

12-31-2010

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### Recommended Citation

Stare, A. (2010). Comprehensive management of project changes. *Economic and Business Review*, 12(3). <https://doi.org/10.15458/2335-4216.1248>

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# COMPREHENSIVE MANAGEMENT OF PROJECT CHANGES

ALJAŽ STARE\*

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**ABSTRACT:** *The goal of this research was to examine how project changes can be prevented, and how to reduce their negative impact. Theoretical research examined risk management, project control and change management. Based on the study a “Comprehensive Change Management Model” was developed and verified after conducting empirical research in Slovenian enterprises. The research confirmed that risk management identifies possible changes and reduces their impact; project control ensures the timely detection of changes and an efficient response, while formal change management ensures the effective implementation of changes. The combined functioning of all three areas ensures effective project execution.*

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**Keywords:** *risk management, project control, change management*

**JEL classifications:** L29; O22; D22

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## 1. INTRODUCTION

According to experts changes are a constant in projects. Since a project is a dynamic process functioning in a changing environment, a team in the planning phase of a long project cannot predict all factors (Wysocki and McGary, 2003; Frame, 2003; Andersen et al., 2004), and even an excellent project plan cannot prevent all unexpected “surprises” (Young, 2000). Even the most sophisticated plans can fail due to changes in customer requirements (Foti, 2004). One other finding is also important: the cost of change (due to a poor plan or customers making changes) rises as the project progresses (Burke, 2003; White, 2006). The later we decide to change (or discover a hidden change), the larger the impact that change will have on the (non)success of the project. As “a project without changes” doesn’t exist, we must find a way to limit the negative impact of changes or even to take an advantage of them.

Despite the awareness that changes are an important factor in the efficient execution of projects, an examination of the literature shows that the area of change management is poorly addressed. On average, this subject is covered by just a few pages in books, not

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even a whole chapter, and we could not find any books dedicated solely to the management of project changes. Moreover, most authors only discuss »formal« changes, namely, changes proposed by one of the project stakeholders and approved (or rejected) in a formal procedure. The suggested processes of managing changes are incontestably relevant, especially when the procedure is set out at the beginning of the project and when all stakeholders consider them. However, many different changes can occur during execution of a project that are more unofficial and they can have a greater negative influence on time and costs (Sun & Meng, 2009). Many changes can be expected on the basis of experience with previous similar projects, the team can already respond in the planning phase, using risk management tools (Kerzner, 2006), but it is impossible to totally de-risk the project (Gerald et al., 2010). A few authors mention such changes, but we could not find any “one-size-fits-all” change management model” to help master all types of changes.

In response to these findings we conducted more extensive research into project management theory and discovered that changes and the management of them are also partly included in risk management and project control. In combination with ideas acquired by executing many projects in practice, we formulated an integrated model of change management, which comprehends project risk management, project control and the formal change management (Fig. 1). We verified the developed construct by empirically researching Slovenian enterprises.

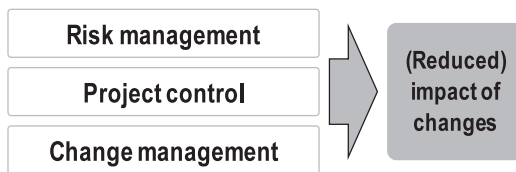


FIGURE 1: *Integrated model of change management*

The most important contribution of the research is the developed comprehensive change management model that was validated by empirical research. The model deals with all kinds of changes – it provides the prevention, early detection and effective realisation of approved changes. Since we have proven that the model contributes to the effective implementation of projects in practice, and consequently boosts the effectiveness of enterprises, we also highlight its high practical value.

This paper is organised in four sections. After the introduction, the first part of the article presents a summary of theoretical research where we review the traditional process involved in the management of changes, project control and risk management. We pay special attention to the relationships between risks and changes, and highlight risk management as a tool for change prevention and project control as a tool for the timely detection of changes. At the end of the second part, we present a construct, a „comprehensive change management model“, developed for the empirical research which is then presented in the third chapter. We first explain the research method, the research and analysis results, and discuss the findings. In the conclusion, we summarise the research

findings, point out the research contribution to science and propose further avenues for research.

## 2. THEORETICAL BACKGROUND

### 2.1 Risk management – the prevention of changes

Many changes can be expected due to experience from previous projects and project team can respond to them already in the project planning phase. The literature includes them in the project risk management process.

Most authors similarly link risks and changes – changes to the objectives, scope and execution are the biggest risk factors. If, therefore, the team is aware of potential changes already at the beginning of the project those changes must be included in the risk management process. Several authors also state that the processes of managing change, project control and risk management have to be linked and harmonised (Heldman & Heldman, 2007; Datta & Mukherjee, 2001; Kerzner, 2004; Meredith and Mantel, 2006). Risk can also arise from the inadequate management and documentation of changes (Heldman & Heldman, 2007). We call undocumented changes »hidden« changes.

Frame (2003) believes the project team must be ready for change so that changes do not surprise them. He also indicates that ignorance of a project's environmental impacts and a lack of information in the planning phase pose a risk that changes might occur in the project. Charvat (2003) sees the problem similarly, while Kerzner (2006) indicates that the purpose of risk and change management is to reduce the number and range of surprises as much as possible. According to Kerzner, change usually creates new risks, while the occurrence of risk creates changes that are again linked with new risks. Risks and changes therefore appear to be "hand in hand" so enterprises often set up a uniform approach to deal with both. Similar views are expressed by Thomsett (2002) and Young (2000).

We also found that both processes are integrated by the following authors:

- Chapman & Ward (1997) state that already in the context of risk management it is necessary to assess the consequences of changes to the design and plan;
- Murray-Webster and Thiry (Turner & Simister, 2000) indicate that the methods which contribute to change management are the value management approach which seeks to provide the maximum benefits to all project stakeholders in terms of the costs and benefits of change, and risk management (in terms of assessing the consequences of the change);
- Heldman & Heldman (2007) and Thomsett (2002) consider that it is necessary, when considering requests for change, to examine other potential risks that could arise were the change to be approved; and
- Oni (2008) states that change management includes the establishment of a procedure for identifying and evaluating scope changes which might affect the cost and performance (which in fact deal with risks).

Expected changes should be handled by the risk management methods. According to the theoretical research findings, all types of changes can be expected. In addition, a database of risks and changes arising from finished projects may be helpful. Experts in the risk management field recommend various measures to reduce risks. As the most effective approach is the risk (changes) prevention, we presume in the model that risk management can be used for preventing expected changes. In the project execution phase risk management overlaps with project control, which is the second part of the model. If a team cannot find appropriate measures to prevent changes, it plans preventive measures to reduce the probability of the risk being realised. The control checks if the measures work or changes will emerge anyway. If the risk (change) emerges, the response can be faster using risk management (corrective measures can be planned in advance), while in a normal control process measures can only be defined after the identification and analysis of the problem, which takes more time. Based on the theory presented above we postulate:

**H1: Risk management** prevents or at least reduces their impact.

## 2.2 Project control – detecting hidden changes

We also considered whether experts include the control of changes in “project control”. In just six out of nearly fifty books in the field of project management, (besides time, cost and quality) we find change control as one of the control areas (Andersen et al., 2004; Brandon, 2006; Howes, 2001; Hughes and Cotterell, 1999; Levine, 2002; Callahan and Brooks, 2004). However, we found a few additional statements that indicate a connection:

- in establishing the control system, two the most problematic areas need particular attention – activities that require a high degree of creativity, and changes (Meredith and Mantel, 2006);
- time control is actually the control of changes that occur during the project and affect the schedule (Newell, 2002);
- the proper management of change is one of the tools of the proactive scope control (Milosevic, 2003);
- the reasons for delays are poor control of design changes and customer changes (Kerzner, 2001);
- for an appropriate level of control it is necessary to obtain information about problems, changes and supplements (Andersen et al., 2004; Burke, 2003); and
- taking measures in the case of deviations, problems and changes is effective if it is done in good time; the condition for this is the regular tracking of the performance according to a detailed schedule which is regularly updated with the status of implementation (Lock, 2003).

If we connect some of the above statements we can see a two-way connection of control and change – corrective measures in the case of changes lead to schedule and scope changes, while measures can be effective if they are timely. Timely reaction depends on regular performance tracking, while performance tracking and the assessment of

variations (as part of control) will yield the right information if the team is aware of the previous changes. This means that changes should be properly documented, project stakeholders have to be informed about the changes, and the schedule has to be modified based on them.

Heldman (2005) comes closest to our idea, which combines the management of changes with control of costs, time and risk. She treats all areas in a chapter “Monitoring and controlling change”, while specifically addressing “Integrated change control” which she believes is the basis for the whole process of control. Changes, updates and corrective measures should be treated as a normal result of the process of monitoring and control, while change management refers to changes in scope, schedule, budget, sometimes even technical elements or elements of quality.

