

Univerzitet u Beogradu  
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Beograd, Srbija



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Bulevar kralja Aleksandra 73/II  
Belgrade, Serbia

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Naučno – stručni simpozijum  
**INSTALACIJE & ARHITEKTURA 2012**

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ZBORNIK RADOVA  
8. novembar 2012.  
Beograd

ISBN 978-86-7924-086-6

CIP - Каталогизacija u publikaciji  
Nародна библиотека Србије, Београд

721.01(082)(0.034.2)  
69(082)(0.034.2)

НАУЧНО-стручни симпозијум Инсталације и архитектура (2012 ;Београд)  
Zbornik radova [Elektronski izvor] / Naučno-stručni simpozijum Instalacije &  
arhitektura 2012, 8. novembar 2012, Beograd ;  
[organizator] Univerzitet u Beogradu, Arhitektonski fakultet =  
[organizer] University of Belgrade, Faculty of Architecture ;  
urednici Gordana Ćosić, Milan Radojević, Milica Pejanović. –  
Beograd : Arhitektonski fakultet, 2012 (Beograd : Arhitektonski fakultet). –  
1 elektronski optički disk (CD-ROM) ; 12 cm

Sistemska zahtevi: Nisu navedeni. - Nasl. sa naslovnog ekrana. –  
Radovi na srp. i engl. jeziku. - Tiraž 100. - Napomene uz tekst. -  
Bibliografija uz svaki rad. - Rezimeji; Summaries.

**ISBN 978-86-7924-086-6**

1. Ћосић, Гордана [уредник] 2. Архитектонски факултет (Београд)  
а) Зграде - Пројектовање - Зборници б) Зграде - Инсталације - Зборници  
COBISS.SR-ID 194988812

Izdavač: Arhitektonski Fakultet Univerzitet u Beogradu

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Dizajn korica: Asis. Vladimir Parežanin

Štampa: Arhitektonski fakultet, Bulevar kralja Aleksandra 73, Beograd, Srbija

Tiraž: 100 primeraka





instalacije i arhitektura  
**8. novembar 2012.**

Zbornik je štampan sredstvima Arhitektonskog fakulteta Univerzitet u Beogradu  
i uz finansijsku pomoć Inženjerske komore Srbije

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Globalizacija i stalni razvoj novih tehnologija u oblasti građevinarstva i sve složeniji zahtevi investitora i društvene zajednice za izgradnju energetski efikasnih objekata sa velikim brojem integrisanih instalacionih sistema, potvrda su za organizatore da po treći put organizuje naučno-stručni skup **Instalacije & Arhitektura 2012**. Arhitektonski objekat kao jedinstvena celina oblika, funkcije, konstrukcije i instalacija u današnje vreme podrazumeva primenu savremenih, složenih instalacionih sistema, a s tim u vezi i uključivanje šireg kruga stručnjaka u svim fazama životnog veka jedne zgrade.

Prvenstveni cilj skupa je prezentacija savremenih naučnih i stručnih dostignuća u oblasti instalacionih sistema, mreža i postrojenja u svim fazama izgradnje objekata (projektovanje, izvođenje radova i eksploatacije instalacija). Za skup Instalacije & Arhitektura 2012, objavljen je Zbornik sa radovima na srpskom i engleskom jeziku, ukupno 29 radova, prevashodno iz zemlje i okruženja. Zadovoljstvo nam je da istaknemo da radovi u ovom zborniku obuhvataju kompleksne arhitektonske, mašinske i elektro instalacione sisteme, kao i elemente i sklopove zgrada u svetlu održive gradnje.

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Poštovane kolegice i kolege, dragi prijatelji, nadamo se da će se ovaj skup u narednim godinama nastaviti i postati tradicionalan, kao i da će ga stručna i naučna javnost prihvatiti i podržati. Očekujemo sve Vaše sugestije i predloge za buduća okupljanja, a u cilju poboljšanja kvaliteta i kompetencija skupa i struke u celosti.

Beograd, oktobar 2012. godine

Organizacioni odbor **I&A 2012**



Naučno-stručni simpozijum  
**INSTALACIJE & ARHITEKTURA**  
8 novembar 2012.  
Univerzitet u Beogradu - Arhitektonski fakultet  
Bulevar kralja Aleksandra 73/II

## SADRŽAJ

<b>ALEKSANDRA KRSTIĆ-FURUNDŽIĆ, TATJANA KOSIĆ, JEFTO TERZOVIĆ.....</b>	<b>11</b>
KONSTRUKTIVNE KARAKTERISTIKE STAKLENIH FASADNIH PANELA .....	11
STRUCTURAL CHARACTERISTICS OF GLASS FACADE PANELS.....	11
<b>ANA PERIĆ, ALEKSANDRA KOSTIĆ, LIDIJA ĐOKIĆ,.....</b>	<b>17</b>
PREPORUKE ZA SELEKCIJU I PRIMENU VATROOPOJNIH MATERIJALA U ENTERIJERU .	17
RECOMMENDATIONS FOR SELECTION AND USE OF FIRE-RESISTANT INTERIOR MATERIALS .....	17
<b>DRAGANA VASILJEVIĆ TOMIĆ, ANA NIKEZIĆ, DRAGANA ĆIRIĆ.....</b>	<b>23</b>
IMPLEMENTACIJA STANDARDA PRISTUPAČNOSTI: MODEL JAVNOG SANITARNOG OBJEKTA NA PRINCIPIMA INKLUZIVNOG DIZAJNA .....	23
IMPLEMENTATION OF ACCESSIBILITY STANDARDS: PUBLIC SANITARY FACILITY MODEL BASED ON THE INCLUSIVE DESIGN PRINCIPLES .....	23
<b>DANILO S. FURUNDŽIĆ .....</b>	<b>35</b>
STAKLO KAO KROVNI POKRIVAČ: SLUČAJ ZIMSKE BAŠTE HOTELA .....	35
GLASS AS ROOF COVERING: HOTEL WINTER GARDEN CASE .....	35
<b>ĐORĐE MANDRAPA, VLADIMIR PAREŽANIN.....</b>	<b>41</b>
SRPSKA CRKVENA ARHITEKTURA DANAS KAO POSLEDICA RAZVOJA MODERNE MISLI .	41
SERBIAN CHURCH ARCHITECTURE TODAY AS A CONSEQUENCE OF THE DEVELOPMENT OF MODERN THOUGHT .....	41



<b>ĐORĐE NENADOVIĆ, VLADIMIR KOVAČ, VLADIMIR PAREŽANIN.....</b>	<b>47</b>
TIPOVI I KLASIFIKACIJA PROGRAMSKIH PAKETA ZA RAČUNARSKU OBRADU GRAFIKE U ARHITEKTURI .....	47
CLASSIFICATION OF COMPUTER GRAPHICS SOFTWARE FOR USE IN ARCHITECTURAL DESIGN .....	47
<b>DRAGAN MARČETIĆ.....</b>	<b>53</b>
ARHITEKTURA IZMEĐU TEORIJE I PRAKSE, UMETNOSTI I TEHNIKE .....	53
ARCHITECTURE BETWEEN THEORY AND PRACTICE, ART AND TECHNOLOGY .....	53
<b>GORAN ĆIROVIĆ, MARINA NIKOLIĆ TOPALOVIĆ, SNEŽANA MITROVIĆ....</b>	<b>59</b>
SANITARY FACILITIES AND ENERGY EFFICIENCY .....	59
SANITARNI UREĐAJI I ENERGETSKA EFIKASNOST .....	59
<b>GORDANA ĆOSIĆ, VLADAN JOVANOVIĆ, MILAN RADOVANOVIĆ .....</b>	<b>67</b>
PROJEKTOVANJE INSTALACIJA I VODOVODA I KANALIZACIJE BEZ INFRASTRUKTURNIH PRIKLJUČAKA.....	67
DESIGNING OF WATER SUPPLY AND DISPOSAL SYSTEMS ON SITES WITHOUT INFRASTRUCTURE NETWORKS.....	67
<b>IŠTVAN MOLNAR .....</b>	<b>73</b>
PRAKTIČNO ISKUSTVO U PRIMENI "ECODESIGNERA (ARCHICAD)" U FUNKCIJI POVEĆANJA ENERGETSKE EFIKASNOSTI STAMBENOG OBJEKTA .....	73
PRACTICAL EXPERIENCE IN APPLYING "ECODESIGNER (ARCHICAD)" IN ORDER OF ACHIEVING ENERGY EFFICIENCY OF RESIDENTAL BUILDING .....	73
<b>JASNA ČIKIĆ-TOVAROVIĆ, JELENA IVANOVIĆ-ŠEKULARAC, NENAD ŠEKULARAC .....</b>	<b>81</b>
GLOBALNI TRENDOVI U RAZVOJU ARHITEKTURE OD STAKLA .....	81
GLOBAL TRENDS IN GLASS ARCHITECTURE DEVELOPMENT .....	81
<b>JELENA IVANOVIĆ ŠEKULARAC, NENAD ŠEKULARAC, JASNA ČIKIĆ TOVAROVIĆ .....</b>	<b>91</b>
DRVO I PROIZVODI OD DRVETA KAO ELEMENTI FAŠADNE OBLOGE U ARHITEKTONSKOM OBJEKTU U KOMBINACIJI SA DRUGIM MATERIJALIMA .....	91
WOOD AND WOOD PRODUCTS AS AN ELEMENTS OF ARCHITECTURAL BUILDINGS' LINING IN COMBINATION WITH OTHER MATERIALS.....	91
<b>JELENA MILOŠEVIĆ, MIODRAG NESTOROVIĆ .....</b>	<b>97</b>
KOMPOZITNE PROSTORNE STRUKTURE.....	97
COMPOSITE SPACE STRUCTURES.....	97

<b>JELENA TRIVIĆ, NIKOLA KLEUT .....</b>	<b>103</b>
PLANIRANJE I PROJEKTOVANJE ZGRADA ZA ODLAGANJE OTPADA PREDUZEĆA.....	103
PLANNING AND DESIGN OF BUILDINGS FOR WASTE DISPOSAL OF A UTILITY COMPANY .....	103
<b>KATARINA VUKOSAVLJEVIĆ .....</b>	<b>111</b>
SMERNICE ZA USPEŠNU PRIMENU PROCESA ENERGETSKE SERTIFIKACIJE STAMBENOG FONDA REPUBLIKE SRBIJE SLEDEĆI PRIMERE ADEKVATNE IMPLEMENTACIJE ZAKONSKE REGULATIVE U ZEMLJAMA EU .....	111
DIRECTIVES FOR SUCCESSFUL IMPLEMENTATION OF THE ENERGY CERTIFICATION OF BUILDINGS IN THE REPUBLIC OF SERBIA FOLLOWING THE EXAMPLES OF ADEQUATE IMPLEMENTATION OF REGULATIONS IN EU COUNTRIES .....	111
<b>MILJAN MIKIĆ, ZORANA PETOJEVIĆ, NENAD IVANIŠEVIĆ, BRANISLAV IVKOVIĆ.....</b>	<b>117</b>
PROJECT RISK MANAGEMENT AND BIM APPLICATION IN SERBIA – SURVEY RESULTS	117
PRIMENA UPRAVLJANJA PROJEKTNIM RIZICIMA I BIM TEHNOLOGIJA U SRBIJI – REZULTATI ISTRAŽIVANJA .....	117
<b>MILAN RADOJEVIĆ, MIRJANA DEVETAKOVIĆ, JOVANA MIHOLČIĆ .....</b>	<b>125</b>
FACILITY MANAGEMENT – PREDLOG KRITERIJUMA ZA ODRŽAVANJE ZGRADA .....	125
FACILITY MANAGEMENT – DRAFT CRITERIA FOR BUILDING MAINTENANCE.....	125
<b>MILICA PEJANOVIĆ, IGOR SVTEL .....</b>	<b>131</b>
PREDLOG MODELA KLASIFIKACIJE PROJEKTANTSКИH GREŠAKA U PROCESU IZRADE PROJEKTNE DOKUMENTACIJE.....	131
PROPOSED MODEL FOR CLASSIFICATION OF DESIGNER ERRORS IN THE PROJECT DOCUMENTATION.....	131
<b>MILICA VUJOŠEVIĆ, MILUTIN MILJUŠ.....</b>	<b>143</b>
UPRAVLJANJE NAUČNOISTRAŽIVAČKIM PROJEKTIMA U OBLASTI ARHITEKTURE, URBANIZMA I GRAĐEVINARSTVA .....	143
MANAGEMENT OF SCIENTIFIC RESEARCH PROJECTS IN THE FIELD OF ARCHITECTURE, URBANISM AND CONSTRUCTION .....	143
<b>MIRJANA DEVETAKOVIĆ, MILAN RADOJEVIĆ .....</b>	<b>151</b>
INTEGRISANO MODELIRANJE ARHITEKTONSKIH OBJEKATA – FAMILIJE KOMONENTI SPECIJALIZOVANIH PROIZVOĐAČA, KAO DEO BIM OKRUŽENJA .....	151
INTEGRATED MODELLING OF ARCHITECTURAL OBJECTS - FAMILIES OF BUILDING COMPONENTS BY SPECIALIZED MANUFACTURERS, AS PART OF BIM CONTEXT.....	151
<b>NEVENKA KNEŽEVIĆ – LUKIĆ, ALEKSANDRA LJUŠTINA .....</b>	<b>159</b>
ARHITEKTONSKO PROJEKTOVANJE I BEZBEDNOSNI MENADŽMENT .....	159
ARCHITECTURAL DESIGN AND SECURITY MANAGEMENT .....	159

<b>NIKOLA KLEUT .....</b>	<b>167</b>
IZLOŽENOST KONSTRUKCIJA ZGRADA POŽARU I STEPEN OTPORNOSTI NA POŽAR .....	167
IZLOŽENOST KONSTRUKCIJA ZGRADA POŽARU I STEPEN OTPORNOSTI NA POŽAR .....	167
<b>SNEŽANA ĐORIĆ-VELJKOVIĆ, SOFIJA RANČIĆ.....</b>	<b>183</b>
INNOVATIVE SYSTEMS AND INSTALLATION FOR PROVIDING OF LIGHT INTO THE BUILDINGS.....	183
INOVATIVNI SISTEMI I INSTALACIJE ZA UVOĐENJE SVETLOSTI U OBJEKTE .....	183
<b>TATJANA JURENIĆ, MILOŠ GAŠIĆ .....</b>	<b>191</b>
PODSTICAJI I MOGUĆNOSTI INOVACIJA U PRISTUPU PROCESU IZGRADNJE OBJEKATA .....	191
INCENTIVES AND OPPORTUNITIES FOR INOVATION IN BUILDING CONSTRUCTION PROCESS APPROACH .....	191
<b>VLADIMIR DIMITRIJEVIĆ, MELANIJA PAVLOVIĆ .....</b>	<b>197</b>
OTVORENI BAZENI SPORTSKOG CENTRA "MILAN GALE MUŠKATIROVIĆ" - PRIMERI I TEHNIČKE PREPORUKE ZA PRIMENU SISTEMA MAPEI .....	197
OUTDOOR SWIMMING POOLS "MILAN GALE MUŠKATIROVIĆ" - EXAMPLES AND TECHNICAL RECOMMENDATIONS FOR IMPLEMENTING MAPEI SYSTEMS .....	197
<b>VLADIMIR PAREŽANIN, IVANA LUKIĆ, ĐORĐE NENADOVIĆ .....</b>	<b>209</b>
INFRASTRUKTURA GRADA - ZELENE PIJACE BEOGRADA .....	209
CITY INFRASTRUCTURE - GREEN MARKETS OF BELGRADE .....	209
<b>VLADIMIR STEVANOVIĆ .....</b>	<b>217</b>
ZNAČAJ PROPORCIJSKIH SISTEMA U ARHITEKTONSKOM PROJEKTOVANJU .....	217
SIGNIFICANCE OF PROPORTIONAL SYSTEMS IN ARCHITECTURAL DESIGNING .....	217
<b>ZORAN CEKIC, NEBOJŠA SURLAN .....</b>	<b>223</b>
CLIENT VALUE SYSTEM .....	223
SISTEM VREDNOSTI KLIJENTA.....	223
<b>ŽELJKO GAŠPAROVIĆ .....</b>	<b>229</b>
EVAKUACIJA OTPADA IZ OBJEKATA .....	229
EVACUATION FROM WASTE FACILITY.....	229

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## PROJECT RISK MANAGEMENT AND BIM APPLICATION IN SERBIA – SURVEY RESULTS

### *Summary*

Although risk towards construction project success may occur in any of project life cycle phase, it is most important for risks to be analyzed and assessed in project development process, where Building Information Modelling (BIM) could improve Project Risk Management (PRM). Risks, if not timely identified, treated and controlled cause that project actual performance significantly varies from planned values. This paper presents results of an still ongoing infrastructure construction project risks survey for projects settled in Serbia. The survey includes: Analysis of usage, necessity and problems with construction PRM practice and BIM practice in Serbia.

### *Key words*

Risk, Construction Project Risk Management, Infrastructure, BIM.

## PRIMENA UPRAVLJANJA PROJEKTNIM RIZICIMA I BIM TEHNOLOGIJA U SRBIJI – REZULTATI ISTRAŽIVANJA

### *Rezime*

Iako se rizici po uspeh projekta izgradnje mogu pojaviti u bilo kojoj fazi realizacije projekta, najvažnije je rizike analizirati i proceniti u fazi razvoja idejnog projekta, pri čemu Building Information Modelling (BIM) može da poboljša upravljanje rizicima na projektu. Ako se na vreme ne identifikuju, tretiraju i kontrolišu, rizici mogu značajno ugroziti planirane ciljeve projekta. U radu su predstavljeni rezultati istraživanja koje je još uvek u toku, na temu rizika na projektima izgradnje infrastrukture u Srbiji. Između ostalog, izvršena je analiza primene, potreba i problema vezano za praktičnu primenu BIM tehnologija i upravljanja projektnim rizicima.

### *Ključne reči*

Rizik, upravljanje rizicima na građevinskim projektima, infrastruktura, BIM

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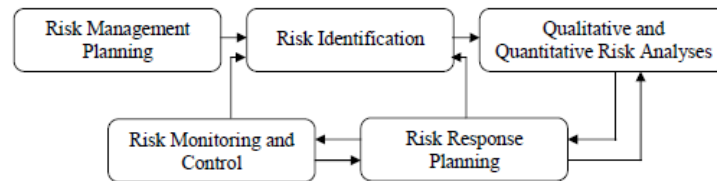
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## 1. INTRODUCTION AND BACKGROUND

Project Risk Management (PRM) in construction, as one of construction project management areas, is extended well beyond the confines of insurance and helps to analyze, mitigate and control risks associated with project cost, schedule, quality, performance, health and safety aspects, environmental aspects but, as well, with other, non-tangible factors, such as corporate image, employee satisfaction, increased customer service [1-3]. Project risk is an uncertain event or condition that, if occurs, has a positive or a negative impact on at least one project objective [4]. Risk is described with a probability of event occurrence and a possible impact that it might have on project goals [5]. On figure 1, the PRM procedure is shown as defined by Project Management Institute (PMI) [4].



*Fig. 1) (adapted from [4]): Project Risk Management (PRM) Processes*

Risk Management Planning is the process of defining how to conduct risk management activities for a project. In Risk Identification, it is determined which risks may affect the project. Qualitative Risk Analysis is the process of prioritizing risks for further analysis or action by assessing and combining their probability of occurrence and impact. Quantitative Risk Analysis is numerical analysis of the effect of identified risks on overall project objectives. Risk Response Planning develops options and actions to enhance opportunities and to reduce threats to project objectives. Finally, Risk Monitoring and Control is the process of implementing risk response plans, tracking residual and new risks and evaluating risk process effectiveness throughout the project.

Large infrastructure projects, due to their nature, specific construction sites, project surrounding, numerous stakeholders, multidisciplinary character, being often complex and international are followed by many uncertainties. In feasibility, design and construction phases of an infrastructure project, it is very important for all stakeholders to be aware of possible threats to the project goals and overall project success. This is especially important for advance planning stage (Figure 2), in which up to 98% of all savings on the project could be made [6]. Much more attention in project management research and practice has been paid to construction, while much less has been focused on advance planning and design phases [7]. Starting from these phases, and particularly from preliminary design, Building Information Modelling (BIM) technologies could be applied. BIM is in literature defined as an evolution of traditional design process, where, dislike from existing practice, design procedure starts and continuous with process of forming a unique 3D model of object that contains all elements of object with information about types, quantities, characteristics of all building materials and equipment, but also, among other, information about planned values of construction costs and schedule [8]. While forming, such a model can be manipulated by more than one designer at the same time, while, after formed, it could be used and upgraded in construction and exploitation phase from different stakeholders. Basic benefits of BIM technologies application in relation to project management would be: standardization of design process, timely discovering and reduction

of design collisions, more accurate and efficient project cost and time planning, easier project performance control [8]. These benefits might be reasons for owner and/or project management team to choose BIM as one of risk avoiding techniques.

## 2. METHODS

In order to provide the opinion of construction professionals on potential risks sources regarding infrastructure project cost, time and quality performance, a survey of Serbian market is conducted. Within this research, infrastructure projects were defined as: road, railroad network projects, water supply and sewage system, gas infrastructure, electricity and telecommunication projects. In the survey, which is still ongoing, existence of risk management practice, as well as the possibility of application of BIM as a risk avoiding technique in Serbia were examined. A goal was also to identify major risks to infrastructure project performance, but due to the scope of this paper, results of that part of the survey will not be presented here.

Some of the previous surveys on construction projects risk perceptions, based on questionnaires with predefined risk list were those conducted by: Adams (2008) [9], comparing perceptions of risks between UK and Ghana contractors; Andi (2006) [10], exploring the importance and allocation of risks on projects in Indonesia; De Camprieu (2007) [11], examining the perceptions of risk among Chinese and Canadian large-scale projects practitioners; and Zou et al. (2007) [12], identifying the key construction projects risks in China and Australia. Thomas et al. (2003) [13] and Bryde and Volm (2009) [14] explored, respectively, the most critical risks of an Indian BOT road projects in an unstructured interview and perception of risks of owners in German construction projects in a semi-structured interview based surveys. Here, the results of three parts of the questionnaire will be presented:

- The PART 1 contained 7 general questions.
- In the PART 2, there were 11 questions which examined the practice of construction project management in Serbia. Risk was here defined as an event that could potentially impact the basic project performance goals (costs, time and quality).
- The PART 3 consisted of 6 questions which analyzed the problems and potential application of BIM as a risk avoiding technique. A basic definition of BIM was given in the first question in this part of the survey.

As risks, General market risks, Risks in Feasibility and Design phase and Risks in Construction phase were considered (Fig. 2).

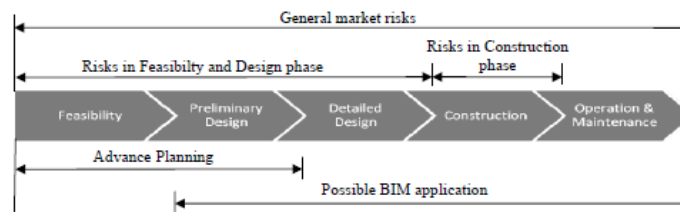


Fig. 2) (adapted from [7]): Infrastructure construction project phases and Risk areas

The survey was distributed to 65 construction professionals with experience on infrastructure construction projects in Serbia. It was also available for the LinkedIn PMI Local Chapter Serbia and Association of Consultant Engineers of Serbia (ACES) group members to take part in. In the survey 36 respondents took part, of which 31 responses were complete. Only complete responses were analyzed.

### 3. RESULTS

Among all respondents, almost all (97%) were construction or civil engineers. 55% of all respondents confirmed that in their career they have worked as a project manager, 42% that they have worked as a designer, 42% confirmed they have worked as a contractor, 39% as a consultant, 29% in company management team, 26% as a supervising engineer, 19% as an investor, 16% have worked the other as well.

The most of respondents have participated in road infrastructure projects (72%), in water supply & sewage system (45%), while significantly less have participated in gas infrastructure projects (17%), in railroad network projects (10%) and in electricity, telecommunication projects (10%). The value of the largest infrastructure projects they have taken part in, for 77% of engineers, was more than 10 EUR millions.

#### 3.1. ANALYSIS OF PROJECT AND RISK MANAGEMENT PRACTICE IN SERBIA

Almost all participants agree or strongly agree that project risk management is an important area of project management (97% of respondents), that project risk management application is important for success of the construction project (also 97%), and that project risk management should be applied on construction projects in Serbia (94%).

However, although the awareness of the project risk management importance and the need for it exist, there is a lack of knowledge on the subject in Serbia. From figure 3 it is notable that only 42% of respondents is very familiar or familiar with Project Risk Management (PRM) tools. To compare, 82% of respondents is very familiar or familiar with Project Management (PM) tools.

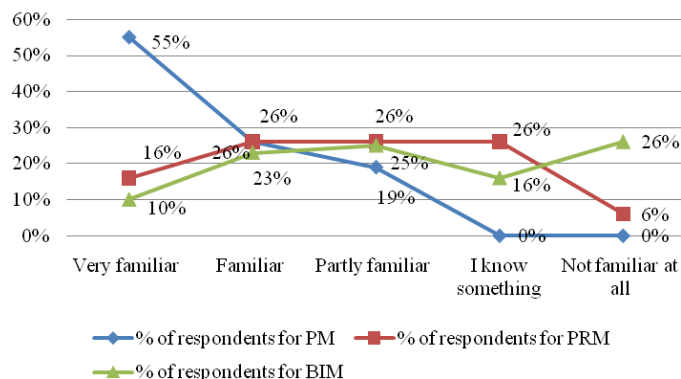


Fig. 3) Familiarity with PM, PRM and BIM

The major problems of PRM practical application on projects in Serbia are, starting from the most significant, evaluated as: organizational problems, no recognition of importance from top management, political, legal and financial problems (Fig. 4). The level of interest in finding out more about PRM on a scale from 0 (no interest) to 4 (very interested) among respondents has a mean of 3.45.

### 3.2. ANALYSIS OF PROBLEMS AND POSSIBLE APPLICATION OF BIM AS A RISK AVOIDING TECHNIQUE

In this part, respondents were firstly asked about their familiarity with BIM technology. Then, their opinion was examined on how much BIM technology application could improve construction project performance and what are the major problems in relation to BIM practical application on construction projects in Serbia.

Only 33 % of the respondents are familiar or very familiar with BIM technology, which is less than with PRM (Fig. 3). The level of interest in finding out more about BIM on a scale from 0 (no interest) to 4 (very interested) among respondents has a mean of 3.35. This shows, similar as for PRM, that the application of BIM is poor, but professionals are very interested in learning about BIM. It might be further concluded that interest in BIM is justified with the opinion of 91% of respondents who agree or strongly agree that applied BIM could enhance planning and control of construction project performance (project cost, time, quality). Assumption of this study that BIM could be considered as a risk avoiding technique is, with such a result, confirmed.

The major problems in relation to BIM practical application for construction projects in Serbia are evaluated as shown on Figure 4, where the only difference among problems evaluation regarding BIM and PRM application in Serbia is that for BIM financial problems are on the third place, while for PRM they were evaluated as the least important.

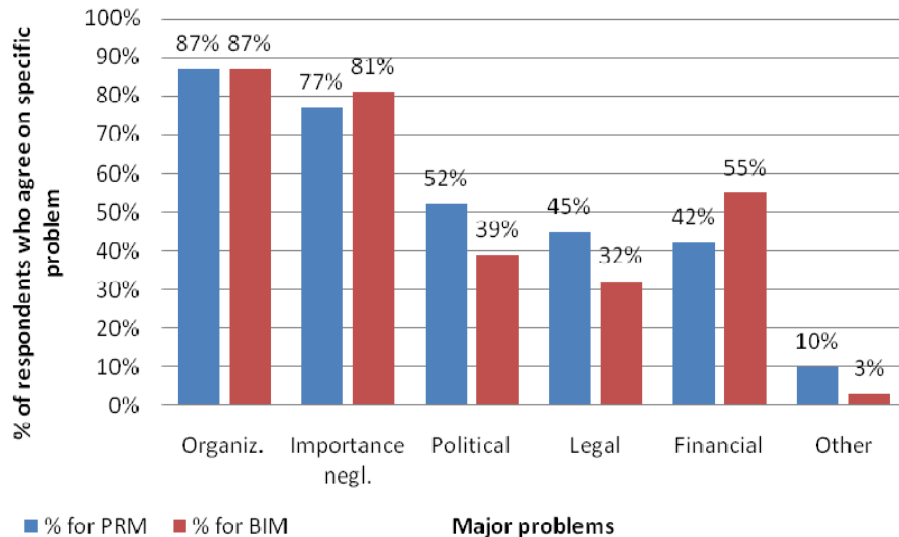


Fig. 4) Evaluation of major problems in relation to PRM/BIM practical application



## 4. CONCLUSION

In this paper, results of still ongoing infrastructure construction project risks survey for projects settled in Serbia are presented. Construction PRM practice in Serbia was analyzed and potential application of BIM as a Risk avoiding technique was performed.

It was found out that there is a strong support and interest for both PRM and BIM application on projects in Serbia, but lack of knowledge on the subject and poor practical application exist. The results of the survey confirmed that BIM should be considered as one of possible risk avoiding techniques. The major problems in relation to both PRM and BIM practical application in Serbia are identified as organizational and no recognition of importance from top management.

The significance of this result is that it provides an empirical basis for further systematic analysis and management of infrastructure construction project risks in Serbia. The application of PRM and BIM would have the ultimate benefit of enhanced performance of projects, which is important for all stakeholders and construction industry as a whole.

## ACKNOWLEDGEMENT

This paper was funded by the Ministry of Education and Science of Serbia under contract TR-36038, and is part of the project 'Development of methods of design and construction documentation for the installation in buildings compatible with the BIM process and the relevant standards,' project leader PhD Igor Svetel.

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