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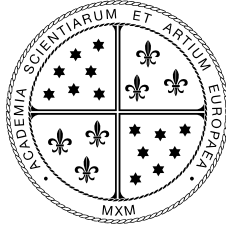
## 8. ZNANSTVENA KONFERENCA Z MEDNARODNO UDELEŽBO ZA ČLOVEKA GRE: RELEVANCA ZNANOSTI IN IZOBRAŽEVANJA

8<sup>th</sup> SCIENTIFIC CONFERENCE WITH INTERNATIONAL PARTICIPATION  
ALL ABOUT PEOPLE: RELEVANCE OF SCIENCE AND EDUCATION

Maribor, 29. 6. 2020 (management in voditeljstvo)  
in 9. 7. 2020 – 15. 9. 2020 (digitalne tehnologije)

**ZBORNIK RECENZIRANIH ZNANSTVENIH PRISPEVKOV ZA PODROČJI  
MANAGEMENTA IN VODITELJSTVA IN DIGITALNIH TEHNOLOGIJ /  
PROCEEDINGS BOOK WITH PEER REVIEW ON SCIENTIFIC CONTRIBUTIONS  
ON MANAGEMENT AND LEADERSHIP AND DIGITAL TECHNOLOGIES**





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## NAGOVOR PREDSEDNIKA AMEU – ECM

Konferenca "ZA ČLOVEKA GRE" pod častnim pokroviteljstvom Predsednika Republike Slovenije gospoda Boruta Pahorja in predsednika Evropske akademije znanosti in umetnosti prof. dr. Felixa Ungerja je v minulih letih obravnavala aktualna vprašanja s področja zdravja, aktivnega staranja, ekologije, medkulturnega sožitja, humanistike, managementa in sodobnih informacijskih in komunikacijskih tehnologij. Namen konference je, da izobraževalne programe Alme Mater Europaea – Evropskem centru, Maribor na vseh treh bolonjskih stopnjah soočimo z akademskimi prizadevanji partnerskih univerz, z izzivi našega časa v praksi ter smernicami bodoče Evrope.

8. znanstvena konferenca "ZA ČLOVEKA GRE" poteka v soočenju z virusom COVID-19 v novih razmerah, ki zahtevajo, da tudi univerze transformirajo učne vsebine in metode za izredne razmere. Konferenca je ob 20-letnici bolonjskega procesa posvečena relevanci znanosti in izobraževanja, tako da se tudi visokošolsko izobraževanje in znanost aktivneje vključita v reševanje sedanjih in pričakovanih izzivov prakse, opozorili OECD ter smernicami bodoče Evrope kot so zelena tranzicija, digitalna transformacija, trajnostna rast in delovna mesta, mir in upravljanje ter migracije.

Konferenca vključuje številne razprave z uvodnim panelom ob 20. obletnici bolonjskega procesa. Pred vami je zbornik celotnih prispevkov s področja projektne managementa ter spletnih in informacijskih tehnologij, ki smo ga pripravili za konferenco, tako da dopolnjuje študijske programe na vseh bolonjskih stopnjah obeh področij z aktualnimi vprašanji prakse in teorije. Oboje na Alma Mater Europaea – Evropskem centru, Maribor razvijamo v samostojnih akademskih programih tako, da lahko za potrebe teorije in prakse ponudimo celovitejše odgovore v skladu z našim načelom Za človeka gre, saj je nov management in digitalne tehnologije tehnologije danes nuja v znanosti in izobraževanju. Tej temi je posvečena tudi naslednja 9. konferenca Za človeka gre 2021.

prof. dr. Ludvik Toplak  
predsednik Alma Mater Europaea – Evropski center, Maribor







# **MANAGEMENT IN VODITELJSTVO**



## **FOREWORD BY THE HEAD OF INTERNATIONAL DOCTORAL STUDY IN PROJECT MANAGEMENT**

Project management is one of the recent AMEU ECM scientific areas that has been incorporated in the study program list during the last few years. Since that we are witnessing very dynamic development of our doctoral study in project management, so as project management courses within the EPS master curricula. This year we joined to the traditional AME ECM conference "All About People" for the first time, and our stream was dedicated to the projectification. Projectification is rather new term in project management language and represent the global trend of increasing number of projects at all levels of human activities. Th contributions in the proceedings mainly came from our students of doctoral study in project management, while in few contributed our staff members or associates. The topic is covered by different aspects and findings which are interesting and important outcomes of different studies. We believe it is just an icebreaking on the way to future, for our even stronger representation and engagements for having visible and respectable project management stream at the conference.

prof. dr. Mladen Radujković  
Head of International Doctoral Study in Project Management



**Jasna Bojanić Dujmović, Master of Informatics**

Student of AMEU ECM International Doctoral Study in Project Management

## **LITERATURE REVIEW OF ARTIFICIAL INTELLIGENCE (AI) - CONTRIBUTION TO PROJECT MANAGEMENT SUCCESS**

### **ABSTRACT**

*This paper surveys Artificial Intelligence (AI) contributions to project management success throughout the project life cycle which is categorized into five Process Groups. A literature review of articles dating from 1994 up to 2018 has been used. In order to explore how AI technology and PM have been used in this period, keyword indexes are defined within the systematic literature review research. Based on a scope of 34 articles on AI technology used in the project life cycle, this paper surveys and classifies AI technology in seven subset groups. Findings are presented in this paper and indicating that **more researchers have been interested in the area of project management process groups: planning and monitoring & controlling, applying AI algorithms** and comparing results with traditional project management. Gaps have also been identified for future research.*

**Key Words:** Artificial Intelligence (AI), Project management (PM), Portfolio, Program, Machine learning, Computer vision, Expert systems, Natural Language Processing, Speech recognition, Planning and Robotics



## INTRODUCTION

### Objective:

The main objective of this paper will be research and analysis of the literature for scientific papers that would define supportive contributions from Artificial Intelligence to boost project management success.

### Hypothesis:

It is possible to increase Project Management success by applying Artificial Intelligence to a project life cycle.

### Research question:

Has Artificial Intelligence technology used in the project life cycle increased the success of project management?

## METHODOLOGY

The purpose of this paper is to research the literature review according to the topic - Artificial Intelligence contribution to project management success. The aim of this paper is to carry out a review of scientific papers that contribute to project management success by using AI technology. The research has been done iteratively over the period of the 2019 year: the first part was conducted at the beginning of 2019 and the second part in the middle of the year.

The first part of the literature research was conducted using keywords index strongly related to the topic of the paper. The keyword indexes used for this search have been: *Artificial Intelligence (AI) and Project management (PM)*. Various scientific search-engines were researched in the period from 1994 up to 2018. After the keyword index filtering, only 13 articles were found, selected by titles without deep analysing of the whole article. A selection criterion was using Artificial Intelligent technology to support the argument of the research problem in project management itself. At this point, the focus of the paper will not be only on project management success.

Based on these results and criteria, an initial analysis of the collected articles was performed by reading whole articles especially the parts of titles, abstracts, conclusions, discussions and limitations in order to select a relevant one. Eight articles were found which have been using Artificial Intelligence in project management. Some interesting research problems were identified within the selected articles:

1. *Project time forecasting capabilities*
2. *The Challenges of Nonparametric Cost Estimation*
3. *Projects monitoring dashboards' formulation*
4. *Tree for project portfolio selection*
5. *Project duration forecasting*
6. *Models for predicting project award price*
7. *Dynamic Prediction of Project Success*
8. *Empowering collaborative decisions*

Summarizing these findings of the initial literature review, AI technology has been used for PM by applying the AI teachings and algorithms to advance existing results of complex project management tasks to successfully manage a project, for example: *forecasting, estimation, monitoring, project selection, dynamic prediction and collaborative decisions*.

In addition, the second part of the research has been done systematically, classifying keywords indexes in two main groups. The first group consists of the AI techniques subset and the other group consists of *portfolio, program and project management*. The different perspectives of the researcher were also taken into account. The research was carried out by searching all combinations of the two keywords groups limited only to scientific papers.

Based on different literature (Javatpoint 2018) and for the purpose of this paper, the AI technology has been classified into 7 main subsets:

1. Machine learning
2. Computer vision
3. Expert systems
4. Natural Language Processing
5. Speech recognition
6. Planning
7. Robotics

Each subset of the AI technology consists of associated technique subfields and algorithms. In this paper, we will focus only on the main AI subsets (see figure1).

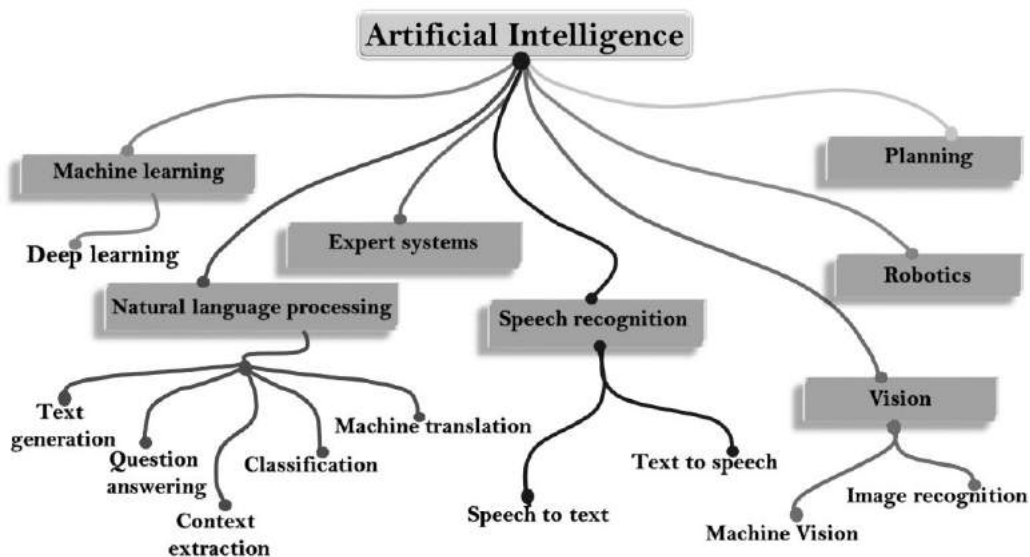


Figure 1. Subsets of AI technology (Javatpoint 2018)

### Machine learning (ML)

"Machine learning is the science of getting computers to act without being explicitly programmed." (Ng 2019).

Basically, machine learning is a learning algorithm (Norvig 2016) that allows computers to learn from historical data, to identify patterns, and make decisions using algorithms. Machine learning algorithms are designed in such a way that they can learn and improve their performance automatically (Javatpoint 2018). Machine learning is one of subset groups of *Artificial Intelligence*. It consists of different AI algorithms such as Deep learning and can be used for solving different AI problems.

### Computer vision (CV)

Computer Vision is a subset of the AI group that enables a machine to recognize an object from a different input device - for example video cameras, drones, etc. These algorithms are programmed with the purpose of accomplishing easily defined tasks such as counting objects, reading a serial number, etc. The CV is divided into methods of recognition: image recognition and machine vision, see figure 1.

### Expert systems (ES)

An expert system is a subset of the AI group and a computer program that has the knowledge base containing a human expert's knowledge with a rules engine which mimics the human decision-making process.

### Natural Language Processing (NLP)

NLP is a subset of the AI group that handles natural language data (speech and text) with interactions between computers and human (natural) languages.

Natural Language Processing (NLP) is divided into five main blocks as shown in figure 1: text generation, question answering, context extraction, classification and Machine translation, according to Javatpoint (2018).

### Speech recognition (SR)

*"Speech recognition is the task of identifying a sequence of words uttered by a speaker, given the acoustic signal."* (Norvig 2016, 912)

Speech recognition is an interdisciplinary subgroup of AI that enables the recognition and translation of spoken language by computers converting it into a machine-readable format. It is a way to talk with a computer, and on the basis of a particular command, the computer can perform a specific task (Javatpoint 2018).

### Planning

*"We have defined AI as the study of rational action, which means that planning devising a plan of action to achieve one's goals—is a critical part of AI."* (Norvig 2016, 365).

According to the authors of the book *"Artificial Intelligence-A Modern Approach"* (Norvig 2016), the Artificial Intelligence planning subgroup is divided into sections: Classical Planning, Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains and Multiagent Planning, in order to solve real life planning problems such as: scheduling, resource constraints, synchronization, cooperation and coordination.

### Robotics

Robotics is a subset group of Artificial Intelligence and engineering which is used for designing and manufacturing robots. Robots are the physical agents which are programmed and can perform a series of actions automatically or semi-automatically. To do so, they are equipped with effectors such as legs, wheels, joints, and grippers.

AI can be applied to robots to make intelligent robots which can perform a task with their intelligence. Nowadays, AI and machine learning are applied to manufacture intelligent robots which can also interact socially like humans. (Norvig 2016) and (Javatpoint 2018).

## RESULTS

According to the methodology for a systematic and classified literature review, 34 articles were found in different scientific screech-engines in the period from 1994 up to 2018, including 8 articles for the first part of the literature review. After the scientific paper filtering, there were only 21 articles related to two groups of the keyword index and a combination of them. The following was found in the AI technology subset group: 7 articles were connected to the keywords *"Artificial Intelligence"* and could not be classified to an AI subset group. Additionally, 10 articles were linked to the *"Machine learning"* subset group, 2 articles were related to the *"Expert systems"* subset group and 1 article was associated to the *"Natural Language Processing and Computer vision"* subsets group. However, no articles were found in the remaining three subset groups of AI technology: *"Speech recognition, Planning and Robotics"*, see table 1.



