jha and Lynch, 2007, Lynch, et al. 2007)



1	-	Students shall be able efficiently to work on their own or in team
2	-	Students shall be able to perform effective communication with engineering community and broad public with the help of different methods
3	-	Students shall know about: legal issues concerning health and safety, engineering practice liability; influence of the engineering solutions on public and environment; professional ethics, obligations of the engineering activity and standards
4	-	Students shall understand project management and business practice, including all limitations (for example, risk management and deviation management)
5	-	Students shall understand the importance of continuous studying and shall have the intention to do it all the life

For all responses, experience (38%) and communication skills (30%) rated as the most important skills needed by project managers. Companies with over $200M revenue placed a higher value on communication skills (46% vs. 26%) compared to smaller companies (<$200M). Overall, respondents rated financial management as the skill that new candidates lack most when entering the workforce (34%), then communication skills (28%), and experience (23%) with technical skills ranked only 14%. Larger companies more often said that communication skills were most lacking in new candidates (42%) with financial management skills the next concern on the list (35%). Larger organizations place a greater emphasis on communication skills than on financial management skills, or experience. This reflects the need to communicate with more people and departments in a larger company internally. Other resources available in larger companies fill the gap for lack of financial management skills, technical competency, and experience. Generally, the weakness in skills of new project management candidates reflects disconnect between universities and contractors. If contractors make it known that they are mostly concerned with technical skills, universities are more likely to turn out graduates strong in technical skills. Universities may respond by adding financial management and communications course materials to the curriculum; however, additional coursework adds time and expense to the attainment of a qualified degree. The alternative for most is to get the training once they enter the workforce through mentoring, on-the-job training, or third-party training programs. The most expensive of these choices is most often the on-the-job method, especially if it means the student has to make several costly errors before he or she learns the right way to go about it (FMI 2006).

According to the FMI Project Management Survey the top five weakest skill sets noted by all respondents were (FMI 2006):

- Cost to complete and profit projections (21% of responses).
- Time management (12%).
- Closeout skills (11%).
- Communication (written) (10%).
- Change order management (10%).

The top five strongest skill sets noted by all respondents were (FMI 2006):

- Client/customer relations (35%).
- Understanding the building process (27%).
- Change order management (8%).
- Cost to complete and profit projections (6%).
- Communication (written) (5%).

The good news when it comes to skill sets is that project managers are best at client/customer relation skills, and they understand the building process. These skills are in line with the two traits that contractors place the most emphasis on when hiring project managers—experience and communication skills. At the same time, communication skills and experience are among the top causes for concern for construction executives with their project managers. There is no single area that all project managers are weak or strong in, but most have sufficient building experience to understand the process. If the goal is to create project leaders, then project managers will need a well-rounded set of skills. It is typical that, over the course of a career, the project managers that become true project leaders increasingly focus on improving their "soft skills," which includes management and leadership skills (see Figure 1, FMI 2006).

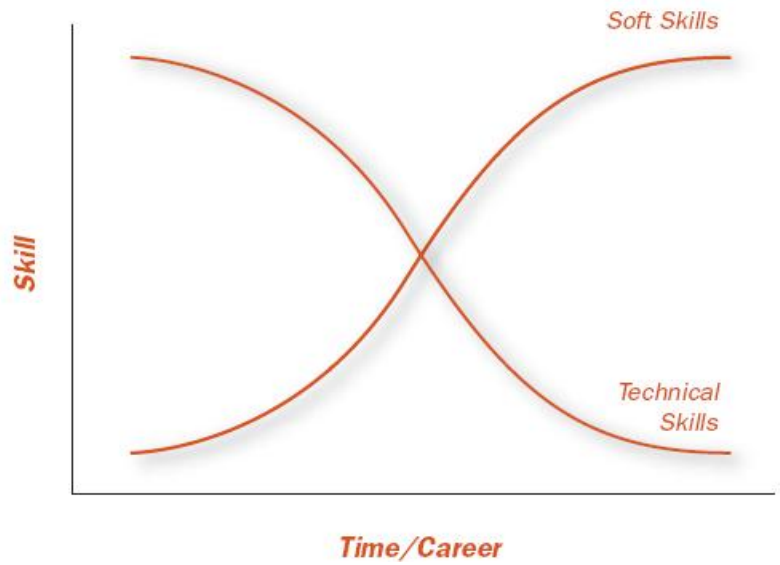


Figure 1: Project leader skills change over the course of a career (FMI 2006)

When we examine the ideal project leader model, it appears we are really thinking about three different people with three different skill sets. Companies look most often for project experience when evaluating new project managers, followed by communication skills. Technical skills are assumed for most project managers entering the job market, especially when the requirement is a four-year construction management degree. Little, if any, emphasis is placed on financial management skills, yet that is the area reported as lacking most often when new project managers enter the workforce. In the FMI Project Leader Model, possessing just one skill is not enough, nor is it enough to have skills in all three areas, if one is operating in a vacuum. To be most effective, the true project leader applies all of these skills collaboratively, and mission-critical processes are designed with this in mind (FMI 2006).