The control also ensures the early detection of unexpected changes, thereby reducing the negative impact of changes. In addition, regular project control effectively detects sudden direct changes (both scope and organisational) and urgent operative changes as a result of detected errors and problems. When a hidden change is discovered, it can also be considered as requested and treated in the formal change management process (depending on the stage of realisation of the change). Mostly the subjects under discussion are unfunded changes, although sometimes changes arranged between a customer and individual team members (without the consent of the project manager) can be discovered. In the formal process, after a change has been discovered a decision is taken as to who will cover the costs of the change. Based on the theoretical research of project control, we developed the second hypothesis:

**H2: project control** ensures the timely detection of changes and an efficient response, and consequently reduces the impact of changes on project performance.

### 2.3 Formal change management

The formal change management process includes the treatment of all formally requested (direct, scope or organisational) changes and ensures their effective implementation. As mentioned, hidden changes that are discovered early can also be treated in the formal process. However, irrational changes may be rejected.

Some authors consider change management as part of scope control (Newell, 2002; Burke, 2003; Milosevic, 2003), whereas most of them treat it as an independent process. In so doing, they generally focus on changes that are directly related to the objectives and implementation of the project. The typical change management process has four steps:

- change requirement: identification and documentation of the proposal (Burke, 2003); recording the need for change (Kliem, 2004); a review of the requirements for scope/organisational changes and identification of activities that are affected by changes (Meredith and Mantel, 2006); and the identification of areas of change (Verzuh, 2005);
- change evaluation: assessment of the impact of change on the schedule, scope, budget (Deeprise, 2002); rating changes, the establishment of responsible, planning change

(Kliem); evaluation of the benefits and costs of required changes (Meredith and Mantel); and a change activities proposal (Verzuh);

- change approval: forwarding the request to the competent people to decide whether to approve or reject the changes; and
- realisation of change: the change/update of the plan (Verzuh, Burke) and information share about the change (Deeprise); implementation of the change (Kliem), informing stakeholders about the change and ensuring effective implementation of the change (Meredith and Mantel).

However, many other authors suggest a relatively similar process (Levine, 2002; Lock, 2003; Steffens et al., 2007; Young, 2000; Thomsett, 2002; Wsocki and McGary, 2003; and Turner and Simister, 2000).

For the effective realisation of changes, a formal change management system has to be established and implemented in the enterprise. It includes the procedure of change approval, the documents generated in the process, and the information system support. The procedure also defines the competences and responsibilities of the project stakeholders in the process. A proper system operation can provide “a change coordinator”, who can also be responsible for documenting changes and accelerating the approval of the changes. The procedure for managing change should be defined in the contract with the client or the contractors. The change proposal should also include who is expected to pay for the change costs (Milosevic, 2003; Heldman, 2005; Kerzner, 2001; Verzuh, 2005; Tinnirello, 2001). Based on the theory presented above we postulate:

**H3: change management** ensures the effective realisation of formally approved changes.

Based on the study of the literature, we developed a **comprehensive change management** model that is presented in Figure 2. We assumed that the developed model which comprehends project risk management, project control and the management of formal changes reduces the impact of changes and consequently provides for the more efficient execution of a project. This was our fourth hypothesis (**H4**).

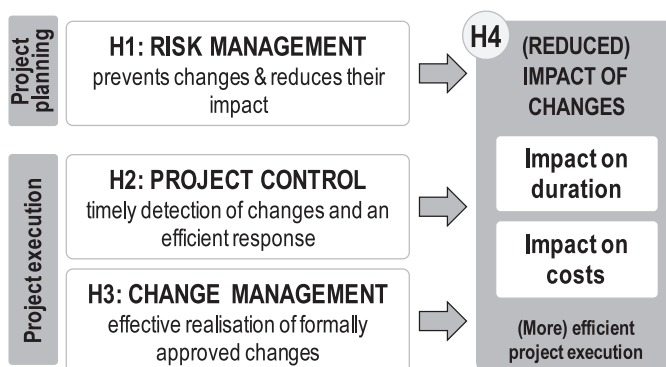


FIGURE 2: *Comprehensive management of project changes (the construct)*

### 3. EMPIRICAL RESEARCH

#### 3.1 Research design

##### 3.1.1 *Sample and data collection*

950 respondents (project managers, team members and other stakeholders) from various companies and the public sector were invited to participate in the survey. The criterion for selecting the participants was their project management knowledge through which we ensured an understanding of critical issues, quality responses and, consequently, better survey outcomes.

Namely, some preliminary researches from the beginning of the decade found that project management knowledge and a systematic project approach were not a „common practice“ in Slovenia. Unfamiliarity with project methods does not provide an adequate plan of a project, resulting in a high number of changes during the project execution phase. In addition, it is impossible to estimate efficient project execution (verification of the performance in accordance with the plan). Therefore, members of the Slovenian Association for Project Management, along with those who since the year 2000 had attended Slovenian conferences on project management, obtained various project management certificates, and been trained in the project management field at various institutions were invited to participate in the survey. The results were collected in a Web questionnaire and we received 137 completed questionnaires.

Demographics of the respondents:

- female: 25%, male: 75%;
- average age: 40 years (42% of respondents were between 30 and 40);
- the majority of respondents were university-educated (87%), 26% of them had an MSc or PhD;
- the majority had some kind of project management training (96%); 33% had taken a course at the faculty, 16% had graduated in the field of project management, 11% have obtained an international certificate; and
- average years of experience: 10 years of project work, 6 years as project managers.

We present the type and size of the enterprises involved in the study in Figure 3.



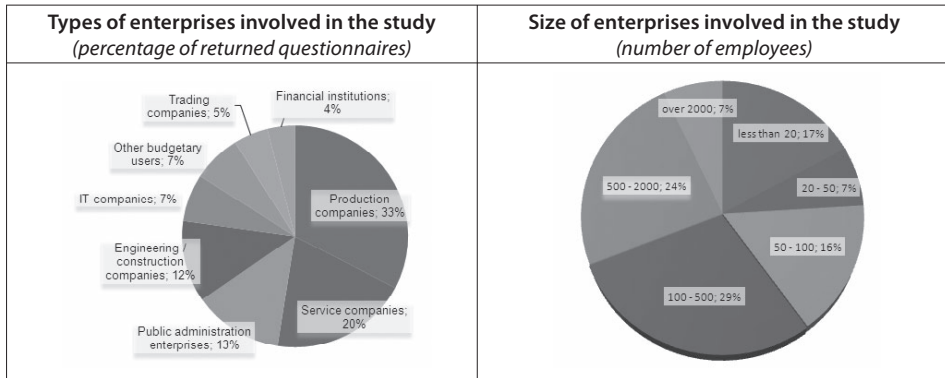


FIGURE 3: *Enterprises involved in the study*

### 3.1.2 Measures and methods

Since our basic hypotheses were: »The individual parts of the model and the entire model provide for the more efficient execution of a project«, we first defined two efficiency factors (dependent variables): project delay and cost surplus. We used the ratio (%) between the baseline and the actual factors (indicated at the end of the project) and these became the dependent variables of the subsequent analysis.

To test the hypotheses and the developed model we analyzed the acquired data with a multivariate analysis, specifically by determining the correlations and regressions.

With a correlation analysis we mostly verified whether the existence of particular variables decreases (or increases) the impact of changes on effective project implementation. By calculating a linear regression of individual variables we found how much they impact on the efficient project implementation. The integrated model and its interacting parts were checked with a multiple linear regression.

The independent variables were derived from the construct. We intended to examine the impact of individual functions on efficient project execution and we therefore determined the presence of those functions in the enterprises (e.g. if certain tasks are performed, whether the enterprise has a policy or a department) and the frequency or scale of the execution of specific tasks. The independent variables we examined were (Figure 4):

- risk management – anticipating changes in the project planning phase, risk identification, evaluation and planning of measures, risk control, risks analysis and database maintenance;
- project control – the frequency of time, cost and quality control; and
- formal change management – the existence of regulations on change management, the determination of who pays for the change in contracts, a report on changes in the project final report, the existence of a changes database.

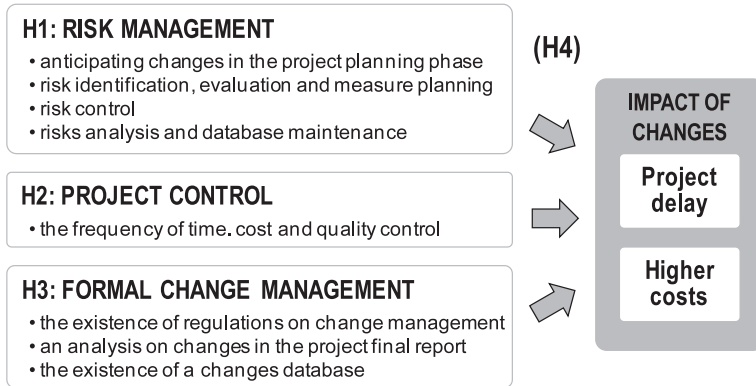


FIGURE 4: *The research model and measured variables*

To determine the impact of the presence of independent variables in the model, we calculated Pearson's correlation coefficient between the binary independent variables and the effectiveness of project execution (project performance) – independent variables had a value of 1 (certain tasks are performed/the enterprise has defined rules) or 0 (the opposite). Only in the case of project control, where the variables were assessed with a nonlinear value (daily, weekly, monthly), did we determine the impact with Spearman's correlation coefficient.

However, to verify the hypothesis that individual parts of the model provide for the more efficient execution of a project (H1, H2, H3) every part (risk management, project control, formal change management) of the impact was examined by a multiple linear regression. We used the same method to verify the comprehensive model and to confirm the fourth hypothesis.

### 3.2 Results

The research showed that in 90% of projects changes are the reason for project delays and higher costs (Table 1). On average projects are prolonged in time by 24.6%, while costs are 14.6% higher.

TABLE 1: *Project delay and increased costs as a consequence of changes in enterprises*

	Time	Cost
Number of enterprises indicating a surplus	123 (90%)	120 (88%)
<b>Average surplus</b>	<b>24.6 %</b>	<b>14.6 %</b>
Standard deviation	24.7	12.6
Number of enterprises with a surplus over 50%	25 (18%)	6 (4%)
Number of enterprises with a surplus over 20%	58 (42%)	44 (32%)

Table 2 shows descriptive statistics and a correlation matrix of the aggregated data. Although all correlations did not prove to be explicit, we consider all the variables in the model verification since individual functions cannot be performed without others (we cannot develop a risk mitigation plan without previous risk identification).

TABLE 2: *Correlation between the model components and project performance*

		Project delay Correlation (Sig.)	Higher costs Correlation (Sig.)
ChP – anticipating change in the project planning phase	Pc	-.130 (.151)	.037 (.689)
RI – risk identification	Pc	-.037 (.686)	-.046 (.622)
RM – risk mitigation	Pc	-.185* (.043)	-.220* (.017)
RC – risk control	Pc	-.265** (.003)	-.133 (.150)
RA – risk analysis	Pc	-.289** (.001)	-.197* (.032)
RDB – risk database	Pc	-.162 (.077)	-.055 (.553)
CT – the frequency of time control	Sc	-.234** (.009)	-.196* (.032)
CC – the frequency of cost control	Sc	-.408** (.000)	-.309** (.001)
CQ – the frequency of quality control	Sc	-.272** (.002)	-.099 (.284)
ChMan – regulations for change manag.	Pc	-.320** (.000)	-.143 (.121)
ChAnal – analysis of changes in the project report	Pc	-.319** (.000)	-.248** (.006)
ChDB – database of changes	Pc	-.154 (.094)	-.113 (.226)

Pc - Pearson's Correlation

Coefficient Sc – Spearman's correlation coefficient

The multiple linear regression showed that **risk management** reduces the negative impact of changes (Figure 4). Risk management mostly contributes to reducing project delays ( $R$  0.413,  $R_{sq}$  0.171), and less pronounced cost reduction ( $R$  0.281,  $R_{sq}$  0.079). The most influential factors for reducing delays are regular risk control and risk analysis (incorporated into a project final report) – table 2. A minor impact on time and cost was also made by the preparation of measures to reduce risks (risk mitigation). Other steps in the risk management process did not prove to be effective in relation to the changes. Otherwise, in most enterprises risk management is still less systematic since only 59% of respondents had knowledge of risk management methodology, half the respondents control project risks, while only 19% of respondents maintain a risk database.

We can partly confirm the first hypothesis (*H1: Risk management prevents or at least reduces their impact*). Risk management reduces the impact of changes on time (project delay), while the reduced impact on project costs did not prove to be reliable.



FIGURE 5: *Results of hypothesis testing (H1, H2, H3)*

**Project control:** about half the enterprises control the time weekly, and the costs monthly, while the answers concerning quality control were quite mixed, which is presumably associated with the type of project involved. The calculated regression coefficients show that in the case of a weekly cost control (compared with a monthly one) the delay of projects (as a consequence of changes) is 6.8% less, and the costs are 4.6% less. However, the second hypothesis (*H2: project control ensures the timely detection of changes and an efficient response, and consequently reduces the impact of changes on project performance*) can also be partly supported – regular project control proved to reduce the impact of changes on project delay, while the reduced impact on project costs did not prove to be reliable.