AI subset groups with titles of articles	Number of articles per subset of AI
Artificial Intelligence	7
A comparative study of Artificial Intelligence methods for project duration forecasting (Wauters and Vanhoucke, 2016)	1
A Nearest Neighbour extension to project duration forecasting with Artificial Intelligence (Wauters and Vanhoucke, 2017)	1
Dynamic Prediction of Project Success Using Artificial Intelligence (Ko and Cheng, 2007)	1
Empowering collaborative decisions in complex construction project scenarios (Kumaraswamy, 2004)	1
Multi-agent technology for scheduling and control projects in multi-project environments. An Auction based approach (Arauzo et al., 2009)	1
Optimized artificial intelligence models for predicting project award price (Chou et al., 2015)	1
The Challenges of Nonparametric Cost Estimation of Construction Works with the use of Artificial Intelligence Tools (Juszczyk, 2017)	1
Computer vision	1
3D structural component recognition and modeling method using color and 3D data for construction progress monitoring (Son and Kim, 2010)	1
Expert systems	2
A framework for developing an expert analysis and forecasting system for construction projects (Al-Tabtabai, 1998)	1
An occupational safety risk analysis method at construction sites using fuzzy sets (Gürçanlı and Müngen, 2009)	1
Machine learning	10
A hybrid grey based artificial neural network and C&R tree for project portfolio selection (Faezy Razi, 2017)	1
A Machine Learning Approach to Software Requirements Prioritization (Perini et al., 2013)	1
A review of machine learning in scheduling (Aytug et al., 1994)	1
A unique intelligent approach for forecasting project completion time in oil refineries (Azadeh et al., 2014)	1
Evaluating subcontractor performance using evolutionary fuzzy hybrid neural network (Cheng et al., 2011)	1
Predicting construction cost and schedule success using artificial neural networks ensemble and support vector machines classification models (Wang et al., 2012)	1
Progress monitoring of construction projects using pattern recognition techniques (Elazouni and Salem, 2011)	1
Project success prediction using an evolutionary support vector machine inference model (Cheng et al., 2010)	1
Software Effort Estimation using Machine Learning Techniques with Robust Confidence Intervals (Braga et al., 2007)	1
Using artificial neural networks (ANN) in projects monitoring dashboards' formulation (Mossalam and Arafa, 2018)	1
Natural Language Processing	1
Retrieving similar cases for construction project risk management using Natural Language Processing techniques (Zou et al., 2017)	1
Grand Total	21

Table 1. AI subset groups and articles

PM groups: portfolio, program and project	Number of articles per PM groups
Project	18
3D structural component recognition and modeling method using color and 3D data for construction progress monitoring (Son and Kim, 2010)	1
A comparative study of Artificial Intelligence methods for project duration forecasting (Wauters and Vanhoucke, 2016)	1
A framework for developing an expert analysis and forecasting system for construction projects (Al-Tabtabai, 1998)	1
A Machine Learning Approach to Software Requirements Prioritization (Perini et al., 2013)	1
A Nearest Neighbour extension to project duration forecasting with Artificial Intelligence (Wauters and Vanhoucke, 2017)	1
A review of machine learning in scheduling (Aytug et al., 1994)	1
A unique intelligent approach for forecasting project completion time in oil refineries (Azadeh et al., 2014)	1
An occupational safety risk analysis method at construction sites using fuzzy sets (Gürçanlı and Müngen, 2009)	1
Dynamic Prediction of Project Success Using Artificial Intelligence (Ko and Cheng, 2007)	1
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Evaluating subcontractor performance using evolutionary fuzzy hybrid neural network (Cheng et al., 2011)	1
Optimized artificial intelligence models for predicting project award price (Chou et al., 2015)	1
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Retrieving similar cases for construction project risk management using Natural Language Processing techniques (Zou et al., 2017)	1
Software Effort Estimation using Machine Learning Techniques with Robust Confidence Intervals (Braga et al., 2007)	1
The Challenges of Nonparametric Cost Estimation of Construction Works with the use of Artificial Intelligence Tools (Juszczyk, 2017)	1
Portfolio	3
A hybrid grey based artificial neural network and C&R tree for project portfolio selection (Faezy Razi, 2017)	1
Multi-agent technology for scheduling and control projects in multi-project environments. An Auction based approach (Arauzo et al., 2009)	1
Using artificial neural networks (ANN) in projects monitoring dashboards' formulation (Mossalam and Arafa, 2018)	1
Grand Total	21

Table 2. PM groups and articles

Furthermore, 3 articles were aligned to "Portfolio"; no articles were directly linked to "Program" and 18 articles were associated to the keywords index "Project management", see table 2.

## FINDINGS

This paper begins with a review of literature on the usage of AI technology throughout the project life cycle which is categorized into five Process Groups. These five Process Groups are as follows: Initiating, Planning, Executing, Monitoring and Controlling, and Closing as supported by PMBoK standards (Project Management Body of Knowledge) (PMI 2017).

The categorization of articles has been based on an analysis of the research problem in the article and on assigning it to a specific process group of the project life cycle. Although some articles are focused only on the portfolio, those articles are also categorized and assigned to the process group according to the research problem the articles dealt with.

The Initiating Process Group consists of two articles which found that AI technologies are used to solve research problems, namely: Artificial Intelligence algorithms and Machine learning. According to the author Chou et al. (2015, 106) Artificial Intelligence was used to solve the research problem of *"Optimizing Artificial Intelligence models to estimate construction costs and the forecast bid award amount for bridge construction projects."* As noted in a recent article, the result of the research was: *"The cross-validation results show that the mathematical model for the ANNs (artificial neural networks) provides more reliable simulations and has a superior fit compared with the regression methods, CBR, and the conventional approach. This study provides an optimization process for estimating project award prices that improves construction and evaluations of AI-based models as well as an auxiliary tool that contractors can use to make bidding decisions."* Furthermore, Faezy Razi (2017) article supporting arguments of usage of the Machine learning technique for the purpose of solving research problems were as follows: *"The selection of project portfolios through hybrid artificial neural network algorithms, feature selection based on grey relational analysis, decision tree and regression"*. The research result of the article was: *"projects ranked based on neural network weights by the grey relational analysis method prove to be better options for the selection of a project portfolio."*

The Planning Process Group contained nine articles about AI technology: five of them on Machine learning, one on Expert systems and Natural Language Processing, and two of them on Artificial Intelligence in general.

According to different authors the Machine learning technique was used to answer the following research problems - in order to **motivate a need of using Machine learning in scheduling** the authors Aytug et al. (1994) made *"A review of machine learning in scheduling"*. In terms of **effort estimation** the authors Braga, Oliveira, and Meira (2007, 352) introduced *"a method based on machine learning which gives the estimation of the effort together with a confidence interval for it"*. Following are the obtained results from the authors Perini, Susi, and Avesani (2013, 445) who described *"a requirements prioritization method called Case-Based Ranking (CBRank), which combines project's stakeholders preferences with requirements ordering approximations computed through machine learning techniques, bringing promising advantages"*. When talking about **forecasting project completion time** the authors Azadeh, Motevali Haghighi, and Yaghoubi Panah (2014, 1) presented *"a hybrid approach is based on artificial neural network (ANN), fuzzy mathematical programming (FMP) and conventional regression for accurate forecasting of project completion time with noisy and uncertain safety factors in oil refineries"*. Specifically, in terms of **predicting cost and schedule of Project Success** a group of authors Wang, Yu, and Chan (2012, 470) outlined *"the development of artificial neural networks ensemble and support vector machines classification models to predict project cost and schedule success, using status of early planning as the model inputs"*. In order to prove the result of project success by using AI technology according to the same group of authors Wang, Yu, and Chan (2012, 470): *"early planning status can be effectively used to predict project success and the proposed Artificial Intelligence models produce satisfactory prediction results."*

Further, the Expert systems and the Natural Language Processing techniques were used to answer other research problems in the process group of planning. For instance, those AI techniques were used for **risk assessment** to improve workers safety and **risk management** to improve the efficiency and performance on a project. Gürcanlı and Müngen (2009, 371) proposed *"a method for assessment of the risks that workers expose to at construction sites using a fuzzy rule-based safety analysis to deal with uncertain and insufficient data"*. In addition, Zou, Kiviniemi, and Jones (2017, 1) stated *"the efficiency and performance of risk case retrieval, this paper proposes an approach of combining the use of two Natural Language Processing (NLP) techniques, i.e. Vector Space Model (VSM) and semantic query expansion, and outlines a framework for this Risk Case Retrieval System."* The result of the research problem was: *"Preliminary test results show that the proposed system is capable of retrieving similar cases automatically and returning, for example, the top 10 similar cases."*

Lastly, we found that two more articles were discussing the usage of Artificial Intelligence in terms of **nonparametric cost estimation and allocation of resources and project scheduling and control** for solving research problems in the process group of planning. (Juszczuk 2017, 415) discussed *"the opportunities and challenges of the approach based on the Artificial Intelligence tools to cost estimation of construction works."* Additionally, the conclusion of the discussion was that *"Neural networks, due to their general capabilities, seem to be a good tool to aid the proposed approach."* José Alberto Arauzo (2009) investigated *"a new method based on multi-agent systems and in combinatorial auction mechanism to allocate resources for the projects tasks"*. The preliminary results of the investigation showed: *"efficient performance, but there are still many issues to investigate."* The Execution Process Group consisted of one article about Artificial Intelligence, particularly multi-agent.

According to (Kumaraswamy 2004, 133) the AI technology especially multi-agents are used to reply to research problems of **collaborative working - stakeholders demand to be "fully-informed"** as stated in the article: *"information and communication technology-Artificial Intelligence supported empowerment systems and sub-systems"*.

For the Monitoring and Controlling Process Group we found eight related articles about the usage of Artificial Intelligence technology. In terms of AI technology for this process group most of the articles discussed Artificial Intelligence algorithms and Machine learning methods, and some of them debated about Computer vision and Expert systems. Those AI technologies used in order to answer the different research problems during the monitoring and controlling project phase were: **forecasting project control & project performance, predicting the final duration of a project, dynamic prediction of Project Success, progress monitoring and project control**.

In terms of **forecasting project control** the authors Wauters and Vanhoucke (2017) provided *"a Nearest Neighbour based extension for project control forecasting with Earned Value Management. The k-Nearest Neighbour method is employed as a predictor and to reduce the size of a training set containing more similar observations. An Artificial Intelligence (AI) method then makes use of the reduced training set to predict the real duration of a project."* Subsequently, when talking about **forecasting project performance** the author Al-Tabtabai (1998, 259) presented that: *"Artificial Intelligence programming techniques such as expert systems and neural networks provide assistance to construction project managing personnel in capturing construction knowledge needed for analysing and forecasting construction projects."* The result of the research problem showed that: *"ANN models that utilize the current data and the knowledge of experts have been developed to improve schedule plans at regular intervals. The ANN models allow the project personnel to use the most current data to dynamically evaluate the impact of environmental variables on work package schedules and to create fresh schedules instantly."*

In terms of **predicting the final duration of a project** the same authors who discussed forecasting project performance, Wauters and Vanhoucke (2016, 2) benchmarked AI methods against the best performing Earned Value Management/Earned Schedule (EVM/ES) methods. And the results of research showed that: *"the AI methods outperform the EVM/ES methods if the training and test sets are at least similar to one another."*

In order to **predict dynamically a Project Success**, in different articles, the previously mentioned authors Cheng, Wu, and Wu (2010) and Ko and Cheng (2007) proposed to using *"an Evolutionary Support Vector Machine Inference Model (ESIM) to predict project success dynamically and Evolutionary Project Success Prediction Model (EPSPM), driven by a hybrid artificial Intelligence technique, could be used as an intelligent decision support system, for project managers, to control projects in a real time base. Furthermore, the model integrates the process of continuous assessment of project performance to dynamically select factors that influence project success."* In order of prediction the paper results showed: *"that Evolutionary Support Vector Machine Inference Model (ESIM) is able to predict project success at a significant level of accuracy."*

In terms of **progress monitoring and project control** two articles presented a model of collecting the actual-progress data. In one of those Son and Kim (2010, 844) proposed an efficient automated 3D structural component recognition and modelling method that is used in construction progress monitoring. The research result showed: *"An outdoor experiment was performed on an actual construction site to demonstrate the applicability of the method to 3D modelling of such environments, and the results indicate that the proposed method can be beneficial for construction progress monitoring."*

In another article the authors Elazouni and Salem (2011, 355) introduced pattern recognition techniques for collecting the actual-progress data, and claimed that: *"Inevitable issues including variations in reporting skills as well as the willingness to record accurate data impact on the quality of the collected data. Basically, pattern recognition techniques are utilized to classify the multiple patterns representing the planned progress at a given cut-off date and the classification is used to evaluate the pattern representing the actual progress at the same date. The pattern recognition techniques generalize a virtual benchmark to represent the planned progress based on multiple patterns generated at a given cut-off date and representing possible benchmarks. In addition to the alleviation of the negative impact of low-quality data on the progress evaluation, the generalization feature potentially encourages a long-run attitude in site personnel to report high-quality data. Finally, the pattern recognition concept and technique proved their robustness to monitor and evaluate the overall progress of the projects based on the technique of critical path method."*

In addition, the authors Mossalam and Arafa (2018, 385) reported in a study about the portfolio of managing hundreds of projects about selecting projects to be monitored. This study aimed to replace the initial existing manual selection process by an intelligent model. According to it the test results showed: *"acceptable confidence level in the model results where accuracy was proven to be initially accepted. The ANN model is expected to evolve and gains more maturity by including more projects that will be introduced in the coming years plans."*

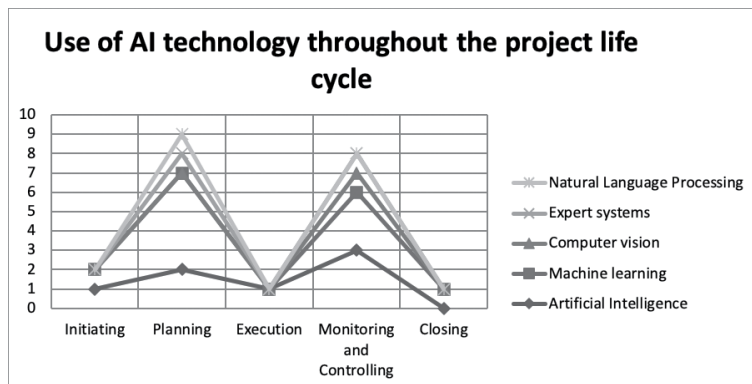
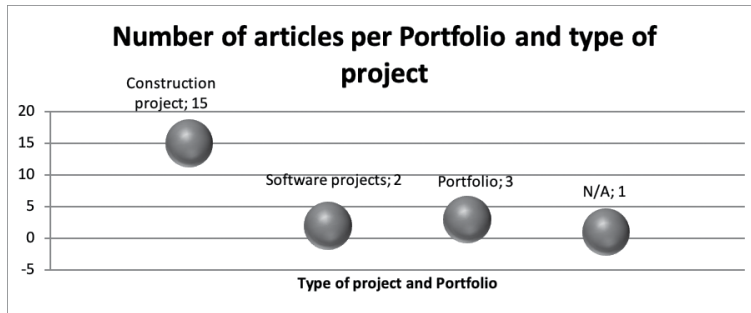


Figure 2. Distribution of AI technology throughout the project life cycle

Finally, only one article was related to the Closing Process Group. The article used Machine learning of AI technology for developing a new intelligent model to assess **subcontractor performance** based on historical information. According to Cheng, Tsai, and Sudjono (2011, 349) the article developed *"an evolutionary fuzzy hybrid neural network (EFHNN) to enhance the effectiveness of assessing subcontractor performance in the construction industry."* And the result of the research showed that: *"the proposed EFHNN may be deployed effectively to achieve optimal mapping of input factors and subcontractor performance output."*

Summarizing the findings of the literature review, the Planning and Monitoring & Controlling process groups have the largest number of articles with usage of AI technology in the project management life cycle. On the other hand, there are fewer articles related to the use of AI technology in Initiating, Executing and Closing. Distribution of AI technology throughout the project life cycle (see figure 2.).

