



Erasmus+ CBHE Project:  
CREATING THE NETWORK OF KNOWLEDGE LABS  
FOR SUSTAINABLE AND RESILIENT ENVIRONMENTS  
561675-EEP-1-2015-1-XK-EPPKA2-CBHE-JP

WB Institution: UNIVERSITY OF BELGRADE – FACULTY OF ARCHITECTURE

Date: .....

## **Study on the needs, constrains and possibilities for the development of postgraduate study programme *Sustainable and resilient environments***

### **Summary:**

*The study presented in this document falls within the scope of the **Work Package 1.2: Analysis of needs, constrains and possibilities for curricula development**. It includes:*

- *General introduction with explained common need for study programmes (extract from the application),*
- *Analysis of national regulations in terms of higher education and the level concerned, and comparison with the application proposal,*
- *National state in the fields Sustainability and Resilience: regulations, practice, existing study programmes; gap detection; comparison with the application proposal,*
- *Consideration of national qualification framework and comparison with the European standards in higher education,*
- *Institutional capacities in terms of development of study programme (institution description, staff capacity, equipment, space (premises), relevant knowledge base at lower levels of education - bachelor and master studies, existing teaching methodology, virtual mobility practice, etc.),*
- *Educational material in national language about Sustainable and Resilient Environments - availability, scope, subjects, etc.,*
- *Results of the survey done among students and working professionals (presentation of the survey sample, number of questioned persons and interpretation of results. The survey includes assessment of the knowledge about Sustainability and Resilience, critical issues recognition, actual practice review, etc.),*

- **Conclusions with accented direction and conditions for curriculum development and foreseen contribution to the fields Sustainability and Resilience**, and
- *any other issues that individual WB partners find as relevant for further work within the scope of Work Package 2.*

*The aim of the study is to set objective base for curricula development.*

## 1. General introduction

The original idea for the project titled CREATING THE NETWORK OF KNOWLEDGE LABS FOR SUSTAINABLE AND RESILIENT ENVIRONMENTS (acronym KLABS) was born from educational and research activities and related awareness about the complex existing conditions. Project formula is research-oriented, meaning that the methodology for its development is based on realistic problem definition or, in another words, need for the project.

Indeed, the included region, that is Western Balkan, today is faced with significant challenges in the fields of sustainable development and adaptation to climate change; these challenges are visible in both urban and rural built environments, where the second are often undeservedly more underestimated.

Sustainability and resilience are two separate, but strongly interrelated concepts. The development process and its main credo by which the needs of present generation must be met in a way which will not compromise the ability of future generations to meet their own needs today is compounded by manifestation of past unsustainable actions in society - the climate change. Increased pressure on the environment thus doesn't origin just from the population, their activities or technology, but as well from the nature itself. Therefore, the sustainability - preservation or upgrade of the possibilities for future generations, and the resilience - development of adaptive capacity of the social environments to the climate change consequences, need to be studied concurrently.

Despite the scientifically proved facts, the measures to achieve sustainability and resilience in practice are rarely applied in subject Region. One of the main reasons for the current state is the lack of knowledge. "Malpractice" leaves significant and permanent damage in the environment and contributes to the increment of environmental, but as well social and economic risks.

In regard to the said, the project intends to contribute to the preparedness for coping with, managing and shaping the conditions of growing complexity. Through capacity building, the project aims to create the base for equipping the professionals with new competences and skills necessary to respond to the recognized needs of today's society and job market.

The overall broader objective is to support the modernization of higher education in WB Region by implementing strategic approach in the development of **innovative platform for the delivery of knowledge about sustainable and resilient environments.**

To define the form and scope of knowledge delivery, foreseen by KLABS project, the current state in higher education sector in included Western Balkan countries was studied. It was concluded that the separate study programmes related to sustainability are rare and mostly focused on energy aspect, while the programmes which would include comprehensive education on both sustainability and resilience do not exists at all.

The two topics are in overall rarely present in existing university curricula and are mostly delivered to the students in a form of isolated theoretical classes; this separation from the curriculum backbone reflect negatively on knowledge integration and its practical application in professional work and real life situations. Additionally, the past generations of students didn't get any in-institutional education in subject themes. Finally, to understand the two concepts and their complexity one must own the sufficient broader professional knowledge and skills.

All these considerations led to the conclusion that incorporation of the themes of sustainability and resilience into existing study programmes would not bring completely satisfying results, although would certainly help to develop knowledge base.

This is why KLABS project proposes the introduction of new postgraduate study programmes Sustainable and Resilient Environments. By doing this, the possibility to gain the knowledge opens not just to graduated students, but also to all working professionals who completed their studies long time before the terms sustainability and resilience were introduced at all, and they are therefore considered as important and large target group to be impacted by project.

## 2. Analysis of national regulations

The basic postulates of higher education in Serbia are defined by the ***Law on Higher Education***. This document regulates the system and all relevant aspects of higher education, which could be organized through the system of academic or professional studies. In the domain of studies and study programmes, the *Law* explains its essential elements and items. In general, study programme is understood as a set of compulsory and elective study areas or subjects, with the outline of the content whose mastering provides necessary knowledge and skills for obtaining the appropriate level and type of studies. In general, as defined by the *Law*, Serbian higher education system includes three levels of study. The first one refers to undergraduate academic studies, the second one to master and ***specialized studies***, while the third one represents PhD academic studies. Study programmes might be realized within one or more of the educational and scientific, or educational and artistic fields, defined by the *Law*.