The companies reporting the highest rate of on time/on budget performance place the highest emphasis on communication skills, yet only about 16% of companies overall said that a four-year, non-technical degree was a minimum requirement. That degree likely would produce candidates stronger in the two areas that concern companies the most—communication skills and financial management. It is typical for a company in an industry as technical as the construction industry is to emphasize project experience for new candidates. Project mistakes can be dangerous and costly. It seems that, historically, the general belief has been that construction firm needs to hire experience and technical skills, and the other, softer, skills will be learned on the job. Often this approach has produced unsatisfactory results, especially if a firm hasn't identified their project management best practices and haven't reinforced the project manager as planner, communicator, and businessperson (FMI 2006).

Project management qualifications, experience and skills required in Wired Consulting are presented in Table 1.

Table 1: Project management qualifications, experience and skills required in Wired Consulting (Wired Consulting, 2010)

Role	Program Manager	Senior Project Manager	Project Manager	Junior Project Manager	Project Coordinator
Minimum Experience	10 years managing large complex projects	5 years experience as a Project Manager	3 years experience as a Project Manager	12+ months experience as a Project Manager	18 months experience working in a project team
Qualification	Practitioner level MSP/PMBOK / PRINCE2	PMBOK (PMP) / PRINCE2 Practitioner	In-depth knowledge of PMBOK / PRINCE2	Understanding of PMBOK / PRINCE2	Understanding of Project Management techniques
Responsibilities	Ability to manage a number of project plans and costs and their interdependencies on resources and schedules	Ability to create project plans and schedules, manage milestones, deadlines and budgets through to successful satisfaction of the customer	Ability to create project plans and schedules and then manage milestones, deadlines and budget through to successful satisfaction of the customer	Ability to create project plans, schedules manage milestones and deadlines. through to successful satisfaction of the customer	Provides administration and coordination to the project team
3rd Party Management	Strong Ability to manage 3rd parties to ensure deliverables are timely and on budget	Ability to manage 3rd parties to ensure deliverables are timely and on budget	Ability to manage 3rd parties to ensure deliverables are timely and on budget	Ability to co-ordinate 3rd parties to ensure tasks are delivered on time.	Supports the project team by applying the Management System to project tasks
Client Relationship	Sole accountability for the Program to the client managing the implementation interface to the telecoms supplier	Strong relationship building skills to ensure that the requirements understood within the capabilities of the provider	Good relationship building skills to enable smooth communication between the client and the supplier	Good relationship building skills to enable smooth communication between the client and the supplier	Supports project team through ensuring smooth communications across project team members
Financial Management	Overall Management of time & costs to ensure that the Program is delivered to scope and budget	Overall Management of time & costs to ensure that the Project is delivered to scope and budget	Management of time & costs to ensure that the Project is delivered to scope and budget	Co-ordination of time & costs to ensure that the Project is delivered to scope and budget	Sources financial information on behalf of the Project Manager and collates as required
Reporting	Timely and regular progress and Risk Management reporting	Timely and regular progress and Risk Management reporting	Timely and regular progress and Risk Management reporting	Timely and regular progress and Risk Management reporting	Responsible for collating and dissemination of progress and reporting
Attitude	Pro-active, "can do" attitude	Pro-active, "can do" attitude	Pro-active, "can do" attitude	Pro-active, "can do" attitude	Pro-active, "can do" attitude

In the global market, modern organizations face high levels of competition. In the wake of increasingly competitive world market the future survival of most companies, depends mostly on the dedication of their personnel to companies. Employee or personnel performances such as capability, knowledge, skill, and other abilities play an important role in the success of an organization. Competencies in organizations can be broadly classified as employee-level and organizational-level.

A core competency can take various forms, including technical/subject matter know-how, a reliable process and/or close relationships with customers and suppliers. Core competencies are the source of competitive advantage and enable the firm to introduce an array of new products and services. Core competencies lead to the development of core products.

Competencies could be very diverse. For example, Goleman (2010) has developed the following model of competencies:

- Personal competence: these competencies determine how we manage ourselves:
    - Self-awareness: knowing one's internal states, preferences, resources and intuitions.
    - Emotional self-awareness: recognising one's emotions and their effects.
    - Accurate self-assessment: knowing one's strengths and limits.
    - Self-confidence: a strong sense of one's self-worth and capabilities.
    - Self-management: managing one's internal states, impulses and resources.
    - Self-control: keeping disruptive emotions and impulses in check.
    - Trustworthiness: maintaining standards of honesty and integrity.
    - Conscientiousness: taking responsibility for personal performance.
    - Adaptability: flexibility in handling change.
    - Achievement-orientation: striving to improve or meeting a standard of excellence.
    - Initiative: readiness to act on opportunities.