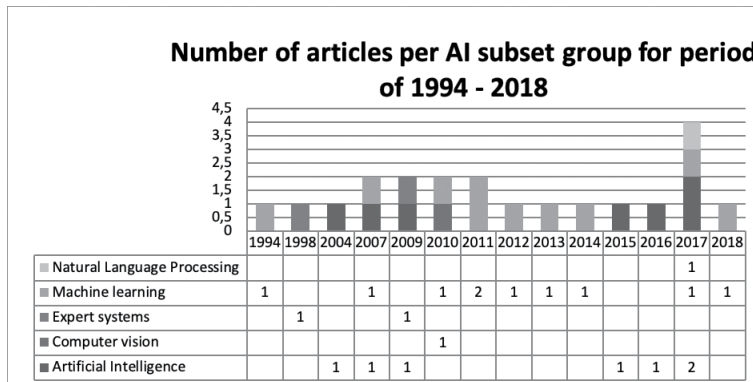
According to the type of project in the literature review we have found that the bulk of projects were construction projects, two of them were software projects. A couple of them were also part of a Portfolio. And finally, one of them has not been identified (see figure 3.). As can be seen, the type of projects with a considerable amount of articles on the usage of AI technology in the project management life cycle is construction projects.



**Figure 3.** Distribution of the amount of articles per Portfolio and type of project

Based on the results of the research, we found articles written in the period from 1994 to 2018. In the mentioned period, two articles were found in 2007, 2009, 2010 and 2011, 4 articles were found in 2017, and in the rest of the years - one article per year (see figure 4.).

According to the sources of the articles, it can be worked out that there is mainly one article per source, with the exception of the "Automation in Construction", "Expert Systems with Applications" and the "International Journal of Project Management" which count more than two articles per journal (see table 3.).



**Figure 4.** Distribution of AI technology in literature since 1994

Name of scientific Journal	Number of articles per scientific Journal
7th International Conference on Hybrid Intelligent Systems (HIS 20C)	1
Automation in Construction	4
Benchmarking: An International Journal	1
Construction Management and Economics	1
Engineering, Construction and Architectural Management	1
European Journal of Operational Research	1
Expert Systems with Applications	2
HBRC Journal	1
IEEE Transactions on Engineering Management	1
IEEE Transactions on Software Engineering	1
Inteligencia Artificial 42 (2009) 12-20	1
International Journal of Industrial Ergonomics	1
International Journal of Project Management	2
Journal of Construction Engineering and Management	1
Journal of Loss Prevention in the Process Industries	1
Procedia Engineering	1
Grand Total	21

**Table 3.** Distribution of articles per scientific Journal

In terms of articles per author, the research paper indicates there is one article per author, excluding two groups of authors, namely: Cheng et al. and Wauters&Vanhoucke who have two articles related to keywords AI and project management published in different years (see table 4.).

Name Author of article	Number of articles per Author
Al-Tabtabai	1
Arauzo et al.	1
Aytug et al.	1
Azadeh et al.	1
Braga et al.	1
Cheng et al.	2
Chou et al.	1
Elazouni and Salem	1
Faezy Razi	1
Gürcanli and Müngen	1
Juszczak	1
Ko and Cheng	1
Kumaraswamy	1
Mossalam and Arafa	1
Perini et al.	1
Son and Kim	1
Wang et al.	1
Wauters and Vanhoucke	2
Zou et al.	1
Grand Total	21

**Table 4. Distribution of articles per author**

## CONCLUSIONS

The aim of this paper was to research the relevant literature (review) according to set keywords and associated combinations of them, in the period - from 1994 to 2018. We can conclude that AI technology has been used mostly in the planning and monitoring&controlling process groups to solve different research problems. According to the majority of the reviewed papers, the AI technology accomplishes better results than the traditional tools or techniques. However, some parts of the process implementation of AI technology in the project life cycle have weaknesses and limitation in terms of data input.

In this literature review, no articles have been found related to three of the AI technology subset groups: Speech recognition, Planning and Robotics. These AI subset groups could open new perspectives on AI usages in project management.

## FOR DISCUSSION

According to the trends in practice, more and more AI technology has been used as an assistant. Could AI technology become an assistant of project managers in order to eliminate repetitive tasks?

## RECOMMENDATIONS FOR FURTHER RESEARCH

For future research, we could broaden it by using more detailed AI subset techniques keywords related to project management so as to prevent bottleneck.

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**PROJECTIFICATION & ITS IMPACT ON SOCIETIES**

Hold it up • Miss it • Authorize

*[Public administration based on transparent project governance structures]*

**ABSTRACT**

"Project governance" is a terminology that surrounds the project management environment where it projects the reason for the community to be aware of all details and procedure that accompanies the project to be accomplished, but in a transparent route.

"Project governance" should be built on a structure where the details are the most important constituents to finalize the mission on its highest/greatest standards. Nevertheless, it will not be a built-template to be customized accordingly to the project in question. The constituents will play an essential role of hegemonizing the governance framework on the project to ensure a neat vision of its perfect ending.

"Project governance framework provides the project manager and team with structure, processes, decision-making models and tools for managing the project, while supporting and controlling the project for successful delivery." (A Guide to the Project Management Body of Knowledge - 5<sup>th</sup> Ed. - Page 60).

Two crucial factors are to be considered in this statement:

1. *"provides manager and team with structure, processes, decision-making models and tools for managing the project"*: The need to have in-hands a robust structure is a powerful engine for the people in charge [*manager and team*] to move forward and overpass every single obstacle to achieve their aim. This engine will guarantee (a) the trust of the community, (b) the self-confidence of the stakeholders [*their leadership and authority are inclusive*], (c) the commitment of the business parties [*referring mainly to the shareholders form the stakeholders*]. The above-mention engine is the primary pillar to start.
2. *"supporting and controlling the project for successful delivery"*: These 2 actions are the beats of the process that make sure of the resistance of its biorhythm. The manager should consider, to get a satisfied outcome, (d) the face-to-face assembly, (e) details records, (f) hazard/expectations study. In brief, a well-structured control and guidance process.

This paper will emphasize the point over:

1. The six characteristics mentioned during the explanation of the crucial factors
2. Success-story of a project governance (pros and cons)
3. Necessary resources needed to build a project governance and their interconnection
4. Project governance estimation
5. A successful project through project governance

**Keywords:** Public project, stakeholders, community, governance, projectification, project management, process, structure

## 1) INTRODUCTION

**1-1.** In recent business environment, activities running great strategies are increasing to be kept updated, shaped as a powerful form that is snowballing to maintain the resistance of the success of the enterprise. This approach is to be keeping the attention awake for every single detail wrapping up the situation of the production and the state of the outcome. Many publications are being released for this field and domain, without pointing the interconnection between the disciplines themselves. For the various sides, this projectification has gaps and lack-points exist but to be defeated and overpassed.

The aim here is to set the seal on the keeping the decision where it should be by following various drivers which allow the outcome to be real, but to verify the decision will endorse to customize the policies and strategies [plan and actions] to be conform to the real performance. The robust part of being on the correct track, well-decided, surely lead the team to the comfort zone visualizing their final structure prior reaching the culminant point; thus here where the discussion and experimentation will be part of the them in this document.

In other words, this structure will:

- Build the obedience for the deadline
- Provide the stakeholders their right to manage the mobile part they possess
- Create a report defining the lacks and risks so to be able to make supportive steps
- Strengthen the poor links between the activity disposition
- Shape the timeline track to efficient results
- Draw the skeleton for the final announcement

It is famous to All that being aligned with respect of the robust structure is an added value for the process of each and any project; but does it mean we have always to "obey the law" and make the "by-the-book" approach a reality? Is it our concern to match the principle of the theory with the execution on-site? Is it primordial to ensure the safe outcome of the results?

This paper will follow the quantitative method where data will be collected on paper based and face-to-face submission for quicker result collection. The survey targeted the General Audience, both genders and specific segment of people employed at public institutions (municipality, government, etcetera).

**1-2.** By definition and for reference in the continuity of the document, here are the explanation of terminologies:

- **Public Project:** the actions, activities and strategies of the plans implemented by any responsible public sector; could be municipality, governmental parties, education service, emergency service, healthcare service, infrastructure service,
- **People in charge:** the team of execution; complete hierarchy. If any specification needs to be mentioned for a position in charge, it will be named separately.

## 2) PROJECT GOVERNANCE

### 2.1 The six characteristics:

#### a. The trust of the community (Fig. 1)

The culture of the organization, managing a public project, creates definitely its reputation towards the community targeted. The strategic operational system of the implementation as well as the perfect organizational structure of the process will make of the received reputation a higher one, and will define the elevate level of trust of the community.



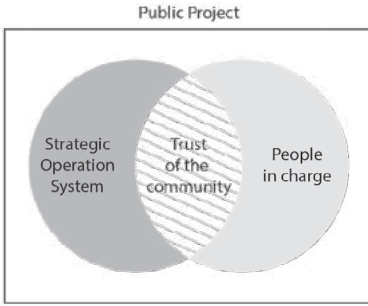


Fig. 1

### b. The self-confidence of the stakeholders (Fig. 2)

Every public project will turn into a result [practical or theoretical] that should satisfy, mainly the audience, and generally the stakeholders [*in particular: customers, shareholders, people in charge*]. This will build the stakeholders' expectations, moreover their satisfaction resulting from their self-confidence. The scale of different factors enhances the approach of the stakeholders towards the public project, which create the perfect reputational vision executed.

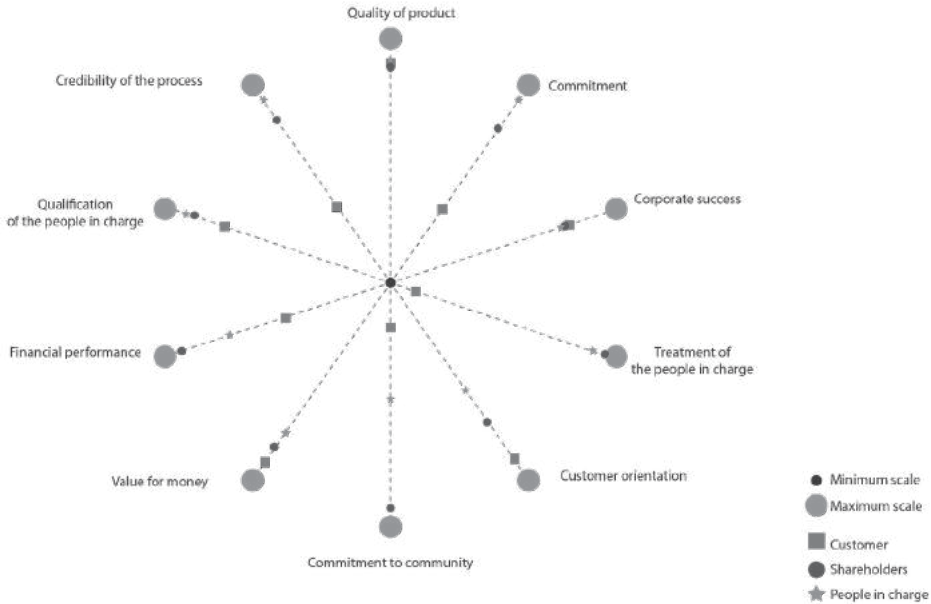


Fig. 2

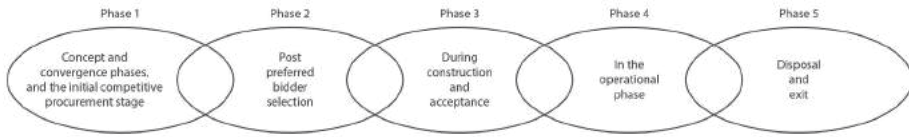
### c. The commitment of business parties

The interconnection between parties is essential to follow up the route of the outcome. This status is made by trust and commitment, but reflects the confidence of the businesses and the mutual loyalty. The statement and transparency of the reports structure the elegant network poles to prepare the business parties to a unique model of success [ownership and sponsorship relation]. Reporting and disclosure are parallel tracking to the expected and desired win-win situation.

### d. Face-to-face assembly

This come through the fact to realize that the human interaction provides more efficient results than reports and analysis shared via viral channels. It relays on a robust structure of the people in charge to ensure the process of experts that are leading the project to the correct and powerful framework/outcome.