Furthermore, the *Law* defines ***basic elements of the content of a programme***, such as:

- the name and objectives of the study programme;
- type of studies and learning outcome;
- professional, academic and scientific title;

- conditions for admission to the program;
- list of compulsory and elective study areas or subjects, with the general content;
- the manner of conducting the studies and the time required;
- ECTS value of each course measured in accordance with the European Credit Transfer System;
- ECTS for the final paper on the basic, specialized and master academic studies, and doctoral thesis;
- prerequisites for entry of individual courses or groups of courses;
- method of the choice of courses from other study programmes;
- conditions for the transition to other study programs within the same or related fields of study;
- other issues of importance for the implementation of the study programme).

The scope of the study is specified by the *Law*, with respect to the type and level of studies. The sum of 60 ECTS is understood as an average total student's engagement in a 40-hour work week during the school year and it consists of active teaching classes (lectures, exercises, practicum, seminars, etc.) and individual work, tests, exams, and other forms of engagement. With respect to this, ***specialized academic studies must have at least 60 ECTS*** in the case of previous completion of master academic studies. The *Law* also defines that ***the study programme of specialized studies can foresee the creation of the final work.***

***The Law on Higher Education*** stipulates the verification of the quality of higher education institutions and their study programmes, for which is responsible National Council for Higher Education as a special body elected by the National Assembly of the Republic of Serbia. The accreditation process is supervised by the special working body of the National Council, i.e. the Commission for Accreditation and Quality Control. This Commission sets standards and procedures which the ***Law on Higher Education*** prescribes and which higher education institutions should follow and fulfil during the accreditation process. Standards refer to different matters, such as the number and qualifications of the teaching staff, organization of study programmes, spatial capacity of institutions, the number of students enrolled and the like.

Accreditation standards clarify certain formal elements that ***specialized academic studies*** should fulfil. Regarding qualifications that students should acquire at the end of specialized studies, standards define that they should have the ability to connect acquired knowledge, to solve problems in the field of specialization, as well as to effectively monitor and adopt innovations and research results. Curriculum of a study programme of specialized academic studies should be structured in a way that it should include about 15% of courses with academic and educational character, about 20% of those that should be defined as theoretical and methodological, about 35% of either scientific or artistic courses and about 30% of professional and applicative courses. Standards also define that ***practical work of at least 45 hours duration is compulsory for all students of specialized studies from the field of technical and***

**technological sciences.** Students should have at least 20 hours of active teaching classes and at least 50% of them should be either lectures or exercises. In the case of specialized academic studies, active teaching classes might be partly realized in a form of research and study work that would help the process of work on the final work.

Following the general framework set by the **Law on Higher Education**, further regulation of education system is under the jurisdiction of universities. **Statute of Belgrade University** gives more precise explanation of definition, status, as well as of rights and obligations of a student, conditions and admission process to the programme, principles of the system of ranking, etc. This document also specifies matters regarding the duration and organization of a school year, procedures and university bodies that participate in the process of adoption and accreditation of study programmes, structure and realization of a study programme, grading system, examination periods and manner of taking exam, elements that define the completion of the study programme, professional, academic and scientific title, documents on completed studies, etc. *Statute* defines that by the rule, all the courses of a study programme should last one semester. According to the *Statute of the University*, **specialized studies** can end in passing all the necessary examinations and fulfilling other study obligations and, if provided by the program of study, and producing the final paper and passing the final exam. The number of credits defined for the final work or the final part of the study program, is included in the total number of credits required to complete the study.

Being the leading higher education institution for architecture and urban studies, Faculty of Architecture, University of Belgrade organizes several types of study programmes at all levels. They are **academic** by their nature and therefore have a goal to qualify students to develop and apply scientific, professional and artistic achievements.

According to the **Statute of the Faculty**, academic study programmes organized by the Faculty of Architecture (undergraduate, master, **specialized** and PhD) are in the **scientific and artistic area of architecture, urbanism and architectural technologies that belong to the following educational-scientific, i.e. educational-artistic fields: arts, socio-humanistic sciences and technical and technological sciences.**

**The Statute of the Faculty states that specialized studies last from one to two years and by its completion should acquire 60 or 120 ECTS. Upon the completion of specialized academic studies at the Faculty, students acquire the academic title of specialist in certain areas, in accordance with the provisions of accredited study programme.**

Following the directions stated by the *Law on Higher Education* and the *Statute of the University of Belgrade*, **the Statute of the Faculty of Architecture offers more precise conditions of admission to the specialized studies. They are intended for persons who finished master academic studies and achieved at least 300 ECTS, with academic background defined by the study programme. Rules of ranking of students are defined on the basis of the general average mark achieved during undergraduate and master academic studies within the number envisaged by the competition for admission.**

*According to the Statute, in the case of post-graduate programmes, such as specialized programmes, overall weekly obligations of students in active teaching classes may reach 12 hours at the most.*

*Apart from the statute, elements of specialized programmes are more clarified by the special faculty document entitled Rulebook of specialist academic studies. This document defines conditions, manner and the application procedure, organization and management of studies and the process of making and defending of the final work at the Faculty of Architecture in Belgrade. Additional requirement regarding the admission to the specialist academic studies refers to the fact that eligibility for admission to postgraduate studies has a person who also knows at least one foreign language. The study program specialized studies is identifying the undergraduate or graduate studies the candidate must have completed to qualify for admission. The Rulebook states that within 12 months, counting from the date of the end of the semester in which the classes ended in total, the student must pass all the exams and other work, and report and defended his final, specialist work. In justified cases, at the personal request of the student, Academic Council may extend this period for an additional 12 months.*

*Rulebook explains in detail all the procedure and steps of reporting of a final, specialist work, as well as procedure and steps for its defending. According to this document, the final work represents an independent professional work, which displays certain themes from the immediate area of specialized studies in depth. It is, as a rule, written in the Serbian language, in the extent of about 15,000 words. Appointed Commission that considers and assesses the elements of final work has, as a rule, at least 3 members. Specialized studies end with a public oral defence of candidate's final, i.e. specialist work.*

