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# *Ict and the new generations of professionals: Are we on the threshold of a change?*

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## **Abstract**

The paper presents the ways of information and communication technologies (ICT) use in teaching and research purposes at the Faculty of Architecture, University of Belgrade. The main aim is to consider opportunities and representation of ICT use for the promotion of architectural education, and ways to overcome current barriers when using ICT as well. First of all, it is given a short historic review of information and communication technologies, from their creation until the use of ICT in modern education. The current status and the level of ICT implementation at the Faculty of Architecture is also briefly shown. Secondly, after the description of the research process, the paper presents the results of research. The research aim was to determine the students' use of ICT in the learning process, their primary requirements and the level of satisfaction with the existing faculty website. The final part gives an insight into the guidelines for the learning process improvement. This indicates the recognition of the university as a key element in the modernization of the entire nation.

**Key-words:** ICT, professional architectural education, e-services, Faculty of Architecture - University of Belgrade

## **Rezime**

Predmet rada je istraživanje načina upotrebe IKT u nastavne i istraživačke svrhe na Arhitektonskom

fakultetu Univerziteta u Beogradu. Osnovni cilj rada je da ustanovi mogućnosti i zastupljenost upotrebe IKT za afirmaciju arhitektonske edukacije, kao i načine za prevazilaženje trenutnih prepreka prilikom korišćenja IKT. U prvom delu rada je dat kratak prikaz istorijata informaciono-komunikacionih tehnologija, od njihovog nastanka pa sve do upotrebe IKT u savremenom obrazovanju. Trenutno stanje i nivo primene IKT na AFUB je takođe sažeto prikazan. U drugom delu rada, nakon opisa istraživačkog postupka, izloženi su rezultati istraživanja čiji je cilj bio da utvrdi način upotrebe IKT u procesu savladavanja nastavnog gradiva od strane studenata, njihove primarne zahteve i stepen zadovoljstva postojećim sajtom fakulteta. Poslednji deo rada pruža uvid u smernice za unapređenje nastavnog sistema na fakultetu. Ovim se ukazuje na afirmaciju univerziteta kao ključnog elementa u modernizaciji čitave nacije.

**Ključne reči:** IKT, profesionalna arhitektonska edukacija, e-servisi, Arhitektonski fakultet Univerziteta u Beogradu.

## **1. Introduction**

### **1.1. ICT - the generator of the information society**

The current approach to the city development can be described by several phenomena. Their common characteristic is reflected not only in the production of new space, i.e. new functions and new image of the city, but also in the creating of new economic force that runs the city. First, the

decline of the urbanization in the city centre is an expression of the demands for the successful economic development of the society. According to Peter Hall, building brand new facilities is economical in sparsely populated terrain, so that we can talk not only about the decline of the urbanization in the city centre, but the urban sprawl in general, due to the spread of suburbs that contain all the necessary urban functions [1]. Second, in the words of Manuel Castells, the transformation of the cities into faceless phenomenon occurs owing to the development of global economy and new information and communication technologies [2].

During the last decade of the last century, actually in 1994 and 1995, a number of European countries developed plans and policies for the electronic communication improvement within their societies. This was the beginning of the creation of so-called information society<sup>1</sup> with its main development objectives specified in a document called the Lisbon strategy<sup>2</sup>. Economic paradigm of our society is knowledge-based economy, with its main determinants: knowledge, change and globalisation. Knowledge-based economy produces a need for changes that are manifested in the emerging of innovation. Among the most important generators of innovation in the information society, ICT takes the significant place. This is directly in regard to the availability and accessibility of ICT to the citizens, organizations and throughout society. Education and training are priorities for the information society development, or as Carol Hughes points out: “Life today in higher education is lived in competitive space” [3].

## 1.2. Relevance and importance of ICT for professional work

At the outset it is necessary to define the ICT. The ICT “means any product that is used for storing, searching, manipulating, transmitting, sending and receiving information in electronic or digital form, such as for example telephone, fax, computer or digital television, and network and facilities used for their connection”[4]. In this paper, computer, telecommunications, Internet, World Wide Web and electronic information resources and e-services present ICT as a widespread set of technology tools.

Electronic education (e-education) takes on great importance worldwide. This can be seen in the fact that many universities have their own virtual studio applications. According to Milica Bajic Brkovic, this form of teaching has many advantages - a university education is accessible to those who study and work at the same time, the dynamics of schooling is adjusted to the user’s time, teachers can be recruited from all around the world, and so on. By e-education the other forms of education such as the concept of lifelong learning become possible. Many library resources are available to people around the world, which creates the opportunity for continuous education and its development [5].

When it comes to the ICT application in Serbia, we can conclude there is a lag to the implementation of new technologies in the development process. As Milica Bajic Brkovic points out: “The dynamics of progress that took place at one time promised acceleration of the process and announced the possibility of an early entry into the information society. Initial momentum and enthusiasm, however, soon became slower what makes us increasingly lag behind the European countries and regions [5].

The document titled *Strategy for an Information Society in Serbia* said that: “The education system must be adapted to provide effective education at all levels by promoting the creative thinking and the introduction of lifelong learning. As the widespread use of ICT has become crucial in many professions, knowledge of how to effectively use ICT should be an integral part of educational programs “[6]. The key areas of work allocated to the previous are:

- Adapting curriculum and teaching process to the needs of the information society - this means adhering of the higher education transformation in accordance with the Bologna declaration as well the introduction of modern teaching facilities, in particular ICT related issues, new teaching methods, better assessment methods and mechanisms for control the quality of teaching;
- Training of teaching personnel for modern forms of teaching - this form of training should be carried out continuously by the specially developed programs and standards of quality;

- Strengthening the capacity for modern education and scientific research - within this area the focus is on providing broadband academic network.

However, despite all the development tendencies of ICT, as define in the above-mentioned strategy, Serbia is faced with the lack of adequate professional staff. This appears owing to the educational structure which do not apply the principles of e-education model. According to Milica Bajic Brkovic: 'Investing in the generations to come' is a trend in many countries, but not in ours. We almost do not even know there is institution of additional education or training and updating knowledge with work, so-called lifelong learning"[5]. Therefore, the research which improves this area is necessary if we want to modernize not only the educational system, but the state as a whole.

### **1.3. The situation in Serbia - an example of the Faculty of Architecture, University of Belgrade**

When it comes to the Faculty of Architecture University of Belgrade, the modern tendencies in the curriculum have been implemented thanks to the Bologna process<sup>3</sup>. This was a challenge for both teachers and students - for teachers in terms of the opportunities for improvement in the way of teaching, while students got the opportunity to creatively explore the specific domains rather than to reproduce the learned material. Such an overall teaching context was a great opportunity to introduce the new ways of teaching. This implies more intensive application of modern information and communication technologies, activation of existing computer resources of the Faculty of Architecture, and the promotion of innovation in the exchange, generation and storage of knowledge.

The efficient form of the student activities monitoring through the combined teaching model, which consists of the lectures held in the traditional manner and the activities in a virtual educational environment, was applied to the elective courses of undergraduate studies<sup>4</sup>. Those are held on the basis of lessons learned from the previously explained compulsory subject and it is its super-

structure. The emphasis of this subject group is forming electoral knowledge and mastering the techniques of ICT, as well as the creation of an academic student network through the active use of the faculty website.

The virtual learning environment involves the simple orientation and effective support to the exchange of knowledge and consists of several elements. According to Mirjana Devetaković Radojević, a support system for the exchange of knowledge includes the following elements: web page of a particular subject, the front page of the virtual environment, a discussion forum and a collection of the student works. Web page of a particular subject presents the relationship between the institutional website and a virtual environment that is formed for a particular subject. The front page of virtual environment can be reached by activating a link from the website of the subject for which virtual environment is formed. This approach can be approved with user's identification. Discussion forum is the focus of knowledge exchange and consists of the topic title, tasks, examples, student contributions, and comments. Collections of the student works are structured collections where the work of each student can be monitored, or where all the contributions with which a student participated in the entire course appear [7].

If we compare the previously described virtual learning environment with other subjects at the Faculty of Architecture, it is concluded that the first two elements, the web page of the subject and the front page of the virtual environment, have been already applied. The aim of this is to determine whether there is a possibility to improve the mentioned type of educational model and to use it for most other subjects in terms of adequate student proficiency for professional practice.

### **1.4. Subject and objective, research questions and initial hypotheses of research**

The author explores the ways of using ICT in teaching and research purposes at the Faculty of Architecture, University of Belgrade. In a narrow sense, the work is concerned with the determining the degree of student satisfaction with e-services and information resources, their capability for

ICT, and the perception of the role and importance of ICT usage for professional work.

The specific goal of this work is to determine the possibility and frequency of ICT usage for the promotion of architectural education, and ways to overcome the current barriers when using ICT. The primary goal is to determine the degree of student preparedness for professional work in practice. The study is expected to answer the following research questions:

- Does the current faculty website provide the students with the necessary information while mastering the curriculum?
- To what extent are the students interested in introducing the new e-services and sources of information via the faculty website?
- What are the students' suggestions for the improvement of ICT in terms of schooling effectiveness?
- What is the potential benefit from the ICT usage for the students of the Faculty of Architecture?
- What are the barriers to full development of ICT-based learning environment in higher education institutions?
- To what extent does the curriculum prepare students to work in practice?
- What are the specific problems regarding to the ICT implementation during the transformation of architectural education in Serbia as a country that seeks EU integration?

To answer these questions, it is necessary to show the overview of existing ICT which have an impact on students while mastering the curriculum. The method for determining the current level of ICT usage by students is questionnaire, which results in providing insight into the evaluation of the student needs for e-materials and services that are offered at the faculty website, highlighting the dominant forms of available information usage, and suggestion the ways to improve existing and develop the new forms of ICT support in the teaching process.

The basic hypothesis is that the quality of education at the Faculty of Architecture can be promoted through the use of ICT training. Research contribution gives insight into the level of students' preparedness for future practical work.

## 2. Research overview

The introductory chapter gives the general review in the field of the ICT development and its application in the architectural education, with the concise overview of the current situation at the Faculty of Architecture, University of Belgrade. As there are no studies that deal with the given topic at the mentioned faculty, the aim of this study is to discover whether there is potential for further affirmation of the ICT usage for teaching purposes. The research should result in creating the complete picture of the ICT use at the faculty.

### 2.1. Research procedure

The study consists of three stages:

- A survey on the students' use of ICT, as well as their need for the new sources of information;
- A statistical and semiotic analysis (content analysis) of survey questions and responses;
- The possible implementation of faculty suggestions obtained from the survey concerning existing situation, and planning for future development.

The article reports mostly on the first two stages.

The research sample of this study was composed of 30 students from the third year of undergraduate studies at the Faculty of Architecture, University of Belgrade. The students were selected randomly, but the analytical unit of 30 students is considered valid for the purposes of statistical analysis, because a small percentage leads to the generalisation of research findings.

The empirical data for the study were collected and processed by the questionnaire as a relevant method. Since the research aims to discover new proposals, which do not arise only from the author's attitude, the survey method was selected as the most adequate one.

An appropriate instrument for the collecting data was a questionnaire consisting of 26 questions divided into two parts. The first part relates to the degree of ICT use in the learning and research purposes by students. The second part of the questionnaire is dedicated to identifying stu-

dent's needs for information, their level of satisfaction with existing e-resources and information services, suggestions regarding involving the new services as well as recommendations for their improvement in the future. The content and types of questions varied from factual (numerical), closed, and open-ended. The content analysis of used words, phrases, concepts, and proposals for improvement within the open-ended questions is also used as a method of collecting data.

## 2.2. Overview and findings about the first part of the questionnaire

The first part of the questionnaire relates to the collecting data about the profile of students and their usual method of ICT use in the process of mastering the curriculum. All survey participants own and are able to use a computer with Internet access at their homes.

As Fig. 1 shows, 60 per cent of the students spend more than 30 hours per week using computers, excluding the computer usage as Internet access. Twenty per cent of students stated they use computer between 21 and 30 hours a week, which is identical with the percentage of students who use computer from 10 to 20 hours per week. There was no percentage of students who use computers less than 10 hours per week. When it comes to the Internet usage by students, results are as follows: 20 per cent of respondents spend less than 10 hours using the Internet, a half of the respondents use the Internet for more than 20 hours per week. Only 2 per cent of students spend between 21 and 30 hours on the Internet, while 24 per cent of the respondents spend more than 30 hours per week using the Internet. The answers from the first part of the

questionnaire show a great interest among students for using ICT in the learning process. The survey results indicate that students spend more time using the computer as the indispensable tool for all academic activities, comparing to the Internet. It is interesting to note that if the use of computers as a basic means for work increases, so far the time spent on the Internet is up to 2.5 times less. On the contrary, if students spend more time using Internet as the main ICT tool, the time used for work on the computer is only a half of that. From this we can conclude that the use of the Internet is an important preparatory activity for the efficient acquisition of teaching materials on the computer.

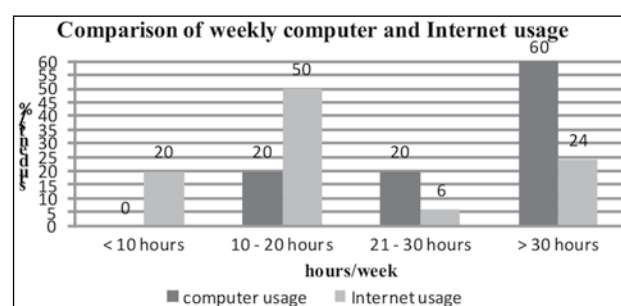


Fig. 1. Comparison of weekly computer and Internet usage by students

Analysis of these data leads to the conclusion that students are aware of the benefits of ICT compared to the traditional teaching methods. Therefore, students are working hard to master the tools of ICT, although the process of learning to use new technologies is not considered simple at all, which indicates the low percentage of students who find the ICT tools as readily manageable.

Table 1 shows which activities are considered the most popular when it comes to using the basic ICT tools - the computers and the Internet. First of all, these are the preparatory activities for teaching

Table 1. Purposes of students' use of ICTs

Questionnaire item	Number of students	Percentage
Preparation of study materials and class exercises	21	70
Exchange of study materials, electronic tests and class assignments	17	56
Communication and collaboration with other students	19	63
Locating, collecting and analysing data	23	76
Preparation of papers and research proposals	10	33
Use of the web-publications	14	46

and learning in the form of: locating, collecting and analysing data, (76%), followed by preparation of study materials and class exercises (70%), followed by communication and collaboration with other students (63%), exchange of the study materials, electronic tests and class assignments (56%), the use of the web-publications (46%) and, finally, preparation of papers and research proposals (33%), which indicates that traditional methods of learning are still used during the creative process of designing and intellectual process of writing a research proposal.

Speaking about the reasons for the using the special forms of ICT when accessing the Internet, the results are as follows (Table 2): ICT are used by students mainly to enhance communication with others (83%), then to take advantage of electronic delivery of information (80%), followed by saving time and increasing productivity (76%) and finding of undiscovered information (53%). Activities such as easily monitoring the current research trends (20%), and determining confidence in reviewing literature (16%) were not so popular, which could be interpreted as insufficient educational maturity of students for such forms of

learning, which is expected of students during the higher levels of studies. In this context the popularity of certain ICT formats can be interpreted.

The most popular forms of ICT tools used by students in the learning process (Table 3) are: electronic journals, books and other sources of text formats (90%), as well as websites with the same percentage of use. The second highest rate holds the course website (76%), while the third one is electronic mail and document exchange (70%), which is above digital video and audio recordings (63%). In the process of mastering the curriculum students use graphics and digital images (60%), followed by an online library (30%) and interactive multimedia software (17%). Table 3 indicates that only online library and interactive multimedia software is used up to three times less than other forms of ICT tools. This is the result of the fact that the two above mentioned ICT tools are designed for more complex processes of teaching at higher levels of studies.

In general, 97 per cent of the students stated that they benefit from using ICT in their learning and research activities, while only 3 per cent of the students find there is no benefit from the ICT

Table 2. Students' reasons for using ICTs

Questionnaire item	Number of students	Percentage
Saving time and increasing productivity	23	76
Determining confidence in reviewing literature	5	16
Finding of undiscovered information	16	53
Easily monitoring the current research trends	6	20
Use of electronic delivery of information	24	80
Enhancement of communication with others	25	83

Table 3. Formats of ICT used by students in learning and research

Questionnaire item	Number of students	Percentage
Electronic journals, books and other sources of text formats	27	90
Online library	9	30
Course website	23	76
Digital video and audio recordings	19	63
Interactive multimedia software	5	17
Graphics and digital images	20	60
Websites	27	90
Electronic mail and document exchange	21	70



usage. We can conclude that the use of ICT tools has the impact on the increasing the student productivity in the learning process, improvement of communication with colleagues and easily locating new useful information.

### 2.3. Overview and findings about the second part of the questionnaire

The second part of the questionnaire is devoted to the identification of the primary students' demands in the learning process, determining the degree of student satisfaction with the existing faculty website and students' suggestions for improvement the ICT-based teaching. In this part of the questionnaire the significant number of open-ended questions was used, for considering the student needs and proposals in a constructive way.

The first question of this part of the questionnaire is in regard to the ways of students' finding the necessary information in the learning process (Table 4). The intention of the question thus posed is to discover students' ability to classify the main sources of information. As the main source of information, most of the students used electronic resources (80%) as follows: websites of various organizations, but not both domestic and foreign faculties, and then different web-publications. Google and Yahoo browsers are very popular, as well as Wikipedia that is relevant for students' research needs.

Table 4. Main sources for students' searches and data

Questionnaire item	Number of students	Percentage
Electronic sources	24	80
• websites		
• web-publications		
• google-browsers		
• wikipedia		
Printed sources	11	36
Teacher's consultation	2	7

This shows that the students are not well informed about the reliable sources of information on the Internet, such as Kobson or Google Scholar

browser where the refereed journals, conference proceedings and books can be found. A much smaller percentage of the students use printed resources as the basic literature in the learning process. In fact, only 36 per cent of the students use books and manuscripts from the library. It is interesting that no one mentions a conversation with the librarian as one of the sources of information, while only 7 per cent of the students lead the consultations with teachers as the relevant form of gaining new knowledge. Above-mentioned classification of the basic sources of information indicates that the traditional way of learning, which involves direct contact and interactive discussion between teachers and students, is replaced with ICT-based learning to a large extent.

The next question is in regard to evaluation of the current website impact on learning process. Slightly less than a half of respondents (43%) stated that ICTs do not influence student approach to search for needed information, while 57 per cent of respondents believe that ICT affect change in the model of learning. The more detailed review of the ICT influence on the learning process is given in the table 5, where the positive and negative factors in the process of e-learning are sublimated. The total ratio of the positive and negative effects arising from the use of ICT in the learning process is almost equal. Specifically, students reported that their biggest obstacle in the faculty website use are access restrictions (67%), followed by problems with the network connection (60%) and the lack of the necessary links within front pages of the virtual environment (46%). Finally, the minor problems in access to faculty website are the lack of instructions (23%) and lack of time (16%). If we consider the top three negative factors when using the faculty website, it can be concluded that it is a technical glitch. However, access restrictions are caused by the lack of input or input the wrong password. The condition for its obtaining is the presence at the lectures or exercises at the faculty, so this is the indicator of insufficient coupling of the electronic and traditional forms of learning, and not a technical problem, which applies to the remaining two negative parameters.

When it comes to the positive effects of the ICT usage in the learning process, 83 per cent of the students stated that the biggest advantage is the

ability to work from home. Also, for its benefits stands the possibility of smooth and clear overview of the complete lectures, which is considered useful by 63 per cent of students, while the advantage of „speeding up“ the learning process took the third place with 53 per cent of the respondents. The particularly indicative is the fact that none of the respondents (0%) consider the traditional learning model as a superior one compared to the modern e-learning. This data refer to the benefits of the e-learning or the synthesis of the two known forms, but not with domination of the traditional one, which illustrates the students' ability to use

ICT in the learning process. It is understood that the entire student population is not at the same level in terms of knowledge and skills to use ICT, but the fact is indicator of their aspirations for the constant improvement in order to acquire new skills, which, eventually, lead to new knowledge.

The next set of questions relate to the frequency of using the e-learning services, the degree of accessibility to the necessary information on the faculty website and the reasons for their unavailability (Table 6). When it comes to how often students use the e-learning, the figures refer to the usage less than five times a week are almost equal, while the

Table 5. Overview of negative and positive effects during e-learning process

Questionnaire item	Number of students	Percentage
<i>Negative effects</i>		
• lack of time	5	16
• of the necessary links within front pages of the virtual environment	14	46
• problems with the network connection	18	60
• lack of instructions	7	23
• access restrictions	20	67
<i>Positive effects</i>		
• „speeding up“ the learning process	16	53
• possibility to work from home	25	83
• possibility of smooth and clear overview of the complete lectures	19	63

Table 6. The frequency of using the e-learning services, the degree of accessibility to the necessary information on the faculty website and the reasons for their unavailability

Questionnaire item	Number of students	Percentage
<i>Frequency of e-services usage</i>		
• very rarely (< once a week)	5	16
• rarely (1 -2 times a week)	4	13
• often (3 - 5 times a week)	4	13
• very often (>5 times a week)	16	53
<i>Did you find all the necessary information at the faculty website?</i>		
• yes	10	33
• no	13	43
• no responses	5	16
<i>Reasons of unavailability of information</i>		
• difficulties in finding the teaching materials	10	33
• difficulties with access	6	20
• lack of instructions	10	33
• other	4	14

sharp increase is recorded in the case of the e-learning use for more than five times a week. To be more precisely, 53 per cent of the student population use e-learning more than five times a week, 13 per cent use the service from one to five times a week, while 16 per cent use it very rarely (less than once a week). Much frequent use of e-learning is the result of proper utilization of the e-learning advantages.

On the question posed to students: Did you find the necessary information on the faculty website?, 33 per cent of studied sample answered yes, 43 per cent stated no, while 16 per cent of the students did not know how to answer the question. In students' opinion the main reasons that lead to the inability of usage the e-learning service are: of-dated lectures, the lack of complete lectures, the incomprehensible information which require necessary consultations with teachers, and the number of teachers who are not versed in data presentation via e-learning service. This is directly related to the need for the teachers' training in accordance with a modern teaching methodologies. The main reasons for the unavailability of information refer to difficulties in finding the teaching materials and the lack of instructions, both with 33 per cent of the students' votes, followed by difficulties with access, which is the main problem in opinion of the 20 per cent of respondents. This includes the website overloading by the large number of students, leading to the slower flow of information. However, 14 per cent of respondents state that they are able to come up with all the necessary information from the faculty website without any problems.

### 3. Conclusion remarks

The conclusion to be drawn by analyzing the first part of the questionnaire is that ICT positively affect the student productivity in the learning process. This can be seen in the following:

- Improved communication with colleagues;
- Easiness to find the new information relevant for the lectures;
- Internet is the important form of ICT tools to master the preparatory activities in the learning process;
- ICT-based learning is more advanced than traditional methods of learning;

- Willingness to invest the effort in the mastering of ICT tools is considered the logical consequence of the desire to use new technologies.

The second part of the questionnaire provides the classification of primary students' demands in the learning process, and also shows the degree of student satisfaction with the existing faculty website. Modern learning process is largely done through the new technology, in contrast to the earlier direct exchange of the information among colleagues. However, the results show that the synthesis of the electronic and traditional learning is necessary. The main obstacles when using the faculty website are defined as the technical problems, but there is also the lack of coupling the electronic and traditional learning. The analysis of the survey results leads to the conclusion that students are interested in the affirmation of the existing website, which could be done by the straightforward approach to data, providing access to additional links regarding the lecture topic, as well as access to the additional links concerning the faculty course. Students also agree with the modernization of the teaching process through the introduction of the new ICT forms.

The results of this study represent only a starting point and open up the new possibilities for research in this area. The aim was to point out the flaws in modern educational process, and to formulate the basic guidelines to overcome them. The application of the modern trends in education with the simultaneous use of the traditional methods should become the goal of Serbian universities. Education of the future architects should play a major role in the modernization of Serbia, in terms of academic research and development of information and communication technologies. Education should play an important role in the re-defining of the social values, by giving the good models and initiating the social reconstruction. In this way professional architecture education may be useful for creating a good environment for the modernization of the entire nation.

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4. *Three subjects which promote innovative forms of teaching are: Mathematics in Architecture 1, Principles of CAAD and Mathematics in the architecture 2. These subjects form a selection group of subjects, whose classes are held during the second semester of the first year of undergraduate studies.*

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## (Endnotes)

1. The term information society is in regard to other concepts, like "global village", "technotronic era", "post-industrial society", "information age", "intelligence society", "information society", "knowledge society" (<http://vecam.org/article517.html>, 29.01.2010.)
2. The most important action plan adopted at the Lisbon summit of EU member states is: "eEurope 2005 - Action Plan of the European Union on the Development and Application of ICT" (Milovanovic Rodic, 2009).
3. More on this in Savic, M., Nikolic, V. and Timotijevic, M. (Ed.) (2006). *Studies by European standards*. Belgrade: Faculty of Architecture.