This required a system of boards that is essential to address various needs of the different project stakeholders and make them safe towards the action undertaken. The system of boards follows the track from the starting line till its arrival to the safe final result. (Fig. 3)

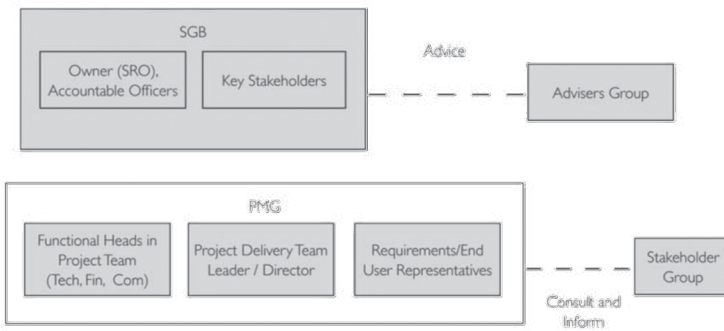


**Fig. 3**

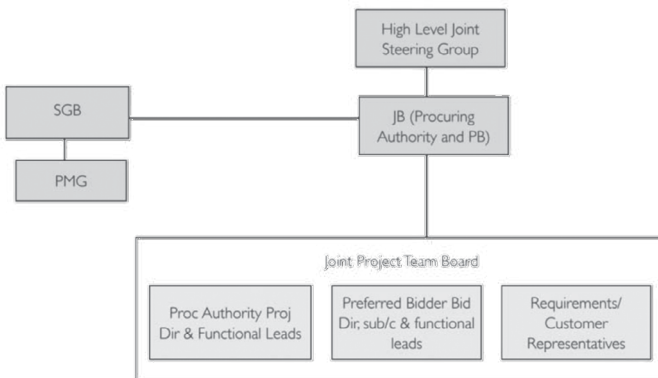
The people in charge must have the capability to manage the operations, the management functions and analyze the situation to provide solution for any obstacle and direct the state of affairs towards solution-oriented perspective.

The structure of the people in charge will designate the frequency of face-to-face meetings, their roles as well as the action plan to work on.

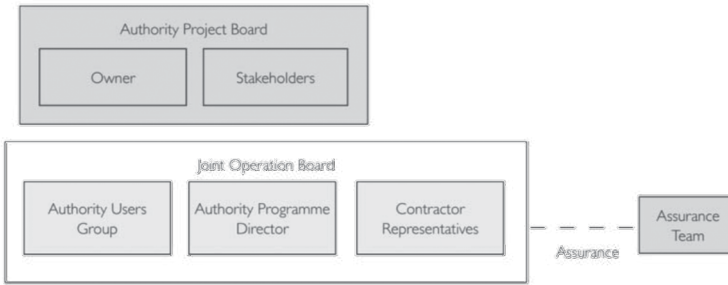
As examples, and as per "Project Governance: a public note for public sector projects", issued in November 2007, ISBN 978-1-84532-376-9", on page 20, here are samples of the people in charge divisions:



**Fig. 4: Level board structure**



**Fig. 5: Board structure incorporating external representatives**



**Fig. 6: In-service operational phase board structure**

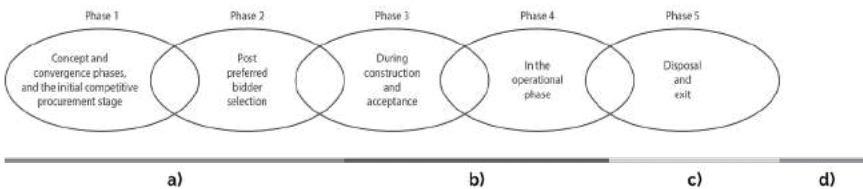
#### e. Details record

Resulting from the face-to-face assembly, the taken and confirmed decisions will be the reporting feeds of the project where the clear and neat guidance are set to implement, as well as the consideration of the resources (materialistic & human). The reports and records should have:

- An independent approach.
- Approval on several processes set to provide the clear understanding of the requirement for the work-process.

The frequency of records will be coordinated as following (Fig. 7):

- Before the implementation phase: meeting to wrap up the concept and decision to launch the project.
- During the implementation phase: watching and scanning the steps in order to meet the concept values and structure as well as the determination of the process.
- At the final outcome phase: observing the final result to deliver and appraising the details that should have matched the previous thoughts and mapping procedures.
- Post-outcome phase: after a considerable period of time where the feedback will evaluate the feedforward that was inserted in the project by the people in charge. It will build the "success story".



**Fig. 7**

#### f. Hazard/expectation study

This point illustrates the real implementation side and its impact on the site while making the concept concrete. At this stage, the study is becoming tangible and offering people in charge the challenge that shows its strength. Risk is a part of the work but its immediate report is a necessity as it brings the suitable support to trigger the safety and security to the situation in question.

The operational management is the structure that contains the most hazard and unstable cycle, but its tolerance should be modest to accelerate the forward moves of the project.

## 2.2 Success-story of a project governance (pros and cons) [Personal Experience - True Story]:

A principal mechanism for overpassing the new challenge was my obsession to show the competence of a unique and remarkable occasion: The Apostolic Visit of His Holiness Benedict XVI to Beirut. This event was going to take place in Lebanon during 14, 15 and 16 September 2012, and I was occupying the position of manager and creative director.

This public project was dedicated to a) general audience, b) selective target audience (customized events), c) private niche audience (targeted private sectors) and managed by the cooperation between the Ecclesial Maronite Management and the Lebanese Republic Government.

The challenge was to deploy the perfect equilibrium between the knowledge of the ecclesial communication and the governmental approach, as His Holiness is the Head of the Catholic Church and the highest instance of the Hierarchy, and the Head of State of Rome.

It was not only important to capture the main point of the structure, but to deliver the know-how for the people in charge to serve the mission perfectly. This will support the program and the action plan to be more smoothly implemented and executed during the right and exact period of the visit.

(Fig. 8)

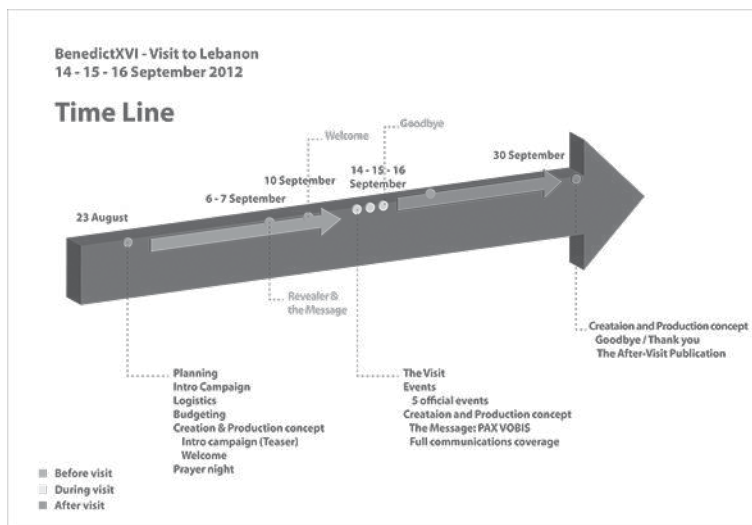
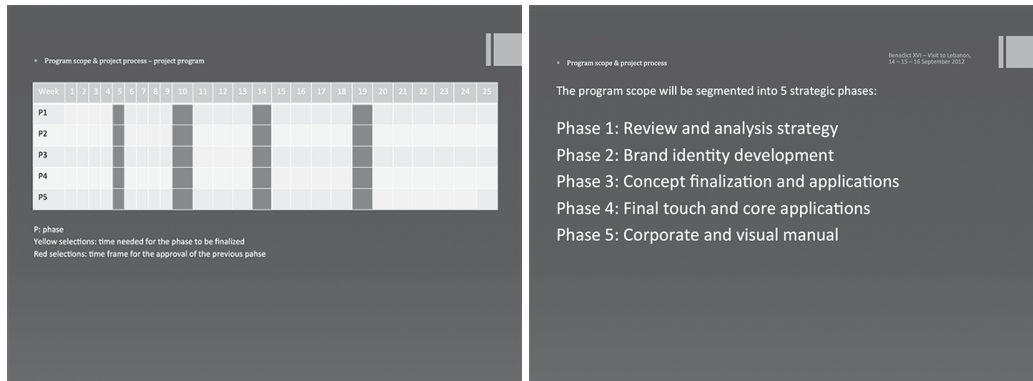


Fig. 8

## Unity surrounding the similarity of knowledge (Fig. 9)

Both above-mentioned management were not a common well-public structure to form the perfect outcome convincing the community and audience, as well as the stakeholders in general, about the principal message to deliver. The conversion of the strategic thoughts into feasible actions, emphasizing the stakeholders' vision of success, was strenuous and demanding. (Referring to the trust of the community mentioned previously, B-1,a)



Benedictus XVI – Visit to Lebanon, 14 – 15 – 16 September 2012

#### Target / Target Audience

The Primary Audience target is the Middle Eastern Christians then the Lebanese ones followed by creating an echo to reach all the Christian communities over the world. In addition, the delicate and important target is the Lebanese/Middle Eastern youth.

To reach the target audience, we will need the support of all the youth community, the Religious/Christian groups and parishes. In addition, the media is our big target to hit so we can expand more to cover all the needed areas where our audience remains.

#### How to get the target audience?

After brainstorming the target and audience we need to reach, here is below the communications channels and tools for that purpose:

Target Audience Sheet	
Target	Channels and tools of communications
Primary audience	BTL, ATL, schools, universities, parishes
Staff, volunteers	Guide and regulations, promotional items
People in charge of responsibility	Conferences, posters, flyers, awareness
Media	Press releases, direct mails, calls, PR, media conferences
Key People	Invitations to event, reports, plans
Secondary audience: NGOs,	Invitations to share the events, links to the resources and findings

#### Strategy

The strategy will be composed by 4 campaigns that will support the concept

- A - Welcoming campaign
- B - Thank you / Goodbye campaign
- C - Introducing Pope Campaign
- D - The Message campaign



Fig. 9

#### Successful steps achieved (Fig.10, Fig. 11)

The favorable outcome was built on the strong corporate governance created between the management parties implementing to reach the strategic objectives delivered to a) general audience, b) selective target audience (customized events), c) private niche audience (targeted private sectors).

High qualified people in charge met together, more than regularly done, and created the perfect business-harmony to provide the sensitive "marketing" strategy and plan to explore. Operating with an equilibrate environment of religious and laic standards, translating focal visions into realized activities, creating opportunities to satisfy the stakeholders, and reducing risks in moving forward towards the principal aim. (Referring to The self-confidence of stakeholders and commitment of business parties in B-1,b and B-1,c respectively).

Pope Benedictus XVI visit to Lebanon - 14, 15, 16 September 2012

Organizational Chart

Coding: F.MT: Father Marwan Tabet, F.AAK: Father Abdo Abou Kasem, F.KA: Father Khalil Alwan, F.GM: Father Charbel Mhanna, MJ: Mario Jade

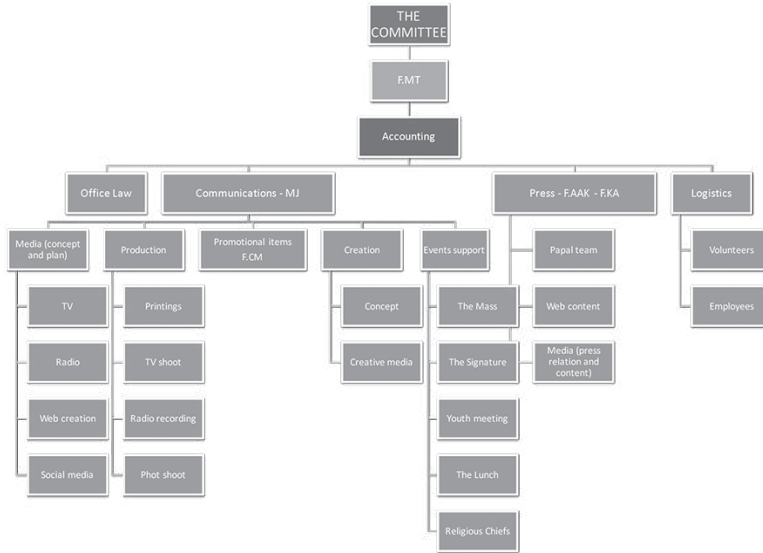


Fig. 10

People

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**Father Abdo BOU KASM**  
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**Father Khalil ALWAN**  
 Rector of the Sanctuary Our Lady of Lebanon  
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**Rana CHAAYA**  
 Media Manager  
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**Mario JADE**  
 Creative and managinf director of the Campaign  
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Fig. 11

**Assimilated results**

The people in charge, tracing the perfect collateral systematization, found the quick turn-around period from thoughts to actions. Decisions were well set to guarantee all delays were avoided due to a time-line plan specifying the deadlines, the level of responsibility, the budget and the available [efficient] resources. (Referring to the face-to-face assembly, details records and hazard expectations study in B-1,d – B-1,e and B-1,f respectively).



### Pros & Cons

More and more resources and people in charge are qualified to manage their strategic and operational tasks tending to reach the greatest outcome for their project. Even though, consideration of positive and negative effects is a must where the planification will be more structured and the execution less hectic to do.

In this success-story case, the people in charge were recruited to enhance the project's level of professionalism and to be able to manage and execute their tasks by meeting the high expectations of the Top Management. They have the requested experience in the field as well as the conveyable tools to work with. They were able to propose the forecast and notice the risk, but prevent it prior to happening. Their expertise made the communication more fluent and the interconnection between leaders and management flexible by creating a solution-oriented vision to deliver to the stakeholders.

Regarding the target audience, the three different segments already mentioned in the study, had a contentment receiving their outcome as expected and encountering the expected reputation with the desired one.

In addition, this level of expertise had supported them to manage effectively their time during the project cycle without keeping obstacles block their ongoing process. The articulation of the action plan detected the accuracy in the risk assessment where the early stage will offer the opportunity to create the solution and to arise the positive opportunities to grab.