Having in mind all the mentioned, the basic elements of the particular specialized academic programme in Energy Efficient and Green Architecture are the following:

Name of the study programme	Specialized academic programme – Energy Efficient and Green Architecture
An independent higher education institution that performs the study programme	University of Belgrade
Higher education institution that performs the study programme	Faculty of Architecture
Educational-scientific, i.e. educational-artistic field	Technical and technological sciences
Scientific, technical or artistic field	Architectural technologies
Type of studies	Specialized academic studies

Total ECTS credits	60
The title of diploma	Specialist in Architecture - Energy-efficient and green architecture; Spec. Eng. Arch.
Duration of studies	1 year
School year in which began the realization of the study program	2012/2013
Planned number of students	32
Language	Serbian

### 3. National state in the fields Sustainability and Resilience

Considering the definitions of two fields and aspect of human development, sustainability and resilience, it must be concluded that they are closely connected, overlapping or having the similar goals. Nevertheless, the term sustainability came into everyday language and practice decades ago, after first energy crisis, while the term resilience is rather new, began to appear in 21 century with the final acceptance of the fact that human activities caused climate change.

Sustainability, as the principle, is one of the bases in a number of laws currently in force in the Republic of Serbia, while the term of resilience still could not be directly connected to any of domestic laws or regulations.

**Law on planning and construction**, in part: Principles for the development and use of space, in article 3, gives the definition on planning, development and use of space based on, among others, the following principles:

- sustainable development through an integrated approach to planning;
- rational and sustainable use of non-renewable resources and the optimal use of renewable resources;
- protection and sustainable use of natural resources and immovable cultural assets.

Sustainable development, referred to in this Law, represents the harmonization of economic, social and environmental aspects of development, the rational use of non-renewables and providing conditions for greater use of renewable resources, present and future generations to meet their needs and improve the quality of life.

On the basis of this law and its provisions referred to in Article 4. Improvement of energy efficiency, (improving energy efficiency means reduction of consumption of all types of energy, saving energy and securing of sustainable construction by applying technical measures, standards and conditions of planning, design, construction and use

of buildings and space), The Republic of Serbia has adopted Rules dealing with energy efficiency of buildings and their mandatory certification (harmonized with EPBD 1, 2002.)

Second key law that deals with the sustainability is the **Energy Law**. In Chapter II Energy policy and energy development, the energy policy is defined. Energy policy objectives, in Article 3, stipulate that energy policy of the Republic of Serbia shall include measures and activities for achieving long-term objectives, namely:

- a reliable, safe and quality supply of energy;
- an adequate level of electricity generation and transmission system capacities;
- create the conditions for reliable and safe operation and sustainable development of the energy system,

whereas in Article 11 specifies that The report on security of electricity supply includes: regional, national and European sustainable development objectives, including international projects.

In the **Law on rational use of energy** basic principles of sustainable use of energy are defined as : Sustainability of energy use involves reducing energy consumption, better use of available technology and the demands of eco - design, greater efficiency and effectiveness in the use of energy and sustainability from the standpoint of environmental impact, with the application of the principles of environmental protection.

In addition to these laws, a number of laws and bylaws are in force, indirectly associated with these areas. These are the laws concerning flood protection, the law on the protection of forests, ordinances dealing with the design of buildings in the seismic area, municipal waste etc.

Daily practice is a direct reflection of the existing regulations. Sustainability as a principle is fully understood, accepted and supported. On the contrary, the principle of resilience is still not accepted in practice and probably, except for a small number of experts, it is still not clear enough and accepted in everyday practice.

It is likely that this state in the legal regulations and the daily practice reflects and represents the result of the existing curricula at universities in Serbia. Sustainability, especially problems related to spatial and urban planning and design, energy efficiency of buildings, water treatment, waste treatment, applying green principles to the design and construction are the subject of a larger number of subjects that have been developed at all levels of studies, bachelor, master, specialist, doctoral. Through several subjects, the idea of sustainability, applied in the process of urban and architectural design, has been developing at the Faculty of architecture University of Belgrade for more than 30 years.

It should be pointed out in particular the level of specialist studies that has been developed in Belgrade (Faculty of Architecture and Faculty of civil engineering) and Faculty of technical science in Novi Sad, where curricula on topics of energy efficiency were specially develop, while in Belgrade on specialist studies Energy efficient and

green architecture, individual subjects dealing with water treatment and waste as well as ecological approach to design and construction also exist.

It should be noted that, despite the existence of specific studies that address sustainability issues through energy efficiency complex, the problems covered by the term resilient, are not present in the framework of these studies. Further progress and development of specialist studies, previously mentioned Energy efficient and green architecture, can be expected and defined through the opening and develop of new subjects based on complex issues covered by the term resilient.

The literature used for the educational purposes is mostly foreign literature and the web sources are used widely. The lack of literature and textbooks in Serbian is evident, on both subjects. While a few books on sustainability in Serbian could be found, there is no book or textbook on resilience published in Serbian. Developing new subjects and curricula as well as upgrading existing ones requires preparation and publishing of necessary literature in Serbian.

## **4. National qualification framework**

## **5. Institutional capacities**

The University of Belgrade (UB) is a state university that was founded over 200 years ago. Today it represents a powerful group of 31 faculties, 11 institutes, 7 centres and a University library. Since 2013, the University has been continuously ranked among world's top universities at the Academic Ranking of World Universities list (popularly known as Shanghai Ranking).

The Faculty of Architecture – University of Belgrade is one of the oldest higher education institution in architecture and urban studies in the Balkan region. In 2016, the Faculty is celebrating 170 years of architectural education in Serbia. Today, the Faculty is the leading higher education institution for architecture and urban studies in the Western Balkans Region and as such, during the last three years, it has been ranked among Europe's Top 100 Schools of Architecture and Design according to DOMUS, the eminent architectural journal.

The Faculty teaching staff counts 125 members, who provide comprehensive education of future architects including a wide range of studies, which enable the sharing of knowledge and development of skills required for practicing architecture within interdisciplinary environment. Teaching staff is organized in three departments,

named after the corresponding scientific and artistic area as: Department of Architecture, Department of Urbanism and Department of Architectural Technologies.

In accordance with the basic concept of higher education, defined by relevant regulations, as well as the specific requirements and needs of modern architectural education, studies are organized in 'study units' and 'modules', which students may choose from so as to independently create their educational profiles. Studies are primarily based on the 'studio-driven' method, having in mind that students learn best by working in small, highly focused groups under a single tutor. Generally speaking, a list of elective courses is compiled almost every academic year, with the aim to stay abreast of current trends and issues. Moreover, a number of conferences, exhibitions and guest lectures organized at the Faculty, and in cooperation with leading universities in Europe, and worldwide spread-out further enhance the teaching-learning process.

Department of Architectural Technologies which is responsible for development and realization of specialized academic programme of Energy Efficient and Green Architecture gathers 32 teachers and assistants with a professional background from three educational-scientific, i.e. educational-artistic areas: Architectural Constructions, Building Materials and Building Physics; Building Technologies, Installations and Management; and Architectural and Structural Engineering. The main goal of this specialized programme is to expand the knowledge necessary for design, construction, evaluation of energy efficiency and green buildings in accordance with the current relevant national and international regulations referred to energy efficiency. Hence, this purpose, 7 teachers from the Department are involved in the teaching process. Due to the interdisciplinary character of the specialized programme and the need to adjust the curriculum to the requirements of training for licensing of engineers for energy efficiency by the Serbian Chamber of Engineers, relevant teachers from other faculties of Belgrade University (Mechanical Engineering, Electrical Engineering, Geographic, Organizational Sciences), as well as relevant professionals are also involved.

Faculty of Architecture is located in a building which is erected in the 1930's to host a group of technical faculties. Today, three faculties are placed in the building, including the Faculty of Architecture.

Spatial possibilities of the Faculty fulfil the minimum accreditation requirements in terms of space for teaching and learning (minimum 2m<sup>2</sup> per student). For the purpose of realization of the specialist studies of Energy Efficient and Green Architecture several rooms are needed: one lecture hall, two classrooms, and a library with a reading room. All the rooms are adequately equipped with suitable furniture and other necessary equipment. Faculty library possesses certain number of library items that are relevant for realization of the programme.

With respect to the curriculum of study programmes organized by the Faculty of Architecture, University of Belgrade, it could be concluded that, for the time being, at lower levels of education students get only basic knowledge regarding the problems that specialized programme on energy efficiency and green architecture deals with. Some competence might be obtained through the participation in certain elective

courses, but this is still reserved to small group of students who do not necessarily get a holistic perspective of the problem. Therefore, this study programme has an important role in the system of higher education of architectural provenience since it enables architects to acquire competence in this very important field for the present architectural practice.

The Statute of the Faculty of Architecture states that the following forms of active teaching classes are being applied: lectures, exercise, work in the studio, workshops, independent work and practice, excursion, and they are envisaged and practiced in the relevant specialized study programme.

Faculty regulations, such as the Statute of the Faculty, allow organization and practicing of distance learning, but possibility has not been practiced so far.

## 6. Educational material in national language about Sustainable and Resilient Environments

Educational material which scope is related to the theme of sustainable and resilient environment is provided through various courses in different study levels and specific courses, varying from science and engineering to management. An overview of currently active academic programs in postgraduate level (master and specialization courses) in Serbia, which are in the relevant field of research, is presented below.

### 6.1 Review of related academic courses

Title of the course	Study level	ESPB	Faculty
<i>Energetski efikasna i zelena arhitektura</i> (Energy efficient and green architecture)	<i>Specijalističke akademske</i> (Specialist studies)	60	<i>Arhitektonski fakultet, Univerzitet u Beogradu</i> (Faculty of Architecture University of Belgrade – UB-AF)
<i>Energetska efikasnost u zgradarstvu</i> (Energy efficiency in buildings)	<i>Specijalističke akademske</i> (Specialist studies)	60	<i>Fakultet tehničkih nauka, Univerzitet u Novom Sadu</i> (Faculty of Technical Sciences University of Novi Sad - FTNUoNS)
<i>Inženjerstvo zaštite životne sredine</i> (Environmental protection engineering)	<i>Specijalističke akademske</i> (Specialist studies)	90	<i>Fakultet tehničkih nauka, Univerzitet u Novom Sadu</i> (FTNUoNS)
<i>Inženjerstvo zaštite životne sredine</i> (Environmental protection engineering)	<i>Master akademske</i> (Master studies)	60	<i>Fakultet tehničkih nauka, Univerzitet u Novom Sadu</i> (FTNUoNS) <i>Tehnički fakultet "Mihajlo Pupin" Zrenjanin</i> (Technical faculty 'Mihajlo Pupin' Zrenjanin)

<i>Upravljanje rizikom od katastrofalnih događaja i požara (Catastrophic events and fire risk management)</i>	<i>Master akademske (Master studies)</i>	60	<i>Fakultet tehničkih nauka, Univerzitet u Novom Sadu (FTNUoNS)</i>
<i>Energetska efikasnost, obnovljivi izvori energije i zaštita životne sredine</i>	<i>Master akademske (Master studies)</i>	120	<i>Državni univerzitet u Novom Pazaru (State University of Novi Pazar - SUoNP)</i>
<i>Energetska efikasnost u zgradarstvu (Energy efficiency of buildings)</i>	<i>Master akademske (Master studies)</i>	60	<i>Državni univerzitet u Novom Pazaru (State University of Novi Pazar - SUoNP)</i>
<i>Energetska efikasnost, održavanje i procena vrednosti objekata u visokogradnji [EES]</i>	<i>Specijalističke akademske (Specialist studies)</i>	60	<i>Građevinski fakultet Univerziteta u Beogradu (Faculty of Civil Engineering University of Belgrade - FoCEUoB)</i>
<i>Еколошки инжењеринг у заштити земљишних и водних ресурса (Environmental engineering in protection of land and water resources)</i>	<i>Master akademske (Master studies)</i>	60	<i>Šumarski fakultet Univerziteta u Beogradu (Faculty of Forestry University of Belgrade)</i>
<i>Геопросторне основе животне средине (Geospatial and environmental science)</i>	<i>Master akademske (Master studies)</i>	70	<i>Geografski fakultet Univerziteta u Beogradu (Faculty of Geography University of Belgrade - FoGUoB)</i>

## 6.2 Review of available materials

Based on the review of recommended literature for selected courses, a list of relevant educational material is given, grouped according to the main field of research. This division into fields is quite rough and should be taken with reserve, since entire area of Sustainable and resilient environments is highly interdisciplinary. Also, it is common that all lectures are also available to students in the form of handouts or presentations, so this form of educational material is not listed.

### Architecture, urban planning, design, energy efficiency in buildings

<b>Title</b>	<b>Type</b>	<b>Scope</b>	<b>Availability</b>
Пуцар М., Пајевић М., Јовановић Поповић М. (1994) <i>Биоклиматско планирање и пројектовање, урбанистички</i>	Monograph - textbook	Urban planning and architectural design principles for sustainable building	UB library, AF library

<i>параметри</i> . Завет, Београд.			
Daniels K. (2009) Tehnologija ekološkog građenja : osnove i mere : primeri i ideje. Prevod sa nemačkog Zečević S.Beoград: Jasen.	Monograph	Technology of ecological building	UB library, AF library
Јовановић Поповић М. (Ур.) (2003) Енергетска оптимизација зграда у контексту одрживе архитектуре – I део, Архитектонски факултет Универзитета у Београду.	Monograph – results of scientific project of FoAUoB	Characterization of residential building stock in Serbia and principles of energy efficiency refurbishments	UB library, AF library
Јовановић Поповић М. (Ур.) (2005) Енергетска оптимизација зграда у контексту одрживе архитектуре – II део, Архитектонски факултет Универзитета у Београду.	Monograph – results of scientific project of FoAUoB	Guidelines for energy efficiency refurbishments in Serbia	UB library, AF library
Јовановић Поповић М., Игњатовић Д. (ур) (2013) Национална типологија стамбених зграда Србије/National Typology of Residential Buildings in Serbia, Београд: Архитектонски факултет Универзитета у Београду и GIZ	Monograph, bilingual edition	Principles of structuring residential building stock according to TABULA project principles, refurbishment potential, refurbishment measures	UB library, AF library
Јовановић Поповић М., Игњатовић Д. (Ур.) (2013). Атлас вишепородичних зграда Србије/Atlas of Family housing in Serbia, Београд: Архитектонски факултет Универзитета у Београду и GIZ	Monograph, bilingual edition	Characteristics and refurbishment potential of multifamily housing	UB library, AF library
Јовановић Поповић М., Игњатовић Д. (Ур.) (2012) Атлас породичних кућа Србије/Atlas of Family housing in Serbia, Београд: Архитектонски факултет Универзитета у Београду и GIZ	Monograph, bilingual edition	Characteristics and refurbishment potential of single family housing	UB library, AF library

Јовановић Поповић М. (2001) Обнова зграда у контексту одрживог развоја. Београд.	Monograph	Refurbishment of existing buildings in the context of sustainable development	UB library
Косановић С. (2009) Еколошки исправне зграде – Увод у планирање и пројектовање. Београд: Задужбина Андрејевић.	Monograph	Principles of eco design in architecture	UB library, AF library
Ђуковић Игњатовић Н. (2010). Фасада – Адаптације и трансформације. Београд: Задужбина Андрејевић.	Monograph	Principles of façade refurbishment	UB library, AF library
Милковић В. (1993) Еколошке куће. НТ библиотека, Нови Сад.	Monograph	Eco-houses	
Ђокић Л. (2007) Осветљење у архитектури – захтеви и смернице за пројектовање. Архитектонски факултет Универзитета у Београду. Београд.	Monograph - textbook	Principles and guidelines fot lighting design in architecture	UB library, AF library, FoEEOB
Љешевић М. (2009) Урбана екологија. Факултет за примењену екологију Футура : НВО Екоризик, Београд.	Textbook	Urban ecology	UB library, library of FoGUoB, National library, Library of Matice Srpske Novi Sad, library of institute of Nuclear Sciences Vinča

It can be seen that monographs of domestic authors are prevailing, dealing both with basic principles of various subjects, as well as results of specialized research projects. Monographs that are designed as textbooks are scarce, and those that exist are outdated and should be modernized through revised and updated editions. Also, edited translations of renewed foreign authors are scarce.

#### **Building science, engineering (civil, mechanical, electrical)**

<b>Title</b>	<b>Type</b>	<b>Scope</b>	<b>Availability</b>
Милинчић, Д. (1989) <i>Простирање топлоте.</i>	Monograph - textbook	Basics of stationary heat transfer	UB library, library of FoMEUoB

Научна књига, Београд, 1989.			
Јовановић-Поповић М., Игњатовић, Д. (2011) Видети енергију. Архитектонски факултет Универзитета у Београду.	Monograph, bilingual edition	Principles of application of thermal imaging in buildings	UB library, AF library
Б. Тодоровић (2009) Пројектовање постројења за централно грејање, МФ у Београду.	Textbook	Design principles of central heating systems	UB library, library of FoMEUoB
Б. Тодоровић (1998) Климатизација, СМЕИТС, Београд.	Textbook	Principles of air conditioning	UB library, library of FoMEUoB
Тодоровић М. Енергетска ефикасност система грејања и климатизације.	Handouts	Energy efficiency of heating and air conditioning systems	UB library, library of FoMEUoB
Медвед С. (2014) Грађевинска физика. Државни универзитет у Новом Пазару.	Monograph - textbook	Principles of building physics: heat, humidity, light , acoustics, fire, climate in cities	library of SUoNP
Костић М. (2000) Водич кроз свет технике осветљења. Minel- Schreder. Београд	Monograph - textbook	Lighting technology principles	UB library, AF library, FoEEUoB library
Крњетин С. (2001) Градитељство и заштита животне средине. Прометеј, Нови Сад.		Civil engineering and environmental protection	
Димкић А. М. (2007) Самопречишћавајући ефекти филтрације подземне воде. Београд: Задужбина Андрејевић.	Monograph	Filtration of underground waters	UB library, University Library of Kragujevac, University Library of Niš, Library of Matica Srpske Novi Sad, etc.
Шумарац Д. (2005) Енергетска ефикасност зграда. Грађевински факултет, Београд.		Principles of energy efficiency in buildings	

As in the previous field, domestic authors are prevailing. Most of the material is in the form of textbooks, mainly recent editions. As in the previous field, translations of key international references in each field is lacking.

## Environmental protection

Title	Type	Scope	Availability
Марковић Д., Ђармати Ш., Гржетић И. (1996) Физичкохемијски основи заштите животне средине - Извори загађивања, последице и заштита, ИИ. Универзитет у Београду	Textbook	Physicochemical principles of environmental protection	
Кубуровић М., А.Петров (1994) Заштита животне средине. СМЕИТС и Машински факултет Београд.	Textbook	Basic principles of environmental protection	national library, library of FoMEUoB, FoMEUoK
Ђонлић М. (2005) Енергија и околина. PRINTCOM ТУЗЛА	Textbook		
Шећеров Соколовић, Р., Соколовић, С. (2002) Инжењерство у заштити околине. Технолошки факултет Нови Сад.	Textbook	Engineering principles in environmental protection	library of UB, library of SUoNP, University Library of Kosovska Mitrovica, Library of Matice Srpske Novi Sad
Ђукановић М. (1996) Животна средина и одрживи развој. Београд: Elit.	Monograph - textbook	Basic principles of environmental protection and sustainable development	library of UoB, library of SUoNP, University Library of Kosovska Mitrovica, Library of Matice Srpske Novi Sad, FoGUoB etc.
Крњетин С. (2001) Градитељство и заштита животне средине. Прометеј, Нови Сад.		Civil engineering and environmental protection	
Љешевић М. (2005) Теорија и методологија истраживања животне средине. Универзитет у Београду, Географски факултет, Београд.	Monograph - textbook	Theory and methodology of environmental research	library of UB, library of FoGUoB, National library, Library of Matice Srpske Novi Sad, University Library of Kosovska Mitrovica
Миленковић Д. (2006) Збирка прописа из области заштите животне средине. Службени гласник, Београд.		Collection of environmental protection regulations	library of UoB, library of FoGUoB, library of Faculty of Organization Sciences UoB, National library, Library of Matice

			Srpske Novi Sad, University Library of Kosovska Mitrovica, library of Law Faculty University of Niš
Тодић Д., Чок В., Вукасовић В., Мијушковић О., Дабић Љ., Павличевић Б. (2000): Законодавство Европске уније о животној средини и земље у транзицији. Бирографија, Београд.	Proceedings	Regulations of EU in environmental protection	library of UB, library of Faculty of Organization Sciences UB, National library, Library of Matice Srpske Novi Sad
Филиповић Д. (1999) Моделовање загађивања животне средине градова – мониторинг и заштита. Библиотека Академија, Задужбина Андрејевић, Београд.	Monograph	Modelling of environmental pollution in cities	library of UB, library of Faculty of Organization Sciences UB, National library, Library of Matice Srpske Novi Sad

Most of the material in this field is in the form of textbooks of domestic authors, and again, translations of key international references is lacking. Review of relevant legislation is given, as well as education material focused on higher education levels (methodology of research in the field, applied research etc.).

## Management

Title	Type	Scope	Availability
В. Горан (2007) Приручник за израду еколошких пројеката.	Handouts	Guidebook for projects of environmental protection	
Миленовић Б. (2000) Еколошка економија: теорија и примена. Факултет заштите на раду Универзитет у Нишу.	Textbook	Principles of environmental economics	UB library, University Library of Kragujevac, University Library of Kosovska Mitrovica, Library of Matice Srpske Novi Sad, etc.
Кековић, З. (2001) Процес интегралног управљања ризицима. Факултет безбедности, Београд.		Integral risk management	

Радојевић Р. (2000) Управљање квалитетом и заштитом животне средине. ДОПИС, Београд.	Monograph - textbook	Management of quality and environmental protection	UB library, Library of Matice Srpske Novi Sad, University Library of Kosovska Mitrovica
Čvorović Z. (2005) Upravljanje rizicima u životnoj sredini. Zadužbina Andrejević, Biblioteka DISSERTATIO, Beograd.	Monograph	Risk management in environmental protection	UB library, library of Faculty of Organization Sciences UB, National library, Library of Matice Srpske Novi Sad

The field of management for sustainable and resilient environment is least covered with adequate educational material. Although several textbooks of domestic authors exist, editions of key international literature in national language are lacking, as well as publications related to successful domestic and international projects in the field.

Based on the presented overview, it can be concluded that research area of building science and engineering is best covered in educational material, while the least coverage exists in the field of environmental management. In all areas domestic authors are prevailing. Also, general impression is that modernization of outdated textbooks is necessary, as well as coverage of all subjects with appropriate textbooks. Also, editions in national language of key international references should be encouraged. Inclusion of different areas of research, especially scientific, in the context of sustainable and resilient environments should also be encouraged.

## 7. Survey results

Since the first accreditation in 2012, the specialist studies *Energy Efficient and Green Architecture* at the University of Belgrade – Faculty of Architecture have engaged three generations of students. Having in mind the intention to prepare an improved study program for the next accreditation period, a survey was designed in order to provide some feedback from the former and active students.

Survey was anonymous, executed via surveyplanet.com web page, enabling the students and alumni to express freely their opinions and remarks.

The questionnaire comprised three groups of questions:

1. General questions, aiming to identify the profile of prospective students: professional background, reasons for applying for the program, etc.

2. Study program and courses evaluation, and
3. Perception of relevance of resilience and sustainability issues in current practice and relation to study program.

## 7.1 Questionnaire

### 01 / СПЕЦИЈАЛИСТИЧКЕ СТУДИЈЕ САМ УПИСАО/ЛА

---

- a) Immediately after graduation from master studies/ непосредно након завршених мастер студија
- b) After less than 2 years in practice/ након мање од 2 године рада у пракси
- c) After 2-5 years in practice/ након 2-5 година рада у пракси
- d) After more than 5 years in practice/ након више од 5 година рада у пракси

### 02 I HAVE ENROLLED AT SPECIALIZED STUDIES FOR/ СПЕЦИЈАЛИСТИЧКЕ СТУДИЈЕ САМ УПИСАО/ЛА ЗБОГ

---

Wish for further specialization and knowledge broadening/ жеље за даљим усавршавањем

Nature of my work (upon request from my employer)/ природе посла (по налогу послодавца)

Because of easier/faster employment/ лакшег/бржег запослења

Other (state the reason)/ друго (навести разлог) \_\_\_\_\_

### 03 HOW HAVE YOU FINANCED THE STUDIES/ КАКО СТЕ ПОКРИЛИ ТРОШКОВЕ ШКОЛАРИНЕ?

---

- a) With own resources/ сопственим средствима
- b) With employer resources/ средствима послодаваца
- c) scholarship/ уз помоћ стипендије
- d) Other (state the financing means)/ друго (навести начин финансирања) \_\_\_\_\_

**04 TO WHAT EXTENT HAS THE PROGRAM FULFILLED YOUR EXPECTATIONS REGARDING THE KNOWLEDGE AND EXPERTISE BROADENING?/ У КОЈОЈ МЕРИ ЈЕ ПРОГРАМ ИСПУНИО ВАША ОЧЕКИВАЊА У ПОГЛЕДУ СТИЦАЊА НОВИХ ЗНАЊА И ЕКСПЕРТИЗЕ?**

- a) Totally/ у потпуности
- b) Partially/ делимично
- c) Has not fulfilled my expectations at all/ уопште није испунио моја очекивања
- d) I have quitted the studies (state the reason)/ одустао/ла сам од студија (навести разлог) \_\_\_\_\_

**05 COURSES EVALUATION (FILL THE TABLE WITH MARKS 0-5)/ ОЦЕНА КУРСЕВА (попунити рубрике у табели оценама 0-5)**

- 0 – I have not taken the course/ нисам похађао/ла курс
- 1 – Unsatisfactory/ не задовољава
- 2 – Satisfactory (minimum)/ довољан (испуњава минимум)
- 3 – Good (partially fulfilling the expectations)/ добар (делимично задовољава)
- 4 – Very good (fulfills the expectations)/врло добар (задовољава)/
- 5 – Excellent/одличан

Course курс	Subject relevance релевантност материје	Contemporariness of the topic актуелност теме	Lecturer competence компетенције наставника	Practical skills (applicability in everyday practice) практична знања (применљивост у пракси)	Interactive work интерактивни рад	Books and teaching material in Serbian language уџбеници и наставни материјал на српском јез.	Books and teaching material in English language уџбеници и наставни материјал на енглеском јез.	Total (do not fill) укупно (не попуњавати)
Sustainable architecture								

Course курс	Subject relevance релевантност материје	Contemporariness of the topic актуелност теме	Lecturer competence компетенције наставника	Practical skills (applicability in everyday practice) практична знања (применљивост у пракси)	Interactive work интерактивни рад	Books and teaching material in Serbian language уџбеници и наставни материјал на српском јез.	Books and teaching material in English language уџбеници и наставни материјал на енглеском јез.	Total (do not fill) укупно (не попуњавати)
– principles Одржива архитектура – принципи Designing and of Green and EE buildings пројектовања зелених и EE зграда								
Elements of Heat transfer science Елементи науке о топлоти								
Building physics Физика зграде								
Termo - technical systems and sustainable architecture Термотехнички системи и одржива архитектура								
Lighting and EE Светлост и EE								
EE Building certification – calculation methods, simulations and performance verification Сертификација EE зграда – методе прорачуна, симулације и верификације								

Course курс	Subject relevance релевантност материје	Contemporariness of the topic актуелност теме	Lecturer competence компетенције наставника	Practical skills (applicability in everyday practice) практична знања (применљивост у пракси)	Interactive work интерактивни рад	Books and teaching material in Serbian language уџбеници и наставни материјал на српском јез.	Books and teaching material in English language уџбеници и наставни материјал на енглеском јез.	Total (do not fill) укупно (не попуњавати)
Laws and economic aspects of EE buildings Регулатива и економија енергетски ефикасних зграда								
Professional practice Стручна пракса								
Certification of green buildings Сертификација зелених зграда								
Elective course Изборни предмет: <i>Green materials</i> <i>Зелени материјали</i>								
Elective course Изборни предмет: <i>Water management in buildings</i> <i>Управљање водама у зградама</i>								
Elective studio Изборни студио: <i>Design and certification of EE buildings – Case study</i> <i>Пројектовање и сертификација ЕЕ зграда – студија случаја</i>								

Course курс	Subject relevance релевантност материје	Contemporariness of the topic актуелност теме	Lecturer competence компетенције наставника	Practical skills (applicability in everyday practice) практична знања (применљивост у пракси)	Interactive work интерактивни рад	Books and teaching material in Serbian language учбеници и наставни материјал на српском јез.	Books and teaching material in English language учбеници и наставни материјал на енглеском јез.	Total (do not fill) укупно (не попуњавати)
<b>Elective studio</b> <b>Изборни студио:</b> <i>Design, energy rehabilitation and certification of Existing buildings – Case study</i> <i>Пројектовање и енергетска рехабилитација и сертификација постојећих зграда – студија случаја</i>								
<b>Total</b> <b>укупно (не попуњавати)</b>								

**06 AFTER THE FINALIZATION OF THE SPECIALIZED STUDIES WAS IT EASIER FOR YOU TO FIND A JOB OR TO ADVANCE AT YOUR CURRENT WORK POSITION/ ДА ЛИ СТЕ НАКОН СПЕЦИЈАЛИСТИЧКИХ СТУДИЈА ЛАКШЕ НАШЛИ ПОСАО ИЛИ НАПРЕДОВАЛИ НА РАДНОМ МЕСТУ?**

---

a) Yes/да

b) No/не

**07 DO YOU APPLY GAINED KNOWLEDGE IN YOUR PRACTICE/ДА ЛИ У ПРАКСИ КОРИСТИТЕ ЗНАЊА СТЕЧЕНА НА СПЕЦИЈАЛИСТИКИМ СТУДИЈАМА?**

---

a) Yes/да

b) No/не

c) Currently not employed in the field of expertise/тренутно не радим у струци

**08 DO YOU CONSIDER THAT SPECIALIZED STUDIES HAVE PROVIDED YOU NOUVELLE KNOWLEDGE FROM THE FIELD OF SUSTAINABLE ARCHITECTURE/ДА ЛИ СМАТРАТЕ ДА СТЕ У ОКВИРУ СПЕЦИЈАЛИСТИЧКИХ СТУДИЈА СТЕКЛИ НОВА ЗНАЊА ИЗ ОБЛАСТИ ОДРЖИВЕ АРХИТЕКТУРЕ?**

---

a) Yes/да

b) No/не

**09 DO YOU CONSIDER TOPICS OF SUSTAINABILITY AND RESILIENCE TO BE WELL KNOWN IN PROFESSIONAL PUBLIC/ДА ЛИ СМАТРАТЕ ДА СУ У НАШОЈ СТРУЧНОЈ ЈАВНОСТИ ДОВОЉНО ПОЗНАТЕ ТЕМЕ ОДРЖИВОСТИ?**

---

a) Yes/да

b) No/не

**10 HOW CAN EXISTING PROGRAM OF SPECIALIZED STUDIES BE IMPROVED ACCORDING TO YOUR OPINION/КАКО СЕ ПО ВАШЕМ МИШЉЕЊУ МОЖЕ УНАПРЕДИТИ ПОСТОЈЕЋИ НАСТАВНИ ПРОГРАМ СПЕЦИЈАЛИСТИЧКИХ СТУДИЈА?**

---

## 7.2. Answers

- Q\_01 Roughly  $\frac{1}{2}$  of examinees have enrolled the course immediately after Master studies (27.8%) or within 2 years after graduation (22.5%). Less than 20% took the course after more than 5 years of practice. >>> Courses should address young and not very experienced professionals.
- Q\_02 Only 1 examinee stated that he/she took the course because of better job opportunities, and no one took the course by employer's initiative. >>> The need for this kind of knowledge is recognised among student population, but not on the job market.
- Q\_03 Confirms the conclusion from Q\_02 since only 2 tuitions (out of 36) were covered by student's employer. Others have personally paid for all the costs.
- Q\_04 The study program has partially fulfilled the expectations regarding acquiring new knowledge and expertise.
- Q\_05
- Q\_06 Confirms the answers to Q\_02 and Q\_03 – only 25% claimed to have had better job opportunities after the course.
- Q\_07 More than half of the examinees are applying their knowledge at their work. Having in mind that 25% is not working as practicing professional, this means that  $\frac{3}{4}$  of professionally employed actually have the opportunity to apply their knowledge and expertise at work.
- Q\_08 Vast majority (91.7%) confirms to have significantly broadened their knowledge in the area of sustainable architecture.
- Q\_09 Vast majority (86.1%) thinks that the issues of sustainability and resilience are not well known and appropriately recognised in Serbian professional circles.
- Q\_10 (open question) – gave us precious comments on various issues (general and particular)- to be further processed and discussed.