**Formal change management** was tested with three issues which showed varying levels of the systematic approach. Only a third of the enterprises had defined a systematic approach (including regulations). However, 81% of the respondents indicated that they include information about the changes in the final report, which could be used for knowledge sharing. A database of changes should have a similar function but only a third of the enterprises maintain one. We found that projects in enterprises where changes are systematically managed have 10.2% fewer delays. An even more important factor is information on changes included in the final report – delays caused by changes are 10.1% shorter, while costs are decreased by 6.2%. As we can see in Figure 5, we confirmed the third hypotheses – formal change management provide for the more efficient execution of a project!

So far we have presented an analysis of individual parts of the model. Since our fourth hypothesis was that all three areas together influence the effective management of changes and effective achievement of project objectives, we also examined a multiple linear regression of the model and the performance deviations, as shown in Figure 6. Below we summarise the main findings of this analysis.

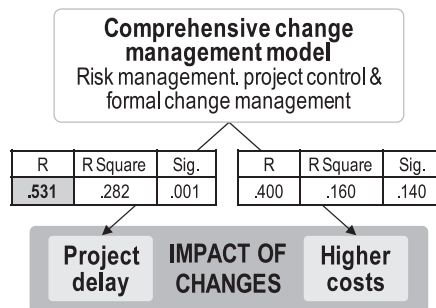


FIGURE 6: Result of the construct analysis

On the basis of calculated reliability (Sig. / ANOVA) we may conclude that the delay of a project depends on at least one of the variables involved. Although the degree of correlation is large (0.531), the variables involved can explain only 28.2% of the project delay. The regression of the variables is shown in Table 3.

TABLE 3: *Multivariate regression results*

Model	Unstandardised Coefficients		Standard. Coefficients		Sig.
	B	Std. Error	Beta	t	
(Constant)	44.134	8.096		5.451	.000
Anticipating change in the planning phase	-3.274	4.468	-.069	-.733	.466
<i>Risk identification</i>	<i>16.419</i>	<i>5.737</i>	<i>.293</i>	<i>2.862</i>	<i>.005</i>
Risk mitigation	-7.470	8.262	-.087	-.904	.368
Risk control	-7.597	4.614	-.161	-1.646	.103
<b>Risk analysis</b>	<b>-10.371</b>	<b>5.051</b>	<b>-.215</b>	<b>-2.053</b>	<b>.043</b>
Risk database	-.861	5.923	-.015	-.145	.885
The frequency of time control	-.011	.030	-.040	-.356	.723
The frequency of cost control	-.062	.043	-.155	-1.448	.151
The frequency of quality control	-.017	.025	-.070	-.659	.511
<b>Regulations for change management</b>	<b>-10.088</b>	<b>4.907</b>	<b>-.210</b>	<b>-2.056</b>	<b>.042</b>
Analysis of changes in the project report	-10.141	6.040	-.170	-1.679	.096
Maintenance of a database of changes	2.695	5.279	.055	.510	.611

Dependant Variable: Project delay due to changes

The most reliable variables of project delay due to changes proved to be the identification of risks (Sig.=0.05), risk analysis (0.043), and the existence of change management regulations (0.042).

The reliability of the influence of the integrated model on increased project costs, considering all of the variables, was 0.14 (a 14% possibility that the variables have no impact), while the variables affect just 16% of the variability of costs.

The fourth hypothesis (*H4: Change management model which comprehends project risk management, project control and the management of formal changes reduces the impact of changes and consequently provides for the more efficient execution of a project*) was partly supported – the empirical research in Slovenian companies proves that comprehensive change management does decrease project delays; while individual parts of the model mutually reduce costs: analysis of changes in the project report (Sig.=0.022), the frequency of cost control (0.051) and risk mitigation (0.121).

Although organisational culture factors were not included in the construct, we did examine them in the empirical research. The analysis shows a high level of importance of organisational culture on the implementation of projects. The degree of correlation is quite large (Time  $\rho_T=0.52$ , Costs  $\rho_C=0.39$ ), while the included variables explain 27.2% of delays and 15% of cost increases. Important factors of culture are: that projects follow the internal project management regulations ( $\rho_T=0.31$ ,  $\rho_C=0.26$ ); everyone respects the competencies of the project managers ( $\rho_T=0.31$ ,  $\rho_C=0.23$ ); the projects have clear priorities ( $\rho_T=0.37$ ,  $\rho_C=0.29$ ), top management supports the projects ( $\rho_T=0.33$ ,  $\rho_C=0.23$ ), and team members are motivated ( $\rho_T=0.42$ ,  $\rho_C=0.26$ ). We believe that the motivation of team

members reduces the impact of changes in two ways. The first involves the acceptance of change – more motivated teams quickly adopt and effectively implement change without any major resistance. Another aspect may relate to unpaid overtime work – if team members feel strong affinity to the project, problems, errors and changes will be resolved in overtime, without the expectation of payment, simply to ensure execution of the project within the deadlines and budget.

#### 4. DISCUSSION AND CONCLUSION

Changes to the objectives and scope, as well as a changed way of implementation, are some of the more important risk factors of a project. Since many changes can be expected, they can be managed by using risk management tools. The probability of change can be reduced by taking preventive measures, while the negative impact of changes can be reduced by corrective actions planned to be implemented in the event that a change occurs. The expectation of change at the same time provides intensive and more focused control which ensures the early detection of change and a rapid response.

An important part of risk management is the use of experience, based on past projects, especially relating to changes. The project final report contains an analysis of project risks, changes and other causes of time and cost deviations. Based on final reports and analysing them, a database of risks and changes is maintained in which causes of deviations are documented and structured, along with corrective measures and other new experiences.

Project control is the process of monitoring, evaluating and comparing the planned results with the actual results to determine the progress made towards the project's cost, schedule, and technical performance objectives. The last step of control is the definition of corrective actions in the event of deviations from the project plan. By implementing these actions, the project team can reduce or eliminate deviations. As the causes of variations can also include changes, the more frequent monitoring of the performance provides the earlier detection of changes, especially since a control can detect hidden changes, errors and problems before they cause any deviations. More frequent project control measures reduce delays and costs due to changes. Detected changes have to be analysed, and after that they have to be completed or rejected.

For the effective realisation of changes, a formal change management system has to be established and implemented in the enterprise. It includes the procedure of change approval, the documents generated in the process, and information system support. The procedure also defines the competencies and responsibilities of the project stakeholders in the process. A proper system operation can provide “a change coordinator”, who can also be responsible for documenting changes and accelerating their approval. The procedure for managing change should be defined in a contract with the client or the contractors.

The combined functioning of risk and change management and project control enables the more efficient management of changes to ensure the better achievement of the project objectives. In the event that each field of activity functions alone, more activities would be duplicated. The changes are significant risk factors, the detection of hidden changes is part of the project control and, in addition, the control also reduces the probability of a new change arising or risk realisation. Changes which can also be control measures usually create new risks while risk realisation creates changes that are again associated with new risks.

The most important contribution of this research is the developed comprehensive change management model that was validated by empirical research. Through the combined functioning of risk and change management, and project control, the model deals with all kinds of changes – it provides the prevention, early detection and effective realisation of approved changes. Another contribution to science is the definition and systematic view of the range of different types of possible project changes. Since we have proven that the model contributes to the effective implementation of projects in practice, and consequently boosts the effectiveness of enterprises, we also highlight its high practical value.

The research also indicated that most enterprises (77%) did not systematically analyse the efficiency of completed projects and hence the majority of respondents had to make a subjective estimate of the average project delay/cost surplus in their enterprise. Because in most cases the dependent variables were not measured, but resulted from the respondents' personal subjective ratings, the empirical examination and analysed results may not be completely relevant. Future research should be made mainly in enterprises which measure, register and analyse project performance. Since the empirical research was only made among Slovenian enterprises and Slovenia is still a post-transitional country, the national culture and level of project management maturity may affect the results. We propose similar research in more developed countries with more mature enterprise and project management.

To better understand change management we also propose further research in two additional directions. The first should focus on human components such as resistance to change, and methods of persuading opponents of change. Further studies should also determine how much the management of change depends on the system and how much on the flexibility, ingenuity and systematic work of individuals. The second direction of research should address the problem of managing change in a multi-project environment. This study was oriented to individual projects and considered that project resources are only limited by cost and not quantity. In practice, companies have a limited number of people available so changes in one project may also influence other projects due to the limited availability of people as they are working on several projects at the same time.

## REFERENCES

- Andersen, E.S., Grude, K. V. & Haug, T. (2004). *Goal directed project management: effective techniques and strategies* (3rd ed.). London: Konan Page.
- Brandon, D. (2006). *Project management for modern information systems*. Hershey: IRM Press.
- Burke, R. (2003). *Project management: planning and control techniques*. Chichester: John Wiley & Sons.
- Chapman C. & Ward S. (1997). *Project risk management: processes, techniques and insights*. John Wiley & Sons, Chichester.
- Callahan, K. & Brooks, L. (2004). *Essentials of strategic project management*. John Wiley & Sons, Hoboken.
- Charvat, J. (2003). *Project Management Methodologies - Selecting, Implementing, and Supporting Methodologies and Processes for Projects*. John Wiley & Sons, Hoboken.
- Datta, S. & Mukherjee, S. K. (2001). Developing a risk management matrix for effective project planning – an empirical study. *Project Management Journal*. 32 (2), 45-57.
- Deeprise, D. (2002). *Project management*. Capstone Publishing, Oxford.
- Foti, R. (2004). Expect the unexpected. *PM Network*. 18 (7), 34-40.
- Frame, J. D. (2003). *Managing projects in organizations: how to make the best use of time, techniques, and people* (3rd ed.). San Francisco: Jossey-Bass.
- Geraldi, J. G., Liz Lee-Kelley, L. & Kutsch, E. (2010). The Titanic sunk, so what? Project manager response to unexpected events. *International Journal of Project Management*. 28 (6), 547-558.
- Heldman, K. (2005). *PMP: Project management professional, study guide* (3rd ed.). Wiley Publishing, Hoboken.
- Heldman, K. & Heldman, W. (2007). *Microsoft office Excel 2007 for project managers*. Wiley Publishing, Indianapolis.
- Howes, N. R. (2001). *Modern project management: successfully integrating project management knowledge areas and processes*. Amacom, New York.
- Hughes, B. & Cotterell, M. (1999). *Software project management*. McGraw-Hill, London.
- Kerzner, H. (2001). *Project management: a systems approach to planning, scheduling, and controlling* (7th ed.). John Wiley & Sons, New York.
- Kerzner, H. (2004). *Advanced project management: best practices on implementation* (2nd ed.). John Wiley & Sons, Hoboken.
- Kerzner, H. (2006). *Project management best practices: achieving global excellence*. John Wiley & Sons, Hoboken.
- Kliem, R. L. (2004). *Leading High-Performance Projects*. J. Ross Publishing, Boca Raton.
- Levine, H. A. (2002). *Practical project management: tips, tactics, and tools*. John Wiley & Sons, New York.
- Lock, D. (2003). *Project management* (8th ed.). Gower, Aldershot.



- Meredith, J.R. & Mantel, S.J. (2006). *Project management: a managerial approach* (6th ed.). John Wiley & Sons, New York.
- Milosevic, D. Z., (2003). *Project management toolbox: tools and techniques for the practicing project manager*. John Wiley & Sons, Hoboken.
- Newell, M. W. (2002). *Preparing for the project management professional (PMP) certification exam* (2nd ed.). Amacom, New York.
- Oni, A. I. (2008). Linking Project Controls Implementation Planning and Project Success: the Northern Canadian Mining Projects Lessons. *2008 AACE International Transactions*. 1-8.
- Steffens, W., Martinsuo, M. & Artto, K. (2007). Change decisions in product development projects. *International Journal of Project Management*. 25 (7), 702-713.
- Sun, M. & Meng, X. (2009). Taxonomy for change causes and effects in construction projects. *International Journal of Project Management*. 27 (6), 560-572.
- Thomsett, R. (2002). *Radical project management*. Prentice Hall PTR, Upper Saddle River.
- Tinnirello, P.C. (2001). *New Directions in Project Management*. Boca Raton: Auerbach Publications.
- Turner, J.R. & Simister, S.J. (2000). *Gower handbook of project management* (3rd ed.). Gower, Hampshire.
- Verzuh, E. (2005). *The fast forward MBA in project management* (2nd ed.). John Wiley & Sons, Hoboken.
- White, A.S. (2006). External disturbance control for software project management. *International Journal of Project Management*. 24 (2), 127-135.
- Wysocki, R. K. & McGary, R. (2003). *Effective project management: traditional, adaptive, extreme* (3rd ed.). Wiley Publishing, Indianapolis.
- Young, T.L. (2000). *Successful project management*. Kogan Page, London.