On the contrary, the lack of the structure would have deviated the correct track to hit the objective with various actors that would have driven the outcome to the failure zone.

Starting with the budget management that creates difficulties to implement the project and to hide the needs that matter the team in charge.

At this stage, the complexity would have increased and the rigidity to solve the issues would have been stronger and unbeatable. It also led to blurry communication with parasite in conversations and would have broken the assembly of diverse people.

The unavailability of management reduces the creativity by focusing out of the correct and needed zone and aids to miscommunication in the team.

At the final stage, working without the structured management might lead to hit the objective, but once over headed by the perfect one, aim will be hit and it opens new door to new opportunities.

### 3) NECESSARY RESOURCES NEEDED TO BUILD A PROJECT GOVERNANCE AND THEIR INTERCONNECTION

Since similarity between the governance of a project and the one of an organization, the policies, regulations, procedures, functions, responsibilities and processes are to clarify the management function and oversee of the project.

This implies the presence of the following (Fig 12: The Petal-Resource Model):

- Respect for the organizational aims:  
This shows the power of the project that should meet the objectives of the organization and the endowment to these objectives.
- The direction of the provided command:  
The link of responsibility between the different positions of the people in charge channels the hierarchy structure and its reputation to be on the considered standard.
- Preparing reports and records:  
The delegation of the human resource is a must to deliver the results and reports on a specific frequency and timeline to maintain the step-by-step process.
- Assurance team:  
It guarantees the safe and efficient process that meets the expectations and objectives of the project at hand.
- Determinations:  
During the life-cycle run, some decisions barge into to push up the process or regenerate some authorities to carry on till the safe and desired outcome.



Fig. 12

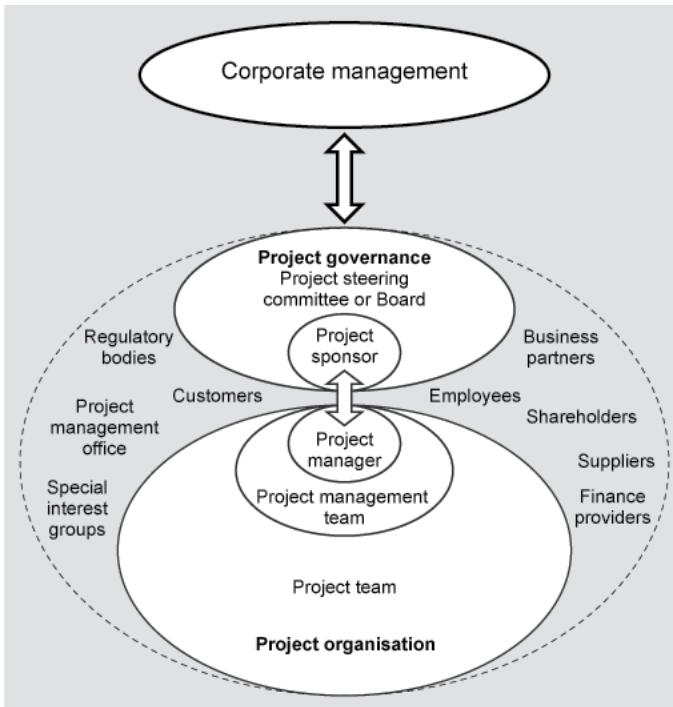


Fig. 13 - (Adapted from ISO 21500, p. 7, Figure 4)

#### 4) PROJECT GOVERNANCE ESTIMATION

The "give me 5" [hand] model (Fig. 14) is one of the most empowered way to drive through the sketching of the project, by the project manager prior launching his plans.

This model is based on purview of influence, caliber standards, period of time, risk/probability level and resources.

The interconnection of these factors create the equilibrium as well as the lifecycle of the project where the detection of each detail prevalence will show the result of the action. Then, due to the analysis of this result, the action will find its way to remain on the right track therefore reaching the correct objective.



**Fig. 14**

These factors modeled in the Fig. 14 are answering the following:

- a) The bulk of work to be considered
- b) The estimation of the technical procedures and processes on-site
- c) The value of money versus the underpinning delivery time needed to accomplish the project and hit the target.
- d) The people in charge who are included in the complete process and the required material.
- e) The money to spend during the process considering any mobility for the budget.
- f) The external or internal facts that might face the process of implementation but tend to decelerate, delay or block the moving-forward actions.

The mobility between the factors of the "give me 5" [hand] model does oblige the people in charge to define its strategic structure to be able to correlate with the end result by drawing the framework relationship for the policies and rules set.

## 5) A SUCCESSFUL PROJECT THROUGH PROJECT GOVERNANCE

Preparations for launching a new project to the community with the vision of analyzing the attention of perfect success is not an easy process to do without the project governance approach. The successful steps to follow a structured management lead to:

- a) Unique center of performance.
- b) Powerful resolution.
- c) Definition of the duty of each team member.
- d) Transparency of the process and non-parasite communication.

Having one focal point to empower the performance of the people in charge will lead to brilliant outcome on the delivery stage accompanies with satisfaction of the stakeholders, because the excessive direction of the power was towards one and unique target. This approach cancels the blurry operations that might redirect the project to failure zone.

The tough decision, by taking clear instructions to move with is essential mechanism of advancement, impacts the community and create key points to manipulate the one [and only] direction of the project. This fact is the result of the decision-making standardized with the analysis of the reports and records collected.

Moreover, the project governance calls to arms the exact role of each member team by defining its job description, its tasks, its duties and area [thoughts and physicals] to move into. The heavy weight of the responsibilities falls on the shoulder of the project manager by determining the resources, their tools, the allocated and needed budget as well as the quality of the outcome but the process as well and the capability to manage the risk and its quickest rescue plan to resist.

At the end, the project governance will be the only flow of information provided from each analysis, research, reports, experiences and collected data. This will enhance the powerful communication between leaders and will support the update of the plans during the ongoing process. The productivity will be channeled to promoted standards and advanced positions.

## 6) CONCLUSION

Various business environment are differently structured due to multi-factors surrounding them with the potential of being fruitful because of the richness of the territory. Fertility in these conditions produced more results, various approaches and profitable rendering.

Because structured management is provoking to lead to hit the objectives and goals of the project, project governance is always a guarantee to be create a move on the route for the easy, transparent and clear way. Successful structure will create ripples to expand the positive results and to secure and confirm the core point is the strongest to link to the gravity tip at the end outcome.

Holding the project governance is crucial; missing it is a lack of experience even though the upshot was done, but possibilities to more expansion won't exist. Authorizing the project management is the only and unique fortunate process to succeed, open doors to new opportunities and make unforgettable work-stories.

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## INTERRELATION BETWEEN CORPORATE GOVERNANCE AND PROJECT GOVERNANCE

### ABSTRACT

*This conference paper focuses on several aspects of corporate governance, governance of projects and project governance in organizations (Joslin and Müller 2016). The literature suggests several interrelations between those phenomena. Project governance is on one hand seen as subset of corporate governance and with that summarizing the main determinants of corporate governance such as: the value system, responsibilities, accountabilities, ethical principles, trust, power and policies. On the other hand, the project governance is seen as a single process with different facets. In organizations (project-based organizations in particular) projects are a mean for achieving organizational (strategic) goals and in particular a mean for achieving value for the organization. The paper discusses several indicators on corporate and project governance correlation and dependency. Recently researched concept of governance paradigms e.g. cross combination of two main dimensions: shareholder versus stakeholder orientation and behavior versus outcome control, gives some important theoretical frameworks insights in the question at hand and also provides several empirical findings on a applicability in relation to size of projects and/or organizations, geographical and industry distribution and similar. Findings in this paper support the top down influence of corporate governance on project governance. The paper also discusses the factors which influence the corporate governance any by that also a governance of projects and project governance and is establishing circumstances under which the project and project deliverables influences the governance model. According to conducted desk research there are several factors identified, like those, already researched among governance paradigms and additionally also inclination to change as one of the important parts of organization's corporate culture.*

**Key words:** Project governance, Governance of projects, Corporate governance, Governance model



## INTRODUCTION

The term governance has several meanings but, in its essence, it could be defined as the action or manner of governing an organization. It is the most general definition, which is often further elaborated, especially in global and/or more complex organizations. Governance is a very comprehensive and broad concept and its definition varies considerably depending on theoretical perspective and layers of the corporate hierarchy (Müller, Shao, and Pemsel 2016). This paper focuses on corporate governance, governance of projects and project governance within an organization.

There are many different definitions of governance, though. Corporate governance could be defined as system of rules, practices and processes (Too et al. 2017) but it could be also defined as principle, policies and framework by which an organization is directed or controlled (ISO 21505:2017) or a relationship between a company's management, its board, its shareholders, and other stakeholders, to provide the structure through which the objectives of the company are set, and the means of attending those objectives and monitoring performance are determined (OECD 2004). Corporate governance is defined either as system, principle, policy, framework or relationships within and with an organization. There is no one fit for all approach in defining the corporate governance. Müller defined corporate governance as institutional framework that regulates the division and exercise the power in the organization (Müller 2009).

As shown above there are three main components/aspects of governance, namely:

- a system of controls,
- a process, and
- a set of relationship.

Those three components are reflected in every organization and its layer of management. The scope is broken down along the corporate structure. As Müller stated, the need of governance emerges at every level of management hierarchy or network, from the board of directors down to the groups of projects, and further on to the project managers (Müller, Shao, and Pemsel 2016).

Organisations exist and operate in various historical, cultural and legal frameworks, therefore several governance theories are researched in literature (Alie 2015). Governance theory typically refers to controls and processes as the components of governance in order to understand and define the organisation's context and its set of rules and practices. Relationships provide on the other hand a theoretical lens for understanding the particular behaviour within an organisation (Müller 2016). Agency theory, stakeholder theory and stewardship theory are theories with significant importance to the topic of this paper. For more details and other theories please see the literature (Ahola et al. 2014; Michiel Christiaan Bekker 2014; Michiel C. Bekker 2015; Cardenas, Voordijk, and Dewulf 2017; Chaza 2016; Derakhshan, Turner, and Mancini 2019; Haq et al. 2018; Joslin and Müller 2015, 2016; Kelly 2010; Liu and Xie 2014; Management 2012; Müller 2009, 2016, 2018b, 2018a; Müller et al. 2012; Müller, Pemsel, and Shao 2014; Müller, Shao, and Pemsel 2016; Müller, Zhai, and Wang 2017; Pinto 2014; Too et al. 2017).

According to some researchers, agency theory may have considerable potential for further enriching our understanding of project governance (Alvarez-Dionisi and Turner 2012; Alvarez-Dionisi, Turner, and Mitra 2016). In particular, the issue of separation of ownership and control is analogous to the setup between business managers and project managers employed by a project-based firm (Ahola et al. 2014). The theories have however, an important impact on governance models of an organization. Governance model under agency theory is considerably different from the one under stakeholder theory. If we put it simple, the particular theory describes the role of (top) management within an organization and in relation to external factors, like owners, community, environment, etc.

There is additional and particularly important finding in relation to corporate governance. As (Licht 2014) pointed out, no institutional analysis of (corporate) governance system would be complete without considering cultural environment in which such system are embedded. The culture has therefore significant influence on governance and influences all components of governance. Also, the organizational trust and ethical decision making significantly influence the governance model and shall be analyzed in the context of governance model.

For the purpose of this paper there is another dimension of corporate governance, which should be mentioned. Corporations are in its substance legally grounded. It is a pure legal and artificial concept of recognizing legal entity and by this, consequently, gives rights and duties to assets. Corporations are therefore plain legal concept without own will and ability to exist and to perform without a help of natural persons. This statement is challenged recently with the development of artificial intelligence however, the corporations are governed by ultimate individual(s).

Governance system is reflected throughout whole organization and defines crucial framework of governance on every layer of management. The relationship between different governance layers within an organization is at great relevance for our research. The governance of projects combined with project governance coexist within the corporate governance framework, and both cover portfolio, program, and project management governance (Joslin and Müller 2015). The literature on project governance addresses several contexts, such as project governance for risk allocation, a framework for analyzing the development and delivery of large capital projects, NASA-specific framework for projects, governing the project process, mechanisms of governance in project organizations, normalization of deviance, and governance in project-based organizations – functional, matrix, or projectized (Joslin and Müller 2015). Project governance is a subset of corporate governance, which contains the value system, responsibilities, accountabilities, ethical principles, and policies (Pilkienė et al. 2018). To put it more straight forward: project governance is the framework within project decision are made (Garland 2009).

Publications discussing governance in the project contexts can be classified into two main groups. Firstly, research and publication in the field of project governance that focused mainly on public sector and large projects (Too et al. 2017). Among these publications, many consider project governance for large multi-firm projects as contract organizations. Others view project governance as a nexus of treaties involving several actors interconnected via inter-organizational relationships and network (Too and Weaver 2014).

The second group examines governance models linking different project related levels (e.g. project management, program management and portfolio management) within an organization. This management framework is frequently being described as either 'enterprise' or 'strategic' project management (Too and Weaver 2014).

The overriding aim of project governance is a consistent and predictable delivery of projects and programs in accordance with their planned contribution to corporate strategy and stakeholder expectations. This is achieved through a consistent and coherent execution of governance roles and responsibilities by the various management levels throughout the organization (Müller 2009). Poor project governance leads to project failure (Garland 2009).

Perhaps the best way to describe the relationship between the corporate governance and project governance is set in literature as a link of principles of corporate governance to projects (Müller et al. 2013).

The interrelation in governance model within an organization is studied by using techniques of a qualitative research.

## METHODS

Research methods, used in this paper, are based on the logical interpretation of literature and practice. In the first part, we gave the theoretical foundations. We used the following methods in their design:

- a method of description for a theoretical description of the issue under consideration,
- compilation method for summarizing the results of scientific research works,
- the method of deduction and induction for drawing conclusions based on the arguments found,
- a method of synthesis and analysis to present the conclusions.

