# The use of project management software in construction industry of Southeast Europe

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# THE USE OF PROJECT MANAGEMENT SOFTWARE IN CONSTRUCTION INDUSTRY OF SOUTHEAST EUROPE

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Original scientific paper

Although the construction industry has always been project-oriented, limited attention has been paid to the Project Management Software (PMS), particularly in the transitional countries. This paper contributes to a deeper understanding of the needs of the transitional economies by providing new insight into deficiencies of implementing the Western PMS in the construction industry of Southeast Europe (SEE). Thus, while the construction industries of the developed economies use PMS for a wider range of project management processes, the SEE construction industry still practices management mainly through financial procedures and material planning. Therefore, the PMS originating from developed countries, in the present form, is of little use in transitional economies.

***Keywords:*** *project management software, the construction industry, transitional economies, Bosnia and Herzegovina, Croatia, Slovenia*

## Primjena računalnih aplikacija za upravljanje projektima u građevinskoj industriji Jugoistočne Europe

Izvorni znanstveni članak

Iako je građevinska industrija uvijek bila projektno orijentirana, tijekom proteklih godina, izrazito mala pažnja je dana računalnim aplikacijama za upravljanje projektima (RUP). Ovaj članak doprinosi dubljem razumijevanju potreba tranzicijskih ekonomija, predstavljajući nedostatke uvođenja RUP-a, nastalih u Zapadnim sustavima, u građevinske industrije Jugoistočne Europe (JE). Istraživanje je pokazalo kako postoji značajna razlika u načinu i procesima kojima se upravlja projektima u građevinskim industrijama Zapada u odnosu na praksu u JE. Tako dok Zapadna praksa pokazuje potrebu za korištenjem mnoštva procesa za upravljanje projektima (npr. upravljanje rizicima, niveliranje resursa u planu itd.), građevinska praksa JE se još uvijek temelji na financijskim procedurama i planiranju potrebnog materijala. Zbog ovih razloga može se ustvrditi kako su RUP, koji potječu iz Zapadnih praksa, u svom trenutnom obliku, od male koristi za tranzicijske ekonomije.

***Ključne riječi:*** *računalna aplikacija za upravljanje projektima, građevinarstvo, tranzicijske ekonomije, Bosna i Hercegovina, Hrvatska, Slovenija*

## 1 Introduction

If present organizations want to compete in today's turbulent market, they will need to become more adaptive, fast and collaborative, and use information technology systems (IT) [1, 2]. This is especially evident in the construction industry where delivering projects within boundaries of the iron triangle: time, cost, and quality, is more than just signing the contract and waiting for the project objectives to be achieved by themselves [3, 4]. For successful Project Management (PM), an efficient supporting infrastructure must be implemented as well [5, 6, 7]. Furthermore, IT is now routinely used in the construction industry as a tool for reducing issues generated by fragmentation [7].

Even though developments in the Southeast European (SEE) countries seem to be of particular interest to the IT community [8, 9], there is scarcity of literature in transitional economies (TE) [10, 11]. Furthermore, investment in the IT in transitional countries is much lower than in the developed countries [10, 12, 13, 14]. This is particularly the case for the Southeast European countries (SEE countries) where there are scant resources for research [16].

Some studies in the US and the Middle East (ME) have shown the interest of construction professionals in the Project Management Software (PMS) [15, 17]. Others have presented cases of application of PMS in the construction [18, 19, 20], but only few have related to the PMS in construction in the transitional economies, and even fewer to the benefits they bring to construction.

While the organizational learning and the information systems (IS) are mutually dependant [21, 22, 23], the IT has been proclaimed to be a key factor in a company's successful transition [22]. Nevertheless, over the last two decades the majority of construction companies in the SEE, which have adopted Western philosophies, have not been successful in implementing them. This is extremely evident in the lack of organizational learning and IT support [13, 24]. As a result, many IT tools which originate from developed countries, are of limited validity and applicability in transitional economies – namely in SEE [10]. Therefore, a study was necessary in order to identify technical and managerial information about the usage of PMS in the construction industry of SEE and to help the industry to become more successful in implementing PMS and consequently managing projects.

The main objective of this paper is to analyze the current usage of the PMS in construction industry of SEE and compare the results with similar ones from the developed economies. It analyses the most popular PMS in SEE: Primavera, MS Project, and GALA and compares their popularity in the ME and the US. Furthermore, the paper identifies a listing of the top processes that the construction industry of SEE uses the PMS for and compares the results with the US practice.

## 2 Literature review

Along with the managerial purposes, the PMS can also serve as a quality management system. Thus, it can act as an enabler of the PM and IS improvement and as such, it plays an integral part in managements of the construction projects [25 ÷ 29]. Furthermore, today's PM standards, i.e. BS 6079-1:2002 [30] and BS 6079-2:2000 [31] define and advocate the use of the IS/IT in project management. The presence of the PMS becomes even more important when considering the fact that many construction organizations in the transitional economies have no such system in place [25] as the management education was not present in SEE during the socialist regime [8]. Therefore, any improvement of the PMS will probably influence the industry's performance

[32].

We found three types of the PMS present in the SEE construction. The first type has limited abilities for PM and is based mainly on scheduling techniques, e.g. MS Project. The second type is a complex project portfolio management system, such as Primavera, which tries to merge all PM processes with the Enterprise Resource Planning (ERP). The third is the PMS that strives to integrate PM processes with an on-site management and the common practices of the SEE construction industry. In the following sections, we will begin with discussing the world practices regarding the PMS in construction industry, and then give an overview of the three types used in the SEE.

Since 1983 the Primavera Systems (http://www.oracle.com) have been developing their PMS package for construction and today it has become a leading provider of the Project Portfolio Management (PPM) solutions for the construction industry [15]. Primavera is suitable for project-oriented and mature companies that one can mainly find in developed countries. However, Primavera can rarely be found in the transitional economies. Furthermore, while Primavera was once mostly used to handle large and complex projects, today it is also used for many projects valued at under $100 000 [33].

The first version of Microsoft Project (www.microsoft.com/project/) was released for the DOS platform in 1984. The application was designed primarily as an easy-to-use tool. Since its birth, the MS Project has always been a popular tool among the project managers [5, 11, 34], but has never become the number one PM tool. This is even more evident in the construction industry, as it was never entirely aligned with the industry's special processes and procedures.

Gala (http://gala-construction-software.com/) stepped onto the market in 2003 as a PMS for the SEE construction industry. It uses a large database of normative work, material, equipment, and it provides analysis of the cost. While the SEE civil engineering standards aid managers in producing the estimates, Gala is aligned with the SEE business conduct and it supports on-site management and procedures prescribed by local regulations. Through the double loop learning, GALA also supports quality assurance in PM. However, its application in a multi-project environment is of a limited use.

If a construction company wants to implement a PMS that is aligned with the SEE business conduct, in our review of the three PMSs, we concluded that it should use the Gala. However, if it wants to implement a detailed enterprise portfolio project management (EPPM), made for the environment of developed economies, it should use the Primavera, and lastly if it wants to use a simple multi-purpose tool, it should use the MS Project.

## 2.1 Use of PMS in construction

The construction industry has a poor image in general [4, 35 ÷ 38]. In 1999 alone, in the UK, the industry spent more than £1 billion on rework [39] and in 2003, more than £1,5 billion on performance measurement applications [40]. In spite of high expenditure, only 34 % of construction projects today meet the iron triangle criteria [41].

During the review we found Primavera and MS Project to be the most frequent PMS used in the construction industry [34]. In the US, over 64 % of construction companies indicated Primavera as their specified software,

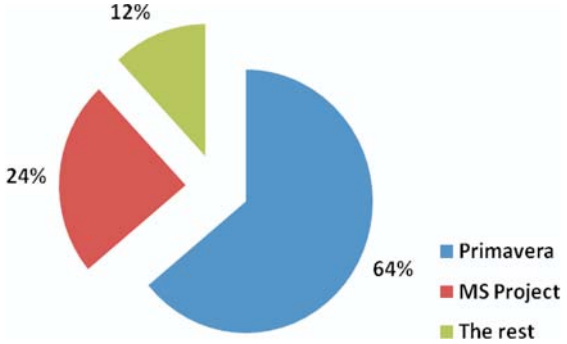


**Figure 1** The usage of PMS in the US [1]

with only just over 20 % requiring the MS Project (see Fig. 1).

Other software mentioned included: OPLAN, MS Excel, Government Proprietary software, CBCM and CA Super Project [34]. It is interesting to find that 14 % still require arrow-diagramming scheduling. This correlates to the corresponding percentage of the MS Project use, as Primavera does not support arrow diagramming. In the ME the distribution was similar, Primavera had 58 % and MS Project 23 % usage (see Fig. 2) [5].

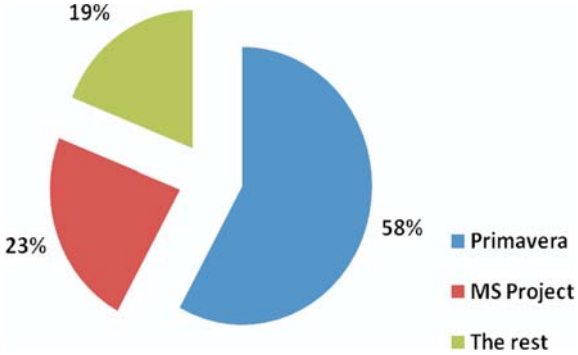


**Figure 2.** The usage of PMS in the Middle East [1]

Primary reasons for using a PMS in the US construction industry were (in ascending order) [34]: a periodic control of work after the start of construction, development of 'look-ahead' schedules, coordination of subcontractors, detailed planning of work prior to construction, schedule impact, claims analysis, tracking of changes, coordination of own trades, estimating and bidding, tracking shop drawings and submits, calculating payment requests for work performed, design development, operation and maintenance of projects, tracking costs and materials planning.

This affirms that the construction industry still sees and acknowledges the PM mainly as Critical Path Method (CPM). Nonetheless, it is encouraging that academia anticipates that by the end of this decade, the industry will have implemented the PMS in their day-to-day business [17]. Furthermore, in the area of IS, a resource and an IT management have become the most frequent topics of discussions today [42].

## 2.2 PMS in the SEE construction

The construction industry in the SEE has even lower performance [43] than that of the developed countries. Following the end of the socialist regime, where software development was mostly carried out through the internal IS functions of a large government controlled enterprises [11],

the economic and political pressures have been forcing the industry to change its everyday processes. Izetbegovic et al. [13] listed the purposes for the IS use in the SEE construction industry: 98 % for accounting and book-keeping, 89,8 % for personnel management, 79,6 % for spreadsheets, 73,5 % for cost prediction, bidding and Bills of Quantities (BoQ), 53,1 % for CAD and only 28,6 % for scheduling. This indicates that the sector is still trying to cope with traditional management procedures through accounting and that the SEE is still a transitional economy. The authors also concluded that the SEE is still in the early stages of computing, i.e. on a technical and operational level, which is similar to other emerging markets [44].

In addition, the SEE construction has a specific business culture. Unlike the US, the SEE countries have a strict law regulation that defines project stakeholders. There are three main management perspectives: investors (sponsors, developers), consultants (project managers, designers, architects, supervision) and contractors. Owing to the former socialist regime policy, the project management is still unknown to the construction companies. It was introduced into the Croatian regulations only recently, in 2008, while Slovenia and Bosnia and Herzegovina still have no such terminology in place. Furthermore, construction companies are not allowed to appear in projects of two different functions at the same time, for instance in a project management and building or a project management and design. Hence, the 'Design and Build' type of projects are not allowed by the law in Croatia. Construction projects are under strict government control and their performance has to be reported by the law defined templates. This is mainly the responsibility of the supervision and the contractor. For this reason, the supervision and the contractors are actually the ones who manage projects, while project managers are often put aside and seen as an obstruction to the construction process.

## 3
## Research hypothesis

The literature review identified only a few studies dealing with the PMS in the construction industry [5, 15, 34, 35]. Since the industry is project oriented, there is a high level of dispersion and a high level of causal links among different management perspectives. Therefore, in order to analyze the industry, every management perspective (investors, sponsors), consultants (designers, architects, consulting engineers, and quantity surveyors) and contractors) had to be examined.

The aims of the research were primarily to find the differences between the SEE and the World practices in selecting the PMS for construction. Secondly, we wanted to compare the processes employed by the PMS in the US and SEE. Lastly, our aim was to discover if the SEE construction believes the current PMS solutions to be sufficient for their projects. The differences could be expected because the construction industry of SEE has not been very successful in implementing the Western IT tools [10]. This is evident in the lack of IT support [24]. Unlike the practice in the US, previous work has shown that [13] spreadsheets are the main IT tools of project managers in the SEE construction [15, 34]. Therefore, we have proceeded to discover and analyze the differences. Finally, we wanted to see if the industry is still satisfied with their current PMS solutions, since there is a low level of successful implementation of the IT tools that originated in the developed economies. In other words, we wanted to see whether SEE is capable of perceiving the lack of IT support as well as its importance in everyday business.

**H1 The most frequently used PMS in SEE differ from those used in the U.S. or in the Middle East.**

Even though the IS has been proven to be a generator of an organizational change [21], it has been argued that Western wisdom poses a challenge to transitional economies [46]. This is because the Western IT tools were designed in the developed economies and made for their stable Western market-economies, which themselves are unlike the transitional unstable and ambiguous post-socialist economical environments.

**H1 The construction industry of SEE still uses the PMS mainly for traditional management procedures characterized by cost control and material planning.**

We compared the Galloway's [15] list of reasons for the PMS use with the reasons found in SEE. The first reason is that it is highly unlikely that the unstable and ambiguous environments will employ the advanced functions of the PMS (developing and controlling 'look-ahead' schedules) and as a result improve the project performance. It is rather expected that the SEE practice will show basic cost control functions employed with the PMS [14]. The second reason is that nowadays the PMS such as Primavera or the MS Project are trying to become integrated into the Enterprise Resource Planning (ERP) systems. As a result, such software provides an opportunity to see processes within a larger context by balancing company resources with different projects' needs and market conditions. It is expected that the SEE construction mainly focus on the first version of the ERP (Material Resource Planning), which itself is characterized by the setting of the static resource plans, with little or no tracking of the changes.

**H1 The level of satisfaction with current PMS in SEE is low.**

Given that the modern PMS are tailored for the developed economies and provide some sort of ERP, it is expected that the SEE construction will not perceive all these features as benefits, but more likely as unnecessary, and in some cases as an obstruction. If the satisfaction level is low, the industry acknowledges its lack of the IT support. However, if it is high, then the SEE construction is still not aware of advantages in use of IT. To identify the level of satisfaction, we had to observe three main management perspectives in the SEE construction, i.e. Investors, Consultants and Contractors. Additionally, we have investigated the satisfaction levels regarding the type of PMS used along with a company size.

## 4
## Research methodology

In order to test the hypotheses, we used the data acquired in a semi-structured survey. After the general information (management perspective, turnover, number of employees etc.), the survey listed the Primavera and the MS Project (according to the literature review). Furthermore, we found five more PMS systems in current use in the SEE.

These were namely: the Excel, GALA, Adria KOD, Carpio and Maris. The survey allowed the respondents to add other PMS. Even though the Excel is not a PMS, due to its popularity in the SEE construction industry [13, 14] we included it in the survey (please note, we will not consider Excel as PMS in the discussion part). Even though the Excel can be upgraded (with PM add-ins) to become a limited PMS, construction companies in the SEE do not practice such upgrades.

To find the reasons for PMS use, the respondents had to select the PM process for which they had been using the PMS, e.g. periodic control of work after the start of construction, developing of the 'look-ahead' schedules, coordination of subcontractors, etc. The listing used was from the studies in the US and the Middle East [5, 15, 34] while it was adapted according to the specificity of the SEE construction market. Furthermore, using the 6-point Likert scale, the respondents had to rate their level of satisfaction with the current PMS. In terms of the scales, one indicated 'not satisfied at all' and the six indicated 'satisfied to a very large extent'. An even scale was used in order to remove the possibility of choosing a neutral value. The test statistics included the reliability and validity of the responses.

### 4.1 Questionnaire survey

The study employed two-step research. First, three professors at the University of Zagreb and then seven selected PM construction professionals in Croatia received a pilot survey. This was necessary to test the potential suitability and comprehensibility of the questionnaire. After each respondent had given us his consent, we sent the questionnaire to all of them by e-mail. In addition to the given comments, we asked the respondents to make suggestions and assess the structure of the survey. Considering that the comments were extremely positive, we did not alter the questionnaire.

In the main survey (conducted in Croatian), we targeted members of civil engineering and construction management associations and chartered civil engineers in SEE. In total, we sent the survey out to a group of 3000 construction professionals in Bosnia and Herzegovina, Croatia, and Slovenia [13, 14]. The survey was conducted through a web application – SurveyMonkey.com – during October and December of 2009. Out of 3000 surveys, 401 valid responses were received, 267 respondents bounced back (because of the invalid e-mail addresses), while there were 2439 non-respondents. Since the pilot questionnaire required no changes to the survey questions, we also added them to the sample, which led to a total consolidated response rate of 16,4 %. The result was acceptable and in accordance with a similar research practice [1, 47].

### 4.2 Sample specifics

In terms of distribution, out of 401 respondents, the majority were contractors (52 %), followed by consultants (32 %) and investors (16 %). In terms of the turnover, the sample was almost evenly distributed. It consisted of 33 % micro, 32 % large, 20 % medium and 15 % small enterprises. The majority (62,4 %) consisted of small and micro organizations, with a turnover less than 10 Mio EUR. 77 % of the answers came from Croatia, while 15 % came from Slovenia and 8 % from Bosnia and Herzegovina.

### 4.3. Data analysis

The data was analyzed using SAS/Insight software. Before further analysis, we tested the data for reliability using Crombach's coefficient alpha (the reliability threshold (α) was preset at 0,7). Thus, every value above the threshold indicated a reliable measurement. The alphas for each perspective are shown in Tab. 1. After we had found the reliable data (a lower level of reliability was only identified among companies with turnover larger than EUR 200 Mio - see Tab. 1) we employed the Relative Importance Index (*RII*) (1), to discover any differences in satisfaction among the perspectives with their current PMS.

$$RII = \frac{\Sigma w}{A \times N} \quad (1)$$

$w$ – the satisfaction score given to each PMS
$A$ – maximal weight given to a specific PMS
$N$ – the total number of respondents.

**Table 1** Reliability measures

| Crombach's alpha (α) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **All perspectives** | **Investors** | **Consultants** | **Contractors** | | | | |
| **PMS** | 0,984 | 0,966 | 0,982 | 0,969 | | | | |
| **Number of employees** | | **<10** | **<50** | **<250** | **>250** | | | |
| **PMS by employees** | 0,982 | 0,967 | 0,958 | 0,958 | 0,973 | | | |
| **Turnover (Mio EUR)** | | **<10** | **<25** | **<50** | **<100** | **<150** | **<200** | **>200** |
| **PMS by turnover (Mio EUR)** | 0,980 | 0,970 | 0,954 | 0,951 | 0,961 | 1,000 | 0,871 | 0,284 |
| **Respective PMS** | | **MS Project** | **Primavera** | **GALA** | | | | |
| **Processes** | 0,942 | 0,863 | 0,929 | 0,872 | | | | |
| **PMS by satisfaction** | 0,984 | 0,958 | 0,978 | 0,972 | | | | |

*RII* refers to a value within the interval of [0 ÷ 1]. Many researchers advocated this test when dealing with ordinal variables and non-symmetric distributions [48, 49, 50]. As *RII* becomes higher, PMS becomes more important. The difference among the perspectives would be significant if *RII* differed by more than 0,1. In order to test whether there were any differences between the respondents' rankings of the independent variable, e.g. PMS with different management perspectives; they used the Kruskal Wallis test (non-parametric ANOVA). This test was employed since variables have either continuous or discrete distribution but on an ordinal scale of measurement. In case any ties occurred, they have to correct the Kruskal Wallis test with the Chi-square and a degree of freedom. Thus, we use a correction factor, yielding to a slightly different value of chi-square. With or without the ties, if $p$ value is less than 0,05, the results indicate that there is a statistically significant difference among the perspectives. Furthermore, if we had found significant difference among the perspectives, we would have conducted the Mann-Whitney test. It is a non-parametric test for assessing whether two independent samples of observations come from the same distribution. The Mann-Whitney is virtually identical to performing an ordinary parametric two-sample t-test.

## 5
## Findings

In this section, we will address the key findings that correspond to the three preset hypotheses. We listed them in order, starting from 5.1 for H1 to 5.3 for H3. The succeeding paragraph brings the discussion of the findings.

### 5.1
### The most frequently used PMS in SEE differ from those in the US or in the Middle East

Fig. 3 shows that the SEE construction acknowledges the Excel as the most frequent tool for PM, with 56,2 %. It is followed by MS Project, GALA and Primavera, with 26,5 %, 7,0 % and 4,6 %, respectively. The remainder is accounted for by other local PMS, i.e. Maris, Adria KOD and Carpio. The results in the SEE differ from the world practice concerning Primavera [5, 15, 34, 45]. The MS Project showed the same level of popularity in SEE as in the US and the ME, where one quarter of the respondents use the application. We will discuss this further in the following paragraph. Surprisingly, a domestic PMS, GALA, overtook the Primavera – the world's leading PMS.

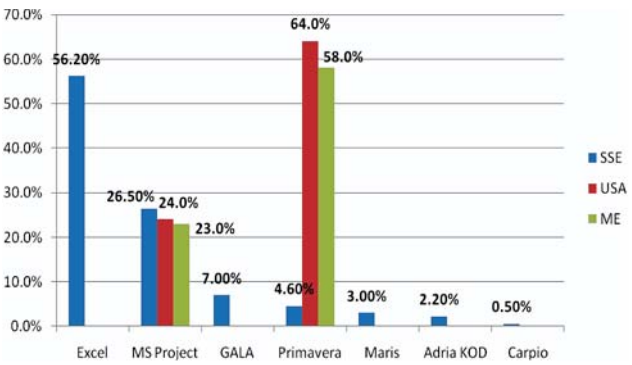


**Figure 3** Frequency of use of the PMS in the SEE construction

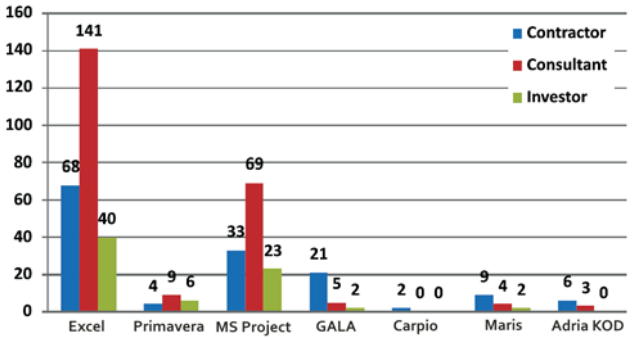


**Figure 4** Distribution of PMS by the management perspectives

Fig. 4 shows the first of the three choices of management perspectives when using the PMS. The consultants and the investors mainly used Excel and MS Project, while contractors were more oriented on on-site PMS e.g. GALA, Maris, Carpio and Adria KOD. We identified significant differences among all three perspectives ($\chi^2$ = 15,925, $p$ < 0,000). The Mann-Whitney discovered that the investors significantly differed from the contractors and consultants ($p$-values of 0,001 and 0,003 respectively). Furthermore, the consultants differed from the contractors only in regards to GALA ($p$ < 0,059).

While all categories evenly use the MS Project, Primavera is predominantly used in the micro and small organizations, while the medium and large organizations use GALA. The Mann-Whitney identified significant differences among all three perspectives concerning PMS selection (the investors – $\chi^2$ = 16,710, $p$ < 0,000; the consultants – $\chi^2$ = 8,526, $p$ < 0,004 and the contractors $\chi^2$ = 6,887, $p$ < 0,009). The Mann-Whitney further discovered that only organizations lower than 250 employees did not significantly differ from the organizations with lower than 10 and higher than 250 employees, with $p$ values of 0,459 and 0,241, respectively (this was applicable only to the MS Project).

Concerning the company size by turnover, all of the perspectives evenly used the MS Project, while, micro and small organizations generally used GALA. However, they evenly distributed Primavera, with the emphasis on organizations with a turnover lower than EUR 100 Mio. Organizations with a turnover less than Eur 10 Mio and the ones with turnover less than Eur 100 Mio ($\chi^2$ = 6,071, $p$ < 0,014); as well as the organizations with turnover less than Eur 50 Mio and the ones with turnover less than EUR 25 Mio ($\chi^2$ = 7,000, $p$ < 0,008), identified significant differences between organizations. The Mann-Whitney further discovered that the organizations with turnover lower than EUR 10 Mio significantly differed from organizations with turnover lower than EUR 100 Mio, in regard to all the three PMS ($p$ < 0,014). Also organizations with turnover less than EUR 50 Mio differed from organizations with turnover less than EUR 25 Mio ($p$ < 0,008).

### 5.2
### The construction industry in SEE still uses the PMS mainly for traditional management procedures, characterized by cost control and material planning

Tab. 2 shows the most frequent PM processes for which the SEE construction industry used PMS. Hence, the top three processes were:

- tracking costs and materials planning
- periodic control of work after the start of construction

**Table 2** PM processes that were implemented using the PMS

| Top processes in SEE | Response Percent | Response Count | Top processes in the U.S. (Source: Galloway [15]) |
|---|---|---|---|
| Tracking costs and materials planning | 60,0 % | 222 | Periodic control of work after start of construction |
| Periodic control of work after start of construction | 49,2 % | 182 | Developing look-ahead schedules |
| Investment assessment | 47,6 % | 176 | Coordination of subcontractors |
| Estimating and bidding | 45,7 % | 169 | Detailed planning of work prior to construction |
| Detailed planning of work prior to construction | 42,4 % | 157 | Schedule impact |
| Book and Bill of quantities | 40,3 % | 149 | Claims analysis |
| Tracking of changes | 35,4 % | 131 | Tracking of changes |
| Resource planning | 30,8 % | 114 | Coordination of own trades |
| Developing look-ahead schedules | 30,0 % | 111 | Estimating and bidding |
| Coordination of subcontractors | 27,6 % | 102 | Tracking shop drawings and submits |
| Document management | 27,3 % | 101 | Calculating payment requests for work performed |
| Work orders | 23,2 % | 86 | Design development |
| Standardization and norm calculations | 21,6 % | 80 | Operation and maintenance of projects |
| Control of indirect costs | 18,1 % | 67 | Tracking costs and materials planning |
| Communication in team | 17,6 % | 65 | |
| Warehouse management | 11,9 % | 44 | |

**Table 3** Level of satisfaction with current PMS

| Satisfaction | All three perspectives | Investors | Consultants | Contractors |
|---|---|---|---|---|
| **Strongly dissatisfied** | 8 | 1 | 4 | 5 |
| **2** | 12 | 4 | 9 | 2 |
| **3** | 120 | 21 | 79 | 46 |
| **4** | 180 | 36 | 114 | 68 |
| **5** | 34 | 7 | 16 | 17 |
| **Highly satisfied** | 16 | 4 | 9 | 5 |
| **Average** | 3,72 | 3,77 | 3,68 | 3,73 |
| **RII** | 0,622 | 0,636 | 0,619 | 0,620 |

and
- investment assessment.

This shows certain differences from the findings in the US and the ME. While the SEE construction industry's top PM process is tracking of the costs, the US construction industry has control from the start of construction. Furthermore, some processes, which were popular in the US, e.g. developing of the 'look-ahead' schedules, coordination of subcontractors etc, were not as popular in SEE.

### 5.3
### The level of satisfaction with current PMS in SEE is relatively high

The overall satisfaction level was relatively high (0,622/1,00). Tab. 3 shows that there were no differences in satisfaction between the different management perspectives, with average satisfaction levels of 3,77; 3,68 and 3,73 for the investors, the consultants and the contractors, respectively. *RII* confirmed these results as well, with the respective values of 0,636; 0,619 and 0,620.

Furthermore, the overall satisfaction level did not vary with company size in terms of turnover and number of employees. *RII* also confirmed these results (with respective values between 0,595 and 0,641) across all of the categories. Primavera received the highest satisfaction level (the *RII* of 0,775). When we correlate this with its popularity, it is clear that only 4,6 % of respondents were highly satisfied with current PMS.

## 6
## Discussion

This research has confirmed that IT tools originating in the developed economies are of limited validity and applicability in the transitional economies, unless aligned with a local business conduct. Yet, this study discovered some other findings as well:

**The most frequently used PMS in the SEE differ from those in the US or the ME**

Companies in SEE had little experience with PM processes other than maintaining operations. This was due to more than 50 years of central planning in large state-owned enterprises (the former Yugoslav construction industry - where the three countries of this study originated from - was marked by companies with more than 15 000 employees) that were charged with prescribed production targets [51]. This is why the PMS from developed countries such as Primavera, which incorporate modern PM processes, are still not applicable in transitional economies.

Even though Primavera has received a high level of satisfaction, its poor image in SEE may be explained by its high complexity [15], project orientation and its misfit with the SEE business culture. Since the SEE construction sector is still function oriented (where the contractor and supervision are the ones who are really managing projects), the project orientation is Primavera's largest adoption issue

when implemented on transitional economies. Thus, while Primavera provides project management reports, terms, methodologies and project organization structure; the SEE construction industry manages projects under strictly legally regulated boundaries (templates, reporting, stakeholders, hierarchy…). Furthermore, since Primavera covers a large span of industries, the tool is not specialized for the construction processes alone, nor is it aligned with the business culture of the SEE construction industry. Therefore, from the SEE point of view, Primavera is a complex system that cannot successfully work without external consultants. If Primavera wants to excel on the SEE market, it will have to align its features with the common business conduct in SEE, by incorporating the templates, reporting and adjusting to the hierarchies of the project stakeholders.

However, even though it originates from the US, the MS Project's results in SEE correspond with the world findings. This is probably due to its simplicity and the fact that it practically comes as part of the MS Office. Although the tool is very adaptable, after a certain level of project complexity, the MS Project becomes inadequate PMS for the construction. The tool is a simple PMS, but if it wants to excel in SEE, a portfolio and an on-site management feature should be added.

It was very interesting to find a domestic PMS, i.e. GALA, overtaking Primavera in SEE. This is the case since GALA is the only PMS that has integrated Project Management philosophy with an on-site management and the SEE regulations, resulting in its high level of popularity in SEE (7 % of market share in five years, especially among contractors). GALA is also the only PMS that supports quality assurance systems (e.g. ISO 9001) in project management. However, it needs further improvement, especially regarding portfolio management. It was also interesting to see how comparable the results are from the ME and the US. This is the case because of the large presence of construction firms from the US and the UK in the ME, which corresponds with previous studies of the large influence of the Western way of managing projects on ME [5].

Finally, Primavera received the lowest rating, which supports Roztocki and Weistroffer's [55] notion of the low applicability of the IT tools originating in the developed countries for the transitional economies. Only fully project-oriented and mature companies should consider implementing Primavera, but with a proviso regarding its complexity and the additional cost for the support. This is evidently not the case in SEE. However, companies that still try to implement Primavera in SEE will also need a PMS tailored for transitional economies, e.g. GALA. Therefore, these results showed the inapplicability of the IT solutions originating in developed economies to transitional economies, which support the hypothesis H1.

**The SEE construction industry uses PMS mainly for traditional management procedures, characterized by cost control and material planning.**

While the practice in developed economies (e.g. the US), shows that the construction industry has started to acknowledge a broader set of PM activities, e.g. enterprise resource planning, coordination, etc., the SEE construction industry still focuses on finance initiatives and material resource planning. This could be explained by the legacy of central planning, but also the fact that transitional economies, as opposed to developed ones, in the past had little experience with other PM processes ( besides cost management) [52] and they operated in functional organizations.

These findings show how the SEE construction industry is still oriented towards financial indicators and the accounting based management (the top three PM processes were financial). This supports the hypothesis H2 and reveals the obstacles that occur when implementing the Western philosophy in the transitional economies. Furthermore it proves how the practice of the SEE construction companies differs from the one in the US (the construction industry in the US has started implementing other PM processes, e.g. coordinating subcontractors).

**The level of satisfaction with current PMS in SEE is relatively high**

Obviously political and economic changes over the last two decades have resulted in a paradigm shift in managing projects and a positive trend towards the PMS acceptance within the SEE construction industry. This is a clear indicator that the project management is finally starting to be acknowledged in the SEE construction.

Still, this hypothesis was raised in order to test whether the SEE construction industry perceives all of the advantages that PMS can bring to projects or just use modern PMS, but in the form that Excel or similar software could easily provide. Unfortunately, in SEE the latter is the case. The analysis showed how a relatively high level of satisfaction does not vary with a company size, in terms of turnover and number of employees. A high satisfaction only verifies the sector's low perception of acknowledging the full benefits of the PMS.

These findings disproved the hypothesis H3 and revealed that the SEE construction is still not ready for the Western PMS. Therefore, the SEE construction lacks the project management knowledge and does not perceive benefits that PMS can bring. In future, the PMS vendors will have either to incorporate the common practice of the SEE construction into their solutions or try to offer project management training as a part of their PMS package.

## 7
## Research limitations

Initially, the definition of PMS raises issues regarding generalizations. According to the latest edition of the PM Book of Knowledge [53], Project Management Information Systems are automated tools, such as scheduling software tools, configuration management systems, information collection and distribution systems; while Project Management Software are systems with the capabilities of organizing, planning and managing resource pools and developing resource estimates, resource breakdown structures and resource availability rates. Since previous studies [5, 13, 15, 34, 45] referred to Primavera and MS Project as PMS, we did the same in this study. Still, we need to acknowledge these differences in results when comparing them with similar studies. Another issue with generalization arises with the acronym SEE. Southeast Europe is a relatively recent political designation for the Balkan countries (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Greece, Kosovo, Montenegro, Serbia and Slovenia) because of the negative connotations of the term "the Balkans" [54]. In this study we referred to Bosnia and Herzegovina, Croatia and Slovenia as SEE.

Lastly, our choice of PM processes might be problematic, since they may not capture all of the complexity of the construction environment. We have selected these processes so we could compare the results from SEE with similar ones in the US [15] and in the ME [5].

## 8
## Conclusion and recommendations for further research

Since only limited research has been conducted in this area so far, especially in SEE, construction organizations should perceive these findings very interesting and useful when implementing PMS.

Although this study has given a survey of PMS in the SEE construction industry for the first time, this paper has also produced some new and unexpected results, which differ from previous researches. Thus, even though the SEE construction has started practicing modern IT tools, it does not follow the project management practices of developed economies. This is important to acknowledge because while western philosophies rely on a wider range of project management processes, the SEE construction sector is still operating very differently towards developed countries [55] and still practices management mainly through financial procedures. This causes inability to assess true costs of their operations [56] and enhances risks of losses, caused by poor decision making [57]. Understanding these major issues should help construction companies in SEE in managing projects more successfully, increasing their learning capacities and influencing the degree to which new technologies are adopted and implemented effectively [58]. Unfortunately, SEE carries the legacy of the former socialistic regime, which represents one of the main adaption issues of implementing western PMS on to transitional economies.

PMS vendors can benefit from this study as well, since the results show critical areas for PMS to succeed in SEE. Probably the worst-case scenario for a vendor would be to keep presuming that one size fits all, both in transitional and developed economies.

Our research may be compared with similar studies in the US [15, 34] and the ME [5], but it differs in that we kept our focus on the differences of the processes implemented by PMS between developed and transitional economies. Furthermore, we focused on the awareness of the SEE construction industry with the benefits that PMS could bring and on the reason why complex Western PMS fail in transitional economies.

These results should be taken as a starting point for further research. For instance, it would be interesting to study the absorption capacity of the SEE construction industry in adopting IT from developed economies, as well as dependency of inadequate PMS and industry competitiveness. Finally, IT tools for project management, i.e. PMS, are definitely one of the pillars in achieving excellence in the construction industry. In future, either the SEE construction industry will begin to use these tools in their full capacity or it will continue to limp behind other developed economies.

## 9
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**List of Abbreviations**

| | |
|---|---|
| BoQ | Bill of Quantities |
| CPM | Critical Path Method |
| EPPM | Enterprise Portfolio Project Management |
| ERP | Enterprise Resource Planning |
| IS | Information Systems |
| IT | Information Technology |
| ME | Middle East |
| PM | Project Management |
| PMS | Project Management Software |
| PPM | Project Portfolio Management |
| SEE | Southeast Europe |
| TE | Transitional Economies |
| UK | United Kingdom |
| US | United States |