- Social competence: these competencies determine how we handle relationships:
    - Social awareness: awareness of others' feelings, needs and concerns.
    - Empathy: sensing others' feelings and perspectives, and taking an active interest in their concerns.
    - Organisational awareness: reading a group's emotional currents and power relationships.
    - Service orientation: anticipating, recognising and meeting customers' needs.
    - Social skills: adeptness at inducing desirable responses in others.
    - Developing others: sensing others' developmental needs and bolstering their abilities.
    - Leadership: inspiring and guiding individuals and groups
    - Influence: wielding effective tactics for persuasion.
    - Communication: listening openly and sending convincing messages.
    - Change catalyst: initiating or managing change.
    - Conflict management: negotiating and resolving disagreements.
    - Building bonds: nurturing instrumental relationships.

- Teamwork and collaboration: working with others toward shared goals.
- Creating group synergy in pursuing collective goals.

Interpersonal skills may include leadership skills, verbal and non-verbal communication skills, decision making, dealing with emotions and stress, conflict management, trust building, negotiating, demonstrating sensitivity to diversity issues, and modelling desired behaviour. The application of interpersonal skills may be influenced by the phase of the project life-cycle.

The next section provides the findings of an analysis conducted by various partner institutions on existing built environment related BSc/specialists, MSc and PhD programmes and identify modules promoting energetically and ecologically sustainable, affordable and healthy built environment.

3 Analysis of existing BSc, MSc and PhD study programmes in promoting energetically and ecologically sustainable, affordable and healthy built environment

The findings were presented in 4 different contexts: global context; UK context; Italian context; and Russian, Belarusian and Ukraine context.

3.1 Global context

To identify what study programmes in energetically and ecologically sustainable, affordable and healthy built environment are available at universities around the globe, we turned to an online analysis of the existing BSc, MSc and PhD study programmes promoting this kind of built environment. The analysis involved looking around the globe for any universities that offered corresponding study programmes related to energetically and ecologically sustainable, affordable and healthy built environment. In the analysis, the programmes were grouped by the cycles of higher education, which were BSc, MSc and PhD. Study programmes that cover topics similar to those mentioned above have been found in a number of universities around the globe. The universities are listed in Table 2.

Table 2: The universities that offer study programmes promoting energetically and ecologically sustainable, affordable and healthy built environment

No.	University	Country	Programme title (Qualification)
1.	Birmingham City university	UK	Planning, Environment and Development (BSc) Environmental Sustainability (PgCert/PgDip /MSc) Environmental Sustainability (Design and Construction) (PgCert/PgDip /MSc)
2.	University of Central Lancashire	UK	Sustainable Energy Management (BSc) Building Services (MSc) Urban Environmental Management (MSc)
3.	Sheffield Hallam University	UK	Built Environment (BSc) Building surveying (MSc)

4.	The Hong Kong University of Science & Technology	PRC	Environmental Management and Technology (BSc)
5.	Plymouth University	UK	Environmental Construction Surveying (BSc) Building Surveying and the Environment (BSc) Environmental Consultancy (MSc) Learning for Sustainability (MSc)
6.	Stony Brook University	USA	Environmental Design, Policy and Planning (BSc)
7.	Kingston University London	UK	Sustainable Development (BSc (Hons)) Sustainability for Built Environment Practice (PgCert/PgDip/MSc/MA)
8.	Northumbria University	UK	Sustainable Development in the Built Environment (MSc)
9.	London's Global University	UK	Facility & Environment Management (Singapore) (MSc)
10.	Nelson Mandela Metropolitan University	ZA	Built Environment (MSc / PGD)
11.	The University of Nottingham	UK	Sustainable Energy and Entrepreneurship (MSc)
12.	University of Brighton	UK	Construction Management (MSc/PGCert/PGDip) Facilities Management (MSc/PGCert/PGDip) Project Management for Construction (MSc/PGCert/PGDip) Environmental Assessment and Management (MSc/PGCert/PGDip) Sustainability of the Built Environment (MSc/PGCert/PGDip) Town Planning MSc (PGCert/PGDip)
13.	University of Dundee	UK	Advanced Sustainability of the Built Environment (MSc/PGDip)
14.	University of Washington	US	The Built Environment (PhD)
15.	Clemson university	US	Planning, Design and the Built Environment (PhD)

Next, the study programmes promoting energetically and ecologically sustainable, affordable and healthy built environment (and their modules) available at the universities listed above are outlined, all grouped by the cycle of higher education.

A statistical analysis was carried out to identify which modules were the most common in the existing BSc, MSc and PhD study programmes promoting energetically and ecologically sustainable, affordable and healthy built environment. The keywords related to energetically and ecologically sustainable, affordable and healthy built environment and most common in the modules were picked out and their

frequency rate determined. Figure 2 shows the most common keywords found in the existing BSc study programmes offered by universities around the world.

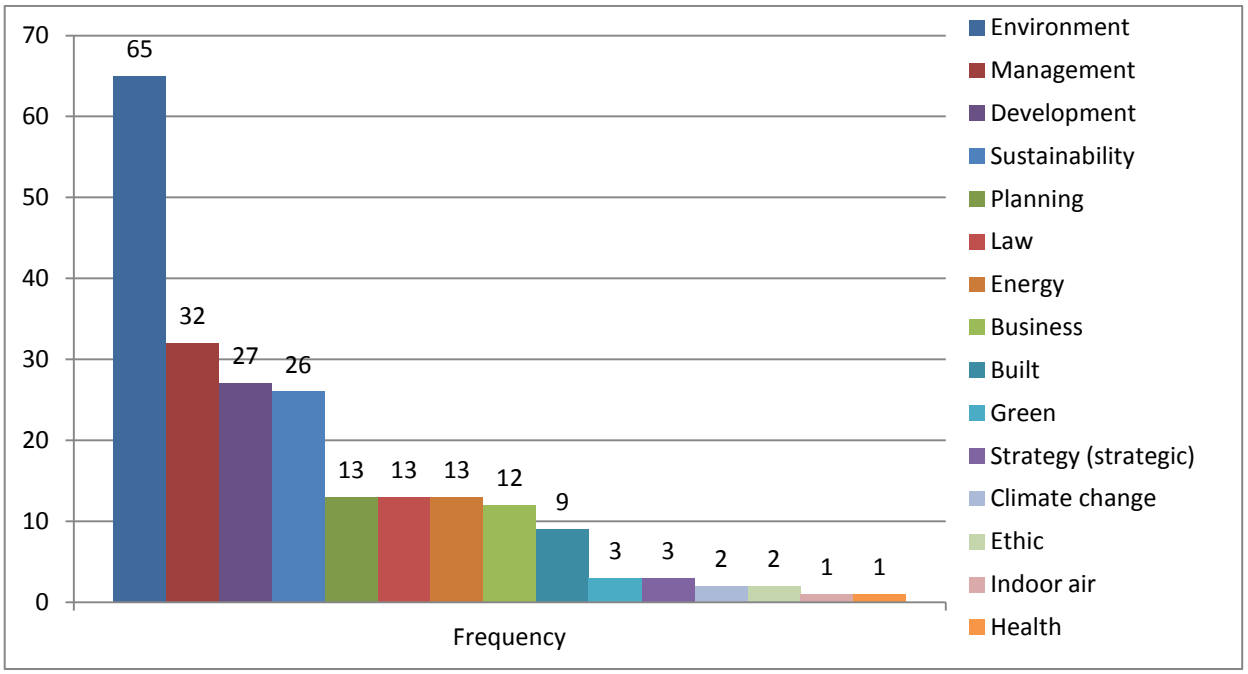


Figure 2: The most common keywords related to energetically and ecologically sustainable, affordable and healthy built environment in BSc study programmes offered by universities around the world

Figure 2 shows that the BSc study programmes in question offered by universities around the world most often comprised modules with such keywords as “environment”, “management”, “development”, “sustainability”, “planning” and “law”. Figure 2 also shows that “Environment” was the most common word in the said study programmes with 65 instances. All other keywords were less common: “management” appeared 32 times, “development” 27 times, “sustainability” 26 times, “planning” 13 times, “law” 13 times, “energy” 13 times, and “business” 12 times. The least common keywords were “climate change”, “ethic”, “indoor air” and “health”. Thus, environmental modules prevailed in BSc study programmes.

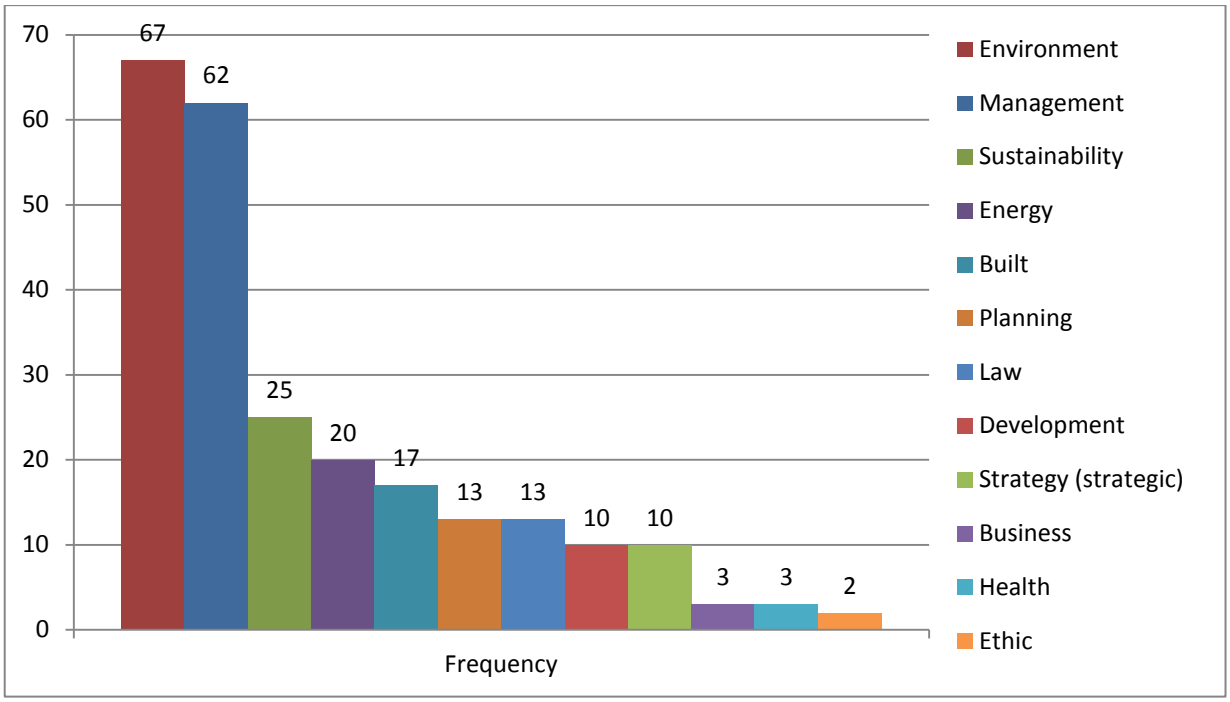


Figure 3: The most common keywords related to energetically and ecologically sustainable, affordable and healthy built environment in MSc study programmes offered by universities around the world

Figure 3 shows the keywords most common in the MSc study programmes. In contrast to the BSc cycle programmes, environmental modules did not dominate alone, with more modules on management, as shown in Figure 3: "environment" appeared 67 times and "management" as many as 62 times. "Sustainability" and "energy" were slightly less common, with 25 and 20 instances respectively. The least common keywords were "Business" and "Health" with 3 instances each, while "Ethic" appeared only twice throughout all MSc study programmes.

Finally, to determine the number of books available for each module related to energetically and ecologically sustainable, affordable and healthy built environment, the books listed on Amazon.com were analysed. The website was scanned for books related to the BSc, MSc, PhD modules suggested in the Project Proposal. The analysis revealed that the books covering the topic "Geographical information systems" made the largest pool with 10,270 titles. The numbers of books covering other topics were slightly lower: "Introduction to sociological methods" came second with 706 titles and "Introduction to renewable energy" came third with 412 titles. The numbers of books covering other topics varied between 10–200 titles. The modules "Micro and small business in local sustainable development" and "Planning, investment and development of built environment" come last with only one title for each.

Existing BSc, MSc and PhD study programmes promoting energetically and ecologically sustainable, affordable and healthy built environment were then analysed based on available literature. According to the findings the themes for BSc, MSc and PhD modules were recommended.

3.1.1 Recommended themes for Bsc/specialists modules

- Introduction to sustainable built environment (Loftness and Haase, 2013, Graham, 2003, Stefanovic and Scharper 2011);
- Planning, investment and development of built environment (Howes and Robinson, 2005)
- Advanced construction technologies for energy efficient buildings (Kruger and Seville, 2012, Chiras, 2000, Jayamaha, 2006)

- Project management in construction and construction site management (Mincks and Johnston, 2010, Ritz, 1993)
- Energy audit for buildings (Al-Shemmeri, 2011, Thollander and Palm 2012, Dall'O', 2013)
- Energy efficiency in engineering systems (Kanoglu, et al. 2012, Harris, 2011, Stepanov, 2011)
- Sustainable renovation of houses (Gelfand, and Duncan, 2011, Lubeck, 2010)
- Introduction to renewable energy (Nelson, 2011, Boyle, 2004)
- Construction materials for sustainable built environment (Spence and Kultermann, 2010)
- Geographical Information Systems (GIS) (Heywood, et al. 2012, Longley, et al. 2010, DeMers, 2008, Jensen and Jensen, 2012)
- Building Information Modelling (BIM) (Crotty, 2011, Smith and Tardif, 2009, Eastman, et al. 2011)
- Buildings in Use and Housing Management (Nieboer, et al. 2012, Rosahn and Goldfeld, 2012)
- Introduction to Environmental Quality, Human Health and the Built Environment (Frank et al, 2003)
- Affordable Built Environment (Koones, 2010)
- The Ecology of the Built Environment (Graham, 2002, Loftness and Haase 2013)
- Introduction to sociological methods (Denzin, 2009, Hughes and Sharrock 2007, Punch, 2005)

3.1.2 Recommended themes for Msc modules

- Life cycle of the sustainable built environment (Crawford, 2011)
- Place-making and urban design (Dannenberg, et al. 2011, Carmona, et al. 2010)
- Introduction to renewable energy (Nelson, 2011, Boyle, 2004)
- Construction materials for sustainable built environment (Spence and Kultermann, 2010)
- Geographical Information Systems (GIS) (Heywood, et al. 2012, Longley, et al. 2010, DeMers, 2008, Jensen, and Jensen, 2012)
- Building Information Modelling (BIM) (Crotty, 2011, Smith and Tardif, 2009, Eastman, et al. 2011)
- Buildings in Use and Housing management (Nieboer, et al. 2012, Rosahn and Goldfeld, 2012)
- Introduction to Environmental Quality, Human Health and the Built Environment (Frank et al, 2003)
- Affordable Built Environment (Koones, 2010)
- The Ecology of the Built Environment (Graham, 2002, Loftness and Haase 2013)
- Introduction to sociological methods (Denzin, 2009, Hughes and Sharrock 2007, Punch, 2005)
- Climate, architecture and energy saving (Watson and Labs, 1993)
- Energy efficiency in built environment (Nieboer et al, 2012)
- Renewable energy applicable in construction and operation of buildings and structures (Trubiano, 2012)
- Passive buildings and Sun City (Allen, 2012, Chiras, 2002)
- Construction of energy efficient structures in civil engineering (Watso and Labs 1993)
- Sustainable renovation of the built and human environment (Gelfand, and Duncan, 2011, Lubeck, 2010)
- Real estate development following the principles of sustainability (Miles, et al. 2007, Balmori and Benoit, 2007, Keeping and Shiers, 2004)
- Project and people management in the built environment (Senaratne and Sexton, 2011)
- Strategic facilities management (Booty, 2009, Atkin and Brooks, 2009)
- Facilities management excellence (Booty, 2009, Atkin and Brooks, 2009)
- Cultural side of economic sustainable development (Asefa, 2005, Goldin and Winters, 1995)
- Micro and small business in local sustainable development (Rogers, et al. 2007)

- The agencies of territorial and sustainable development governance (Sedlacko and Marinuzzi, 2012, Voss, et al. 2006)
- The initiatives for the local development with a bottom – up approach (Pike, et al. 2010, 2006)
- Network analysis for local systems
- Sociological methods used for sustainable urban development (Denzin, 2009, Hughes and Sharrock 2007, Punch, 2005)
- Indoor environmental quality and human health (Gammage and Berven, 1996)
- Technogenic problems in 21st century

3.1.3 Recommended themes for PhD modules

- Sustainable design theory (DeKay, 2011, Walker, 2006, Palazzo and Steiner, 2011)
- Innovations in sustainable built environment (Newton, et al. 2009)
- Intelligent cities and smart built environment (Deakin and Al Waer, 2012)
- Intelligent and biometric systems
- E-Networking in the sustainable built environment.

3.2 UK context

In analysing existing built environment related BSc/specialists, MSc and PhD programmes, the universities across United Kingdom have been taken into consideration. Methodology adopted within this section has taken the form of an extensive web search. With the increase in demand for built environment higher education, the number of built environment related courses have increased, and more and more institutions have started offering courses in this field. As such "University League Table 2013" has been taken as a basis to identify the top most universities offering built environment courses. "University League Table" assesses the performance of UK universities in nine quality factors. In identifying the universities, 'building', 'architecture', 'civil engineering', 'land and property management' and 'town and country planning and landscape' areas were taken into consideration. Accordingly the following universities have been identified for the study.

1. University of Bristol
2. University of Bath
3. Cardiff University
4. University of Cambridge
5. The University of Edinburgh
6. University of Glasgow
7. Imperial College London
8. Loughborough University
9. University of Liverpool
10. The University of Nottingham
11. Newcastle University
12. Oxford Brookes University
13. University of Reading
14. The University of Salford
15. The University of Sheffield
16. University of Southampton
17. University College London
18. University of the West of England, Bristol

The second stage was to identify modules of BSc/specialists, MSc and PhD programmes promoting energetically and ecologically sustainable, affordable and healthy built environment. Based on the available data on each and every university's web site 3 tables have been created for BSc/specialists,

MSc and PhD programmes. The structure of the table consists of 3 main columns, namely, the institution, under which the programmes are being offered, Programme title and qualification obtainable with the successful completion of the programme, and modules which promotes energetically and ecologically sustainable, affordable and healthy built environment. Finally the data in the tables were analysed to propose a list of themes for BSc/specialists, MSc and PhD programmes to be implemented in the universities of Belarus, Russia and Ukraine.

The proposed modules for BSc/specialists, MSc and PhD programmes are given below.

3.2.1 Recommended themes for Bsc/specialists modules

Table 3: Recommended themes for Bsc/ specialist modules

No	Module title	The programmes under which the module could be implemented
1	Sustainable Design/Low Energy Architectural Design	Architecture/ Civil engineering
2	Sustainable Construction	Architecture/ Civil engineering/ Construction management/ surveying/ Planning
3	Engineering Ethics and Sustainability	Civil engineering
4	Sustainability & Urban Design	Architecture/ Planning
5	Infrastructure Management and Sustainability	Civil engineering/ Planning
6	Sustainable Water Resource Management	Civil engineering
7	Introduction to Urban Regeneration	Architecture/ Planning
8	Ecology and Conservation/ Biodiversity and Conservation	Architecture/ Landscape/ Planning
9	Natural Hazards and Environmental Fluid Mechanics	Architecture/ Civil engineering
10	Disaster Risk Reduction, Resilience & the Built Environment	Architecture/ Civil engineering/ Construction management/ Planning
11	Modelling of Floods/ Flood Risk Management / Urban Flooding and Drainage	Civil engineering/ Construction management/ Planning
12	Earthquake Engineering	Civil engineering
13	Climate Technology Management	Architecture/ Civil engineering/ Construction management/ Planning
14	Climate Change: Earth System, Future Scenarios and Threats	Architecture/ Civil engineering/ Construction management/ Planning
15	Environmental Sustainability/ Environmental Decision Making	Architecture/ Civil engineering/ Construction management/ Planning/ Real Estate

No	Module title	The programmes under which the module could be implemented
16	Environmental Building Modelling and Building Performance	Architecture/ Civil engineering/ Real Estate
17	Environmental Assessment of the Built Environment	Architecture/ Civil engineering/ Construction management/ Planning/ Real Estate
18	Applied GIS and Modelling	Architecture/ Civil engineering/ Planning
19	Performance of Construction Materials/ Sustainable Materials and Recycling/ Natural Building Materials	Architecture/ Civil engineering/ Construction management/ Surveying
20	Introduction to Renewable Energy/ Renewable Energy Design	Architecture/ Civil engineering/ Construction management/ Real Estate
21	Energy Efficient Systems/ Alternative Energy Systems/ Energy, Sustainability and the Environment	Architecture/ Civil engineering/ Construction management
22	Energy and Waste/ Waste Management and Recycling	Architecture/ Civil engineering/ Construction management

3.2.2 Themes for Msc modules

Table 4: Recommended themes for MSc modules

No	Module title	The programmes under which the module could be implemented
1	BIM, Energy Efficiency and Sustainability	Architecture/ Civil engineering/ Construction management/ Planning/ Surveying
2	Sustainable Design Theory and Practice	Architecture/ Civil engineering/ Construction management/ Planning/ Survying
3	Lean Integrated Design and Production	Architecture/ Civil engineering/ Construction management/ Planning/ Survying
4	Technology and Green Construction	Civil engineering/ Construction management
5	Urban and Regional Regeneration/ Urban sustainability (Eco-city)	Architecture/ Civil engineering/ Construction management/ Planning
6	Sustainable Development/Sustainable Housing and Community Development	Architecture/ Civil engineering/ Construction management
7	Principles of Environmental Assessment and Management	Architecture/ Civil engineering / Planning/ Construction management
8	EU Environmental Law/ Policies for Sustainability and Development	Architecture/ Civil engineering / Planning/ Construction management

No	Module title	The programmes under which the module could be implemented
9	Spatial Planning in Action	Architecture/ Civil engineering/ Planning
10	Building Physics and Thermal Comfort / Health and Comfort in Buildings	Architecture/ Civil engineering/ Real Estate
11	Advanced Thermal Modelling/ Advanced Airflow Modelling/ Advanced Lighting Modelling	Architecture /Civil engineering
12	Building Solar Design	Architecture /Civil engineering
13	Post-occupancy Building Evaluation	Architecture/ Civil engineering/ Real Estate
14	Climate Change, Adaptation and Mitigation	Architecture/ Civil engineering/ Construction management/ Planning/ Real Estate
15	Major Hazards Management/ Disaster Risk Reduction in Cities	Architecture/ Civil engineering/ Construction management/ Planning
16	Earthquake Engineering and Structural Dynamics/ Seismic Resistant Design	Civil engineering
17	Energy and the Environment/ Energy in buildings/Sustainable Energy	Architecture/ Civil engineering/ Construction management/ Planning/ Real Estate
18	Renewable Energy and Low Carbon Technologies	Architecture/ Civil engineering/ Construction management/ Planning/ Real Estate
19	Materials for Durable and Sustainable Construction/ Natural building materials/ Sustainable construction materials	Architecture/ Civil engineering/ Construction management/ Surveying
20	Transport Planning for Sustainable Development	Civil engineering

3.2.3 Themes for PhD modules

Table 5: Recommended themes for PhD modules

No	Research area
1	Sustainable real estate
2	Sustainable building design, construction and maintenance
3	Climate change and sustainable construction
4	Planning and climate change
5	Urban futures and scenario-based studies
6	Carbon foot printing and waste management

7	Whole-life cost and value modelling
8	Emerging technologies and innovations for sustainable buildings
9	Energy assessment of buildings, both new build and refurbishment
10	Carbon foot-printing and carbon mapping of buildings, both new build and refurbishment
11	Post-occupancy evaluation of buildings
12	Sustainable use of construction materials
13	Disaster risk management/ Shelter after disaster
14	Environmental impact assessment
15	Integration of renewable technologies into buildings
16	Innovative construction technologies
17	Cities and technology
18	Seismic design and analysis
19	Resilience of complex infrastructure networks

3.3 Italian context

Almost till now the Built Environment subject, in BSc Specialists MSc and PHD programmes is not diffused and particularly structured in Italian Universities. As the restructuring of the University of Bologna is still in progress we maintain the previous framework based on Faculties to explain the situation.

Table 6: The University of Bologna structure

	School of Engineering >>>	**and Architecture**	**School of of Economics, Management and Statistics**	**School of Informatio n Sciences**	**School of Biology**
Bsc	Engineering for Environment and Territory (150 Ects)				
Msc	International Master Course in Civil Engineering (120 ECTS)	Health and Environmental Engineering (Course 6th Credits)			
PHD					
1st Lev.P.Master			Master in City		

			Management		
2nd Lev.P.Master					
Interdepartmental					Inter departmental Research Center on Environmental Sciences.

The most similar to Built Environment teaching could be detected in Laboratory or Research Centers that, having more autonomy in the University Structure and in the Recruitment of Teachers and External Experts, could be more near and attentive to needs of market as it concerns Professionals and Competencies.

The Laboratory for Research on the City mainly focuses on:

- Transformations of the contemporary city from an interdisciplinary point of view.
- Improvement of the quality of urban life and works toward sustainable development in cities.
- Critical analyses of some of the world's metropolitan situations and examines their modes of evolution through history.
- The sociological and judicial aspects of the various phenomena of immigration that are producing new scenarios of aggregation and participation.
- Identify the best practices within and across various areas such as that of urban planning, communities, institutions.
- Analyse the historical city and of the "post metropolis".

Market demand of competencies:

One of main issues is concerning the effective presence of 'new urban policies' are placed on the political agendas of local governments – the main customers and users of competencies in this field - and how they contribute to the transformation of the urban government system and to the implementation of urban governance. Another topic is concerning the relationships holding between integrated policies of urban development and systems of urban regulation and governance. This is the basis of the co-operation among the various agents at work in the city and, symmetrically, on the multi disciplinary approach to studies and in the competencies requested.

3.4 Russian, Belarus and Ukraine context

Analysis of the Market of building environment confirms the growing demand for professionals (Bachelors, Masters, PhD) in the planning, production fields and provision of urban areas.

Training and retraining of specialists in these areas should be done comprehensively and structurally. Training specialists should be done in a number of disciplines, including: the city's economy; territorial development planning, land use management and site development management; architectural design of building areas, designing and exploiting of energy systems of cities and energy communications; energy management, security and urban ecology; transport systems; socio-economic policy of urban development, including housing policy and housing economy and others.

The analysis of existing Bachelor's, Master's and Ph.D. programs in these areas shows the necessity to start immediately the training and retraining of specialists in these areas.

Main directions of training and retraining specialists in the field of building environment market are proposed by the partners of the project.

4 Conclusions

The report has been prepared as part of a EU funded CENEAST (Reformation of the Curricula on Built Environment in the Eastern Neighbouring Area) research project aimed at upgrading the curricula on built environment in the universities of Belarus, Russia and Ukraine according to Bologna practices in order to increase their capacity to continually modernise, enhance the quality and relevance of education of the building and civil engineering students to the labour market needs and to ensure international cooperation. The report seeks to identify a list of modules promoting energetically and ecologically sustainable, affordable and healthy built environment for BSc/specialists, MSc and PhD programmes. Report summarises the findings of 4 reports prepared by project partners, on global context; UK context; Italian context; and Russian, Belarus and Ukraine context. Based on the needs of built environment market and analysis of BSc/specialists, MSc and PhD programmes conducted within various universities a list of themes have been recommended to implement at universities of Belarus, Russia and Ukraine. Some of the common themes identified are:

- Energy efficient systems/ energy management
- Urban planning and development
- Land use management/ Applied GIS and Modelling
- Sustainable design and development
- BIM (Building information modelling)
- Renewable energy applicable in construction and operation of buildings and structures
- Sustainable construction materials

However, a detailed study need to be carried out on these universities' existing programmes and modules, academic capacity, resource availability and any incompatibility issues before implementing these modules within the existing course structures.

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