## DISCUSSION

One of the earliest studies to address the interaction of project level and corporate level governance was presented in article by Müller, Anderson, Shao and Kvalnes in 2014 (Gemünden 2016). It is important, how organizations that follow good corporate governance principles positively influence ethics and ethical behavior of the wider organization, including their projects and reduce the need to adjust ethics at the project level through project governance (Müller et al. 2014). Using institutional and agency theory as their theoretical lenses, the authors show how macro level corporate governance and the micro level project governance are contingent on each other in influencing the likelihood and severity of ethical issues in projects (Gemünden 2016). As Bekker defined, project governance should be applied to a project (and governance of projects to program and portfolio of projects) in a same manner as corporate governance applies to an organization (Michiel C. Bekker 2015).

### Governance paradigms

The question however remains, how the governance theories affect the governance of projects and project governance. If the governance of projects and project governance are subset of corporate governance and therefore the governance gap seems to be evident (Renz 2007), how those theories directly or indirectly affect the governance of projects and project governance.

The literature offers answers in defining governance paradigms by Müller (Müller 2009, 2016, 2018b, 2018a):

	Shareholder Orientation	Stakeholder Orientation
Outcome control function	<p><b>Flexible Economist Paradigm</b></p> <p>Achieving highest possible Return on Investment (ROI) for the organizations' shareholders through optimization of the management of projects. Done by establishing project management as core competence (for example, through training, certification and related career ladders) executed by professional project managers who are employees of the organization.</p> <p>They are guided by tactical Project Management Offices (PMO), which support and control the application of accepted project management methods and tools.</p>	<p><b>Versatile Artist Paradigm</b></p> <p>Consists of balancing the qualitative and quantitative requirements of a wide range of stakeholders (both often differ by project). Achieved through selection or tailoring of project management methods for the different projects. Project management is understood to be a core competence of the organization and a profession of the individual. Both aspects are guided by a strategic PMO which defines the organization's business results to be achieved through project management.</p>
Behavior control function	<p><b>Conformist Paradigm</b></p> <p>Maximizing shareholder return by strictly applying existing development methodologies. Project management is often a subset (possibly invisible) in the specific development processes for technical products or services. Project management is understood as an on-the-side task for leading technical experts.</p>	<p><b>Agile Pragmatist Paradigm</b></p> <p>Balances the diverse requirements of a variety of stakeholders by maximizing their collective benefits through the timely development of functionality or value. Project management methods maximize value of a series of project outcomes over time, based on the strict prioritization of user needs.</p>

**Table: Four governance paradigms (Müller 2009)**

The paradigm model was tested worldwide (Müller 2018a) and results shows that:

- English-speaking countries using on average more shareholder than stakeholder approaches on which all except Australia prefer on average to control behavior,
- Some countries, such as Sweden, are almost exclusively represented in the sample through large corporations which speaks for its shareholder orientation,
- Larger projects are more often governed by strict shareholder orientation and process compliance,
- Small projects are on average governed through a stakeholder orientation combined with outcome control,
- The IT and telecom industries are shown as relatively more process oriented than other industries,
- In engineering and constructing industry is more focused on outcome control and those both industries are more focused on shareholder-oriented governance.



Geography, industry, and size of the projects influence the most appropriate paradigm and with that consequently the project governance model. The literature suggests that for certain characteristics of the projects, program, and portfolio the certain paradigm is most suitable to obtain desired results as projects, program or portfolio deliverables (Aragonés-Beltrán, García-Melón, and Montesinos-Valera 2017). Furthermore, it is also evident that corporate governance and its underlying theories affect the governance of projects and project governance. It seems the top down relationship is well researched and established, so the impact is from the corporate governance on governance of projects and project governance as last two being a subset of corporate governance.

There are also some theoretical evidences and literature findings that there are many factors, which impact corporate governance (Badewi 2016). We have researched in several ways to establish findings with the most impact in governance literature. Several similar phenomena exist, which are researched in both streams of literature and the most important are organizational trust, organizational culture and ethical decision-making.

### **Organizational culture**

Lima and Patah (2016) found out that cultural issues influence positively and negatively the governance of projects and project governance. According to those authors the culture involves stability, stresses conceptual statements, and serves as a factor of union to lead the member of the group towards consensus. They further define culture as the sum total of beliefs, standards, techniques, institutions and artifacts that characterize human population (Wang et al. 2019).

A subset of culture within an organization is organizational culture, which is one of the most influential dimensions of the work environment and, consequently, the main force of the direction of a business. It is reflected on how the tasks are performed, the goals are achieved, and the people are directed to the achievement of goals. The culture affects the decision-making process, how to think, feel and respond to the opportunities and threats. The culture is rooted in the people and unconsciously influences their behaviors and affect their performance and vice versa (Lima and Patah 2016).

In the context of project management, organizational culture can influence how the departments interact and mutually support each other in search of project goals. It also influences the level of involvement of employees in achieving the objectives of the project, to balance them with other existing goals and potential competitors. The organizational culture still influences the planning process of the project as well as how the form of work is estimated or how the resources of projects are designed. Finally, the culture affects how managers assess the performance of team projects and how they understand the outcome of the project (Lima and Patah 2016).

Meyer, Pretorius, and Pretorius (2015) conducted a research and the following primary issues a scribed to cultural differences, were identified:

1. Issues with communication
2. Issues with decision-making
3. Issues with task performance
4. Issues with trust among people
5. Issues with adapting to new environments
6. Issues with lack of cultural intelligence training
7. Issues with lack of project management training

Those authors found out that cultural differences are part of multicultural teams. These differences have an influence on project management processes (communication management, decision-making, task performance and time management). This influences the efficiency of the people that need to work together (Meyer 2015). Cross-cultural communication and decision-making are key cultural elements to consider in a multi-cultural work environment. Cultural differences are a subset of multicultural teams (Meyer 2015). These differences have an impact on project management and this impact influences the people that need to work together (Meyer, Pretorius, and Pretorius 2015). The same Authors also stated that an early understanding of the various cultural differences should be considered at the start of each new project.

### **Organizational trust**

Tuan (2011) established that organizational trust will grow in such a constructive culture where organizational members offer to share knowledge and values to increase organizational intellectual capital. Leaders shape such values as innovation or market orientation by translating and transferring these values across the organization to build knowledge-based or identification-based trust. These values and trusts will synergize to increase corporate governance effectiveness.

Literature review identifies trust among project team members as another factor that may affect project performance and is one of the most important factors, that influences the team collaboration (Jørgensen and Åsgård 2019). The absence of trust among members may occur time waste, since more effort is expended by monitoring one another and backing up each other's work (Antoniadis 2019). The Author states that increase of individual trust can improve collaboration effectiveness, project performance and, as a consequence, project result and that trust is essential and mandatory for project success (Antoniadis 2019).

Antoniadis finds out that effective communication and individual trust are the main factors that a multicultural team needs to operate effective (positive correlation exists).

In addition, highlight the importance of members' trust for project implementation, noting that group work independence requires high level of trust for effective collaboration, while low level affects the cooperation negatively (Antoniadis 2019). One more important issue that is presented both at the research findings and the literature review is this regarding the different trust between multicultural and monocultural teams. Antoniadis agrees with literature findings that trust among team members with the same cultural background is much higher than this among the cultural diversified (Müller et al. 2014).

One of the key mechanisms of linking the governance structure of an organization and individual is trust. The trust shall be established in both directions: trust of governance structure in people and vice versa (Müller et al. 2012).

### **Ethical decision-making**

Ethical decision-making is becoming more important in recent period. Organization can imply rules and regulations in many aspects of the organization's operations but when it comes to ethics, it is unlikely that ethical behavior could be regulated in full extend like the processes, approval matrix, etc. Researchers from philosophy, theology, and the related disciplines develop links between traditional moral philosophy and management, in what can be called normative ethics approaches to the topic, whereas work from social psychologists and other social scientists can be put under the heading of behavioral ethics (Müller et al. 2013). Within normative ethics, the focus is on what a person or organization ought to do in each situation. What are the principles and norms the agent should consider when deciding? Contributions to clarify these questions fall into three main categories: emphasizing process, outcome, and character, respectively. (Müller et al. 2013).

Research within behavioral ethics attempts to determine why individuals behave unethically in the workplace (Müller et al. 2013). A wide range of empirical studies has shown that a dispositional approach (partly overlapping with virtue ethics) needs to be supplemented with a situational one (Müller et al. 2013).

The research on bad apples has shown that promoting a belief in determinism can increase cheating, that otherwise honest people may act unethically under specified circumstances, and that performance goal individuals tend to cheat more than mastery goal individuals (Müller et al. 2013).

Ethics in project management is a relatively new research area (Arena 2008; Müller et al. 2014; Renz 2007). It needs to link up with the development in behavioral ethics to supplement the current approaches based on normative ethics. (Müller et al. 2013). However, it should be emphasized that there is no common approach over importance of ethics in project governance. There are some authors which are arguing the importance even to the extent that teaching ethics to management candidates can be ineffectual and contra productive (Müller et al. 2013).

### From corporate governance to projects

We have discussed different phenomena, like organizational culture, trust and ethical decision-making, impacting the corporate governance and consequently governance of projects and project governance as a subset of corporate governance. In this context a model of the governance gap was established in literature (Renz 2007). According to (Pilkienė et al. 2018) project governance contains the value system, responsibilities, accountabilities, ethical principles and policies. In other words, a proper mixture of written rules and policies (like processes, approval matrix, set hierarchy, levelled management, etc.) and soft, unwritten determinants of an organization (culture, trust, ethics) could lead to project success and by that to achieve organizational (strategic) goals. Corporate governance is more than merely a device to control a corporation. It is helpful in the project management, as it presents oversight on compliance, mitigating risks and offer guidance and direction for project managers. By offering an ethical standard or moral choice, it can offer context to the larger picture when deciding – as opposed to getting lost in the project weeds (Westland 2016).

There is no one fit for all approach to a proper mixture, mentioned above since there exist no two completely equal organizations. Corporate governance and its subset governance structures should be enhanced to a specific case, considering the people, which run and work within an organization. The governance framework gives only the framework, but the content is to be provided individually. If we have reflected on the culture, trust, ethics, value system, responsibilities, accountabilities, policies, etc. phenomena which form a governance model of an organization and by that determine the project governance. The set framework of an organization, influenced by internal and external phenomena, lead to a project success. This paper pointed out several (but clearly not all) phenomena, setting the governance model of an organization and by that influencing on projects, its success and contribution to organization's goals as ultimate endeavor of each organization.

### From projects to corporate governance

By determining top down effect (from corporate governance to projects), the immediate *vice versa* effect comes into consideration. So, how projects influence the governance model of an organization, if at all. The focus of a bottom up approach is not a foreseen effect when an organization conducts a project (even program or portfolio) which goal is to impact on organization and its governance models. The world is full of such projects where an organization leads a change of business model, market offering etc. on a project basis. This is a pre-embedded, envisaged effect which is expected and desirable.

The focus of interest is therefore on those effects of projects and projects deliverables on governance model, which are not envisaged, in many cases even not visible as project deliverable, but do change an organization over the shorter or longer period. Therefore, how do organization change little by little through invisible project deliverables.

The project management literature is very rich in top down approaches and influences, however there are practically no researches published on a bottom up approach. There are no findings and conclusions on how a project deliverable influences *inter alia* on organizational governance model and framework and its external and internal factors.

The further research leads us to determine whether other literature supports the finding in this respect. The only partially admissible term to define the research phenomena leads through fragmented approach. It means that the research is to be conducted on each factor, influencing the governance model of organizations.

Literature offers several findings. In respect to evolution, e.g. change of organizational culture, we found out that when we talk about the strengthening of its organizational culture and not a complete and fundamental change in its philosophy and system of shared values (Mitroussi 2003). As Gadomska-Lila concluded, there is no doubt that changes in organizational culture are not only forced by external factors but can and should be internally stimulated and oriented at desired values as well. An appropriate process encourages development and sustaining of efficiency – and innovation – supporting cultural patterns thus improving the competitiveness of companies and the economy as a whole (Gadomska-Lila 2008).

Non-project management literature offers little direct answer to our research. On the sample on evolution of organizational culture, we have not identified elements of influence of project deliverable on governance model. However, we have identified two streams of insight, namely that the change is gradual and the second that the change influences the governance framework from external and internal factors.

The other stream of literature, used in our research, is the organizational change and change management, which are closely related to inclination to change (Bovey and Hede 2001). The first findings show some prospect in this respect but the organizational change and change management are described as ability to change in a desirable direction. As Garetti et al. pointed out, after the top management commitment to the project, a successful change management strategy has to pursue the following path (Garetti et al. 2005):

- ensure regular information to top management on project implementation steps,
- apply the experimental learning approach in the change management activity,
- ensure regular communication on project progress to everybody involved.

Finding of (Vakola et al. 2007) shows that a forward-looking and proactive approach to competency modelling is essential for (large scale) organizational change. The organizational core competencies required for a business to compete successfully are several, but one of the most relevant is institutionalizing change. The right mix of skills and behaviors that the individuals would need to possess to produce and support those core competencies are at most relevant (Vakola et al. 2007).

Our research on ability to change and change management did not result in any factors, characteristic only for non-envisaged interrelation of project and project deliverables on governance model. We might however draw some discussion points on the change ability and change management literature findings. If one trigger (like particular project deliverable) results in a change in governance model, then the organizational governance model must be non-resilience to such effects. The organization should build the change management strategy (Garetti et al. 2005) in order to be capable to observe and to control such effect and by that to allow the effect to take its place in organization's DNA. Interrelation is therefore mutual and interdependent. There is no evidence that in an organization with good governance model a deliverable of a project would have any effect on governance model itself if the governance model is not open to such changes at all.

However, this does not give the full answer, which would be applicable to all organizations. It is clear for now that organizations have a toll to observe and to control the change like (Garetti et al. 2005) suggested.

## CONCLUSION

Our research was focused on interrelation between corporate governance, governance of projects and project governance. It is well established that governance model of an organization is quite unique and there is no one fit for all models. However, we have shown some common characteristics of governance models by discussing the governance paradigms model of Müller (Müller 2018a) and organizational culture, organizational trust and ethical decision-making (Derakhshan, Turner, and Mancini 2019; Joslin and Müller 2016; Licht 2014; Meyer, Pretorius, and Pretorius 2015; Müller et al. 2014; Ranf 2010; Too et al. 2017). The paper also highlighted the influence of governance model on projects, its success and contribution to organization's goals as ultimate endeavor of each organization which is described as top down influence.

We were not able to confirm the bottom up influence, e.g. the influence of projects and projects deliverables on governance model, which are not envisaged, in many cases even not visible as project deliverable, but do change an organization over the shorter or longer period. We have researched the non-project management literature, which offers little, and very fragmented findings in this respect. On the case of organizational culture evolution, we could only identify two streams of insight, namely that the change is gradual and the second that the change influences the governance framework from external and internal factors.

We suggest that bottom up influence should be further researched. The focus should be given to the effect of projects and project deliverables on governance models in particular to the effects, which are not envisaged, not anticipated in advance and are in many cases even not desirable. Further research could be focused also on implementation of path, suggested by (Garetti et al. 2005) and its direct or indirect influence of project governance.

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# "DESIGNING AN ORGANIZATIONAL STRUCTURE SUITABLE FOR A START-UP PROJECT IN MOROCCO"

## ABSTRACT

*Previous research demonstrates the importance of designing the organisational structure that suits best a particular project. However how this is done remains unclear. Complementing and extending prior research, this study based on a practical case questions if critical project management competence elements of stakeholders influence the design of the project as temporary organisation. As projects are about people and each project stakeholder might have a different view on how the project structure should look like it is important to agree on a project structure that is well accepted by the stakeholders involved. In addition of being accepted, the project design should enable the project stakeholders to work as a team and achieve the project goals in the project context. The used method to address the research question is ethnography consisting of observing the actors in their environment and analysis of the artefacts which were mainly emails and oral exchanges between the project manager and the project team.*

*With a particular case taken from the practice we will show that a project starts with a certain structure. Secondly we will underline the importance of the project manager as a critical stakeholder in the project design. Lastly, we will address some critical competence elements of the project stakeholders that determine the project structure. This will be done by taking the example of a practical case in which the author was a certified project manager and taking into consideration the strategic plan of the organisation, the stakeholder context and management competences.*

*A description and analysis of starting a project located in Morocco with international stakeholders are made. Implication for research and practice are discussed.*

**Key Words:** design, organizational structure, project management, project competences, Morocco





## 1. INTRODUCTION

The nature of the project as a temporary organization can be analysed from the perspective of organizational theory. It is suggested that classical definitions of projects are not wrong, just incomplete (Turner and Müller 2003). An important and repeated question in organisation and behavioural science is why persons perform in at work in a project (Janssen and Van Yperen 2004). Here the role of a project structure that takes into consideration main project stakeholders acceptance is critical. Often stakeholders have different interests. This is certainly true for large projects but often also for smaller projects related to non-profit organisations (Balser and McClusky 2005, Fernandez, Le Roy, and Chiambaretto 2018). Therefore, the design phase of the project becomes critical (Ansoff et al. 2019). Not only must the design of the structure be transparent, but also it needs to involve the stakeholders by a sound regular communication and reporting process. The establishment of a project canvas (see annexe) requested by the project sponsor summarizes the main elements of the project design. As projects are about people, each project stakeholder (including the project manager) might have a different view on how the project structure should look like in order to achieve the project goals. Previous research demonstrates the importance of designing the organisational structure that suits best a particular project. However how this is done remains unclear. Complementing and extending prior research, this study base on a practical case firstly uncovers critical project individual competence elements that influence the design of the project as temporary organisation.

The main objective of this research is to analyse the main factors that influence the designing of a project structure. Firstly, the paper describes some well-known project structures designed according to good practice and research. Secondly, as projects are about people and each project stakeholder might have a different view on how the project structure should look like, the paper will address the mapping of the project stakeholders to design an acceptable project structure. Thirdly, we will discuss the importance of the project manager as a critical stakeholder in the project design. Fourthly, the paper highlights some critical competence elements of the project stakeholders that will help to address specific project challenges. This will be done by taking the example of a practical case in which the author was a certified project manager. A description and analysis of starting a project located in Morocco with international stakeholders is made. Lastly, implications for research and recommendation for practice at regional level (Maghreb) are outlined.

## 2. METHOD

In the case study presented, the method used ethnography, i.e. a qualitative research study looking at the social interaction of users in a given environment. This research provides an in-depth insight into the user's views and actions along with the sights and behaviours they encounter during the project. The ethnographic method applied are the following: observations (as project manager running the project described in the case) and analysis of the artefacts (documents, mainly email messages, issued by the project manager to project team members)

## 3. RESULTS

### 3.1 Designing project structures

The objective of designing an organisation or project (temporary organisation) structure is to achieve profitable growth (Raisch 2008), to achieve the project goals (Kerzner 2018) and to conceive a project structure that is accepted by the vast majority of project stakeholders.



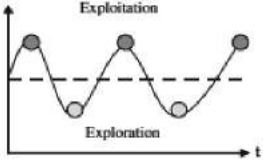
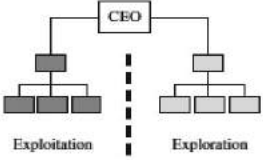
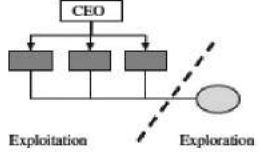
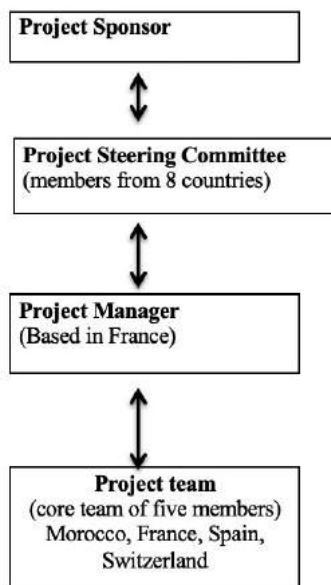
Category	Description	Related Theoretical Concepts
<p>Temporal Separation</p> 	<ul style="list-style-type: none"> <li>■ Organizations change back and forth between different corporate structures.</li> <li>■ Decentralization is used to ignite innovation and change; centralization to increase coordination and efficiency.</li> <li>■ Exploitation and exploration are emphasized <i>sequentially</i> rather than simultaneously.</li> </ul>	<ul style="list-style-type: none"> <li>■ Cycling (e.g., Cummings, 1995; Eccles &amp; Nohria, 1992)</li> <li>■ Sequencing (Siggelkow &amp; Levinthal, 2003)</li> <li>■ Vacillation (Nickerson &amp; Zenger, 2002)</li> </ul>
<p>Structural Separation</p> 	<ul style="list-style-type: none"> <li>■ Organizations are divided into two (or more) separate units with different structures.</li> <li>■ Flexible 'innovative units' explore new areas for growth; more formal 'operational units' ensure efficient operations in the existing business.</li> <li>■ Exploitation and exploration are addressed by <i>different</i> employees and organizational units.</li> </ul>	<ul style="list-style-type: none"> <li>■ Ambidextrous organization (e.g., Duncan, 1976; O'Reilly &amp; Tushman, 2004; Tushman &amp; O'Reilly, 1997)</li> <li>■ Plural form (Bradach, 1997)</li> <li>■ Loosely coupled organization (Christensen, 1998; Levinthal, 1997)</li> </ul>
<p>Parallel Structures</p> 	<ul style="list-style-type: none"> <li>■ Organizations create supplemental network structures to complement the formal primary structure.</li> <li>■ Employees switch between the two types of structures depending on their respective tasks.</li> <li>■ Exploitation and exploration are addressed by the <i>same</i> employees, but in <i>different</i> structural environments.</li> </ul>	<ul style="list-style-type: none"> <li>■ Collateral organization (Zand, 1974)</li> <li>■ Dualistic structures (Goldstein, 1985)</li> <li>■ Hypertext organization (Nonaka &amp; Takeuchi, 1995)</li> <li>■ Parallel learning structures (Bushe &amp; Shani, 1991; McDonough &amp; Leifer, 1983; Stein &amp; Kanter, 1980)</li> </ul>

Figure 1: Three types of balanced design solutions according to Raisch 2008

As described in figure 1, in the temporal separation of structures, organisations change back and forth between different corporate structures; decentralisation is used to enable innovation, which in some cases has shifted to the paradigm of self-organisation (Skobelev et al. 2018). In the case of structure separation (figure 1), sub-teams are created in order to create flexible innovation units especially in large organisations involving different expertise from different corporate units. In the parallel structure, people switch between different units depending on their specific tasks

A more classical organisational design to define project structure can be used when the project is small both in terms of budget and available resources (Figure 2).



**Figure 2: Classical project structure according to the author: designed to start a project management organisation in Morocco to become a non-profit organisation working essentially with volunteers.**

The project manager has a line management responsibility for the project team members. Examples of this would include large construction builds, but also corporate initiatives that require a dedicated team. The project manager has the ultimate authority, reporting to the steering committee which reports to the project sponsor. The team members work directly for the project manager. This organisation was ultimately chosen for the project 'creation of a project management association in Morocco'. The reason for this choice were the main advantages and further determining factors of the designed project structure outlined in the following section of this paper.

- The obvious advantage of a project structure is that the project manager have more control over the team.
- Teams can have a strong sense of identity. It is the easiest structure within which to create a strong team culture.
- The whole team is focused on the team's goals, so conflict of loyalty exists with the daily job for the people working on the project. Their daily job is the project.

Projects run in this classical structure are great environments for improving project management skills of the main project stakeholders outlined in figure 2.

The classical project structure is the easiest to work with in the chosen case study, but still has some drawbacks as realised from the case in which the author was the project manager:

- If team members (who are mainly volunteers) are removed from their functional jobs, they might find it difficult, especially if the project is long. Project work stretches people, so returning to a previous role after working in a multidisciplinary environment on a new, challenging project, isn't an appealing prospect for many people. Thus, managing the transition of the team when the project manager closes a project becomes even more important.
- Project managers in this type of structure do line management for their teams, too, which means spending time and effort on human resource tasks the project manager wouldn't have to do in other structures. If the project manager enjoys this element of working with people, this factor could be an advantage.

The next section will address critical determining factors in the design of the project structure and the project context.

### 3.2 The stakeholder mapping, organisation strategy and project governance as a critical project design factors

International Project Management Association (IPMA) is a federation of professional associations that was founded in 1965 and until recent years was mostly composed of European associations. It is only in the last ten years that the federation of project management associations decided to go really international with special focus on Latin America, Asia and Africa. The case about Morocco is particularly interesting from a stakeholder perspective in the process of designing a project structure to settle a new organisation in the city of Casablanca.

The approach taken to build a project management association in Morocco was based on a similar project and organisation structure applied two years earlier in Algeria (Saidoun 2016).

#### 3.2.1 The critical role of the project manager in the design phase

The main drivers of the idea to create a project management association in Casablanca were based in France, Spain and Morocco. Some had already a sound experience in starting organisations in the private and non profit-sector in other parts of the world, some did not and were rather sceptical as regarding the outcome of the project, especially due to the particular project context. Although the working language of the organisation is English, the working language of the project stakeholders was French right from the project inception.

The project manager was based in France, the project sponsor in Switzerland and the project team members in France, Spain and Morocco (Figure 2). The project took place in Casablanca where many important stakeholders were based: the public Moroccan authorities, the future members of the organisation to build, the private and public sector sponsors and the future Executive Board of the future professional organisation. As the project idea was developing, the project manager understood that based on the high power distance which is culturally rooted in the management and leadership among Moroccan leaders and organisations, the proposed a classical design structure of the project appeared to be the most accepted by the project stakeholders. In addition to the main advantages of the project structure previously described (figure 2), the project manager through regular oral and written communication with the project sponsor was able to gain the approval of the proposed designed project structure with formed part of project canvas (See annex 2). elaborated by the project manager and endorsed by the project steering committee. The project canvas included as series of other important aspects such as project purpose, project goals, project deliverables, project time line, project resources and project team including names and functions. The canvas is a prerequisite to start a project and helps tremendously to design the most convenient project structure, at least for its inception phase.

#### 3.2.2 Organisation strategy

As one critical project stakeholder in the project sponsor (formally represented by the Executive Board/Vice-President membership in charge for membership development), it was critical to make sure the project design was embedded in the overall organization strategy. The reason for this is that the project should fit in the overall organisation strategy approved by the project sponsor. The strategic goals of the organization include key performance indicators consisting of increasing the number of members of the organisation / project management associations by 2020. This strategic goal was defined by the members of the organization back in 2014 when the organization had sixty members (sixty countries). The project steering committee is represented by the Executive Board of IPMA which meets every two months to review the approved project portfolio for monitoring and controlling purposes.

The project manager is in charge to drive the project, to keep most of the stakeholders satisfied with the progress of the project. He makes sure the defined milestones are achieved on time, on budget and according to the requested quality.

The project team was composed of an international project team (Moroccan, French, Spanish) of five persons as the core-team. Each of the project team has a set of responsibilities and activities defined in a classical work breakdown structure.

The designed project structure needed to take into consideration project governance.

### 3.2.3 Project governance

Project governance can be defined as an organization's overall process for sharing decision rights about projects and monitoring the performance of project interventions. All development organizations have some form of project governance. Those with effective governance have actively designed a set of project governance mechanisms (committees, budgeting processes, approvals, etc.) that encourage behaviour consistent with the organization's mission, strategy, values, norms, and culture (Saidoun 2016).

The objective of project governance is to establish clear levels of authority and decision-making including the planning, influencing and conducting of the policy and affairs of the project. It involves the people, policies and processes that provide the framework within which project managers make decisions and take actions to optimize outcomes related to their areas of responsibility. This is achieved by defining and identifying the roles, responsibilities and accountability of all people involved in a project, including their interaction and level of coordination with internal and external dependencies.

A good project governance document elaborated in IPMA helped to design the project structure by defining the procedures to follow escalation of issues, defines the decision making structure, roles and responsibilities of each key stakeholder about the different processes in the project from communications to budget change authorizations. Another key deliverable of the project with the chosen project structure were the elaboration of a project portfolio (Annex 1) to make the future Moroccan project management association sustainable and to set-up the organogram of the association. As outlined in annex 1, the project portfolio as one of the deliverables is critical in shaping the future permanent organisation which will be one of the outcomes of the project. The choice of the design of the project structure is also determined by the project deliverables. A single project management helps to generate an make project portfolio efficiently with scarce available resources (Martinsuo and Lehtonen 2007) which are essentially volunteers.

After having described the role of the stakeholders, the role of the project manager and the importance of the project deliverable in designing of the project structure, the next section will address a series of critical project management competences which are either needed or available among the stakeholders and that shape the project structure design.

### 3.3 Encountered project challenges and project management competences

Executing a project while at the same time pursuing new ideas to shape the future is a challenge. As a new idea to be realised is a project which by definition is unique, innovative and limited in time, the available individual project management competences in the organisation need to be mapped. This is even more difficult if almost none of the project stakeholders is certified against any international project management standards.

The following sections will address some of the challenges fact on the project and with which particular project management competences they were addressed in the designed project management structure that slightly changed as the project was delayed.

#### 3.3.1 Power and interest

The power and interests competence element describes how the individual recognises and understands informal personal and group interests and the resulting politics and use of power. This competence element defines how individuals participating in projects should recognise how informal influences (resulting from personal and group ambitions and interest, and modified by personal and group relations) relate with the project context. These informal influences differ from formal interests (as for instance formalised in a business justification that derive from organisations' strategy or from standards, regulations, etc. (IPMA 2015)

As the initially designed project structure was agreed among the project stakeholders and as the project went along with that structure, a conflict started between two team members as both wanted to take the lead of the future organisation. The project manager notes that the power conflict was jeopardizing the progress of the project and demotivating some of the project team members. The project manager was requested to intervene by one of the conflicting parties. The conflict was solved and the crisis prevented after several presential and virtual bilateral and trilateral mediating sessions between project manager the conflicting parties.

The origin of the conflict was caused because of the lack of competence element power and interest by one of the local project stakeholders.

### 3.3.2 Self-reflection and self-management

Self-reflection is the capability to accept, reflect and analyse the emotions, behaviour, preferences and values that one has as well as their impact on our environment. Self-management is the ability to define goals, to control and adapt progress and to manage the work involved on a daily and systematic basis. It includes managing changing conditions and dealing successfully with stressful situations. In the project context, there was at some point in time a lack of self-management of one key person. Indeed, promises were made but no work was followed by the promises. A lot of time was lost and kind of decision-making vacuum appeared. The project manager tried to show the person why this did not only lead to a conflict among the team members. He also made proposals to solve the conflict. This consisted of reducing the promises of making more efforts in order to achieve the promised deliverables within the promised milestones. At the end of the day, the person concerned left the organisation as it was not accepted anymore among the other project members.

### 3.3.3 Personal Communication

The designed structure was enabling a two-way personal communication as indicted in figure 2. Personal communication covers the sharing of adequate information, delivered precisely and consequently to all relevant parties. If this is not done in a professional manner, it could reduce the level of trust among the project stakeholders.

This was noted at some point of the project when two team members were not yet able to communicate on a face-to-face basis in an open manner. Often a divergence in opinion about subjects of minor importance were emerging. However, when the communication between two team members becomes nearly impossible, then it is up to the project manager to intervene in order to mediate between the two persons concerned. If the conflict still persists, the project manager has to refer to the formal structure and processes. If then still the project structure does not help, it is important to use the escalation process in place.

### 3.3.4 Team work

Team work is about bringing people together to realise a common objective. Project teams are commonly multi-disciplinary; specialist in different disciplines work together to realise complex outcomes. Team communication and team relations are among the most important aspects of successful teamwork. If at the beginning of the project, the project canvas is not elaborated together with the team, the commitment of some individual team members is either suffering or clashes are programmed. This is one of the lessons learned from the case study.

### 3.3.5 Culture and values

The culture and values competences element describes the individuals' approach to influence an organisation's culture and values and the wider society in which the project is situated. It also includes the acknowledgement by the individual participating in or leading a project of the consequences of these cultural influences for the projects and how to incorporate this knowledge in the management of the project. Culture may define a set of related behaviours within a community and the importance that individuals in the community base her actions. Explicit definitions of values might include code of ethics (IPMA 2015).

In the case described, the project manager knew the context, the language, the mentality and some basic behavioural codes.

### 3.3.6. Resourcefulness

Resourcefulness is the capability to put in practice various techniques and ways of thinking to define, analyse, make priorities and find different ways to solve challenges and simulating solving challenges and problems. It often needs thinking and acting in an original and creative manner, and stimulating the creativity both at individual and team level. Resource fullness is useful when risks, opportunities, problems and challenging situations pop-up (IPMA 2015). In the case of the Moroccan project, the first president of the Moroccan organisation that was elected stopped down and the project team was able within short to elect and new one within a short period of time. In addition to project management competence the next section will deal with management styles as drivers to design the adequate project structure.

## 4. DISCUSSION

Organization culture is a strong influence on the type of management styles that are used on projects (Brewer, Mitchell, and Weber 2002). This in turn influences the management style applied in organisations, may they be family owned and non family owned (Mullins and Schoar 2016). In addition to the culture of the main stakeholders of the organisation, the local and more contextual culture, including customs and social dynamics also influence the management style along with the nature of the project, the nature of the team and the personality and skills of the project managers. The four distinct organizational management styles that have a strong influence on how project are managed and how this influences the design of the project structure are generally divided into autocratic, paternalistic, democratic or laissez-faire. Without entering in the definition of each of these management styles known from the literature, it could be observed that in practice and as the case in Morocco has shown, the management style is adaptive so that in general one could recognise a "hybrid leadership style" which takes different combinations along the previous mentioned management styles. One of the management styles described will often dominate as it is inherent to the personality of the stakeholders involved. The adopted classical project design structure was favouring such a hybrid management style, mainly with aspects of autocratic and democratic style. Sometimes one could observe that makes all the decisions, keeps the information and decision-making among him/herself or the senior management. Sometimes, The manager allows the employees to take part in decision-making, where everything is agreed by the majority.

## 5. CONCLUSION

Designing an organizational structure has to take into account various determining factors. In addition to the project goals to be achieved, the design needs to take into consideration the various stakeholders involved, especially the project manager who has a critical role in the design process. The final design structure can either be a temporal separation, a structural separation, be parallel or classical. Each of them has its related theoretical concepts as referred to in figure 1. In the case study "starting a project management association in Morocco" a classical hierarchical project organisation structure was designed. In addition to the previously determining factors of the design structure, the project challenges need to be taken into account, in particular the existing and needed project management competences, the management styles of some key actors as well as the project governance context. Regarding project management competences, leadership, personal communication, resourcefulness, teamwork, self-management and self-reflection appeared to help addressing the encountered project challenges and to adapt the best project design fro the case study project. By addressing the project objectives of this study, the author would underline some limitations. As the case was limited to one country in a specific region (Maghreb), further research should therefore investigate if the determining factors of project structure design could be valid in neighbouring countries with similar culture and values. This would help enhance the knowledge on a critical aspect in project management when starting projects in this region.



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**Annex 1:****Defining a project portfolio of the incubated association to make it sustainable (2016-2021)****Projets**

- F5. Implementation of a PM barometer in Morocco every 2 years
- F4. Implementation of an MPMA periodic information medium (Newsletter)
- F3. Submission to calls for associative projects
- F2. Setting up workshops to debate PM
- F1. Implementation of annual events
- E3. Development of a program of activities for Young Crew
- E2. Partnership with ANAPEC to strengthen the employability of unemployed youth
- E1. Partnership with the world of education to develop Young Crew PMs
- D2. Development of an ecosystem for training through accreditation
- D1. Launch of marketing campaigns for the recruitment of new members
- C3. Implementation of the MPMA certification center
- C2. Launch of certifications in collaboration with SMAP
- C1. Launch of marketing campaigns around the certification
- B2. Establishment of partnerships with other national and international associations
- B1. Development of Corporate Membership and Sponsoring
- A4. Regionalization of MPMA activities
- A3. Cooperation of an executive team
- A2. Setting up a CRM
- A1. Setting up a website

Annex

Project Canvas: Incubating a project management association in Morocco

2:

**Project Canvas: Incubating PM association in Morocco**

**Date:** 19-01-2014

<p><b>Purpose of the project:</b>                  To incubate the creation of a sustainable project management organisation in Morocco Casablanca in order to implement one of the strategic goals of IPMA and promoting project management culture</p>	<p><b>Stakeholders:</b>                  Project sponsor, project steering committee, project manager, project team members, local government and public authorities, private and public companies</p>
<p><b>Project goals</b></p> <ul style="list-style-type: none"> <li>• To create a Moroccan project management association with legal and public recognition</li> <li>• To set up an adequate governance structure of the association</li> <li>• To promote through events the existence of the organisation</li> <li>• To attract new association members</li> <li>• To prepare for the application of the PM association with IPMA</li> </ul>	<p><b>Project deliverables:</b></p> <ul style="list-style-type: none"> <li>• Organise a national project management conference in Casablanca to promote the project idea</li> <li>• Create by-laws for the association in alignment with PM</li> <li>• Establish the list of members</li> <li>• Draft a strategic plan</li> <li>• Design an association structure with assignment of responsibilities</li> </ul>
<p><b>Project uncertainties:</b></p> <ol style="list-style-type: none"> <li>Level of commitment of the identified project volunteers</li> <li>Acceptance of the project idea by local contact</li> <li>Ability to work together towards a common goal</li> </ol>	<p><b>Project schedule:</b>                  2014-2016</p> <ul style="list-style-type: none"> <li>• Q1: Identification of project team</li> <li>• Q2: Event preparation</li> <li>• Q3: Event</li> <li>• Q4: Preparing organisation structure</li> <li>• Q1: Registration of association</li> <li>• Q2: Preparing the strategic plan</li> <li>• Q3-Q4: Preparing application package</li> <li>• Q1: Presenting application o</li> </ul>
<p><b>Project organisation/Responsibilities (see also project deliverables):</b></p> <ul style="list-style-type: none"> <li>• Project Sponsor: IPMA (Mr. VP membership)</li> <li>• Project Manager: Mr. XX</li> <li>• Project Team: Mr. xx, Ms. xx, Mr. xx, Ms. xx, Mr. xx, Ms. xx</li> </ul>	<p><b>Project collaboration:</b>                  F2F meetings                  Regular virtual meetings</p>



CoD  
 vvvv

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## **GENDER DIVERSITY IN MANAGING CONSTRUCTION PROJECTS**

### **ABSTRACT**

*Diversity is in the heart of nearly any project management attempt, which is not the case only with cultural diversity in multicultural project teams, but also age and gender diversity. The latest is stressed on the special way in the industries that are still predominantly traditional, such as construction industry. The aim of this article is to research the existence of practical implications of this type of diversity in the national context of Croatia through a preliminary analysis of the range of possible problems emerging from the absence of gender diversity in managing projects in construction industry. In order to obtain this aim, a qualitative research approach is adopted. The sample of people working on construction projects is collected in order to answer on questions of different type connected with gender diversity, among which opportunities and challenges when working with the opposite gender, through the semi-structured interviews. Based on the research findings, main problems are addressed and possible solutions given, as well as recommendations for the future research on the area. The main findings from the study are linked with the dominant perception of existence of differences in male and female approach to various project issues. These findings are relevant both for the further research of project management, as well as praxes. In practical context, findings may be useful as a help in developing a working atmosphere of more understanding in situations where problems addressed to gender diversity occur. Also, they can be used in educational sense, to empower women to enroll technical studies and be open minded towards careers in traditionally masculine industries.*

**Key words:** Gender diversity, Construction, Project management



## 1 INTRODUCTION

Diversity is popular and significant topic in project management research and practice, which is quite natural, due to the fact that diversity is in a heart of every project management attempt. Projects are all about people, they solve people needs, fulfil society requirements or offer different or new perspectives to community. The job of a project manager is to direct people in a project team in order to fulfil project goals – that is, solve problems or needs of other people. And when we think about people – they are diverse. People are equal, but people are not and could never be the same – there is not a single one person identical to You at the world. Therefore, people are unique, diverse. The premise that managing projects is basically managing people, leads us to the fact that managing people is – managing diversity. Hence, it is very useful for a project manager to understand the definition and categories of different types of diversity, as well as issues that may emerge out of them while managing projects.

Diversity is according to Cambridge dictionary (2013) defined as 'the fact of many different types of things or people being included in something; a range of different things or people; the fact that there are many different ideas or opinions about something; the condition or fact of being different or varied; variety; or the fact of there being people of many different groups in society, within an organization, etc.'

If we talk about diversity in project management, most of researches discuss cultural diversity (Aytemiz Seymen 2006, Binder 2016, Dadfar and Gustavsson 1992, Iles and Kaur Hayers 1997, Laroche 2012, Ochieng and Price 2010). However, there are more types of diversity present in project management, such as age and gender diversity. The latest is stressed on a special way in industries that are still predominantly traditional, like construction industry. Managing construction projects can therefore be quite challenging for people who do not belong to the predominant social group on project, in this case – women.

The aim of this article is to question the position of women in construction projects in Croatia, by giving two perspectives on the topic of gender diversity in construction management – male and female. In order to do so, a comprehensive review of relevant literature is made. Afterwards, a semi-structured interviews are conducted with eight female and eight male engineers that work in construction project management, allowing them to express their thoughts and views on the topic. Qualitative analysis (based on Leavy 2014) of the data gathered is made, and applicable conclusions are drawn. Finally, recommendations for future research on the area are given.

## 2 LITERATURE REVIEW

Gender diversity is the term that refers to equitable or fair representation between genders within a company, occupation and/or industry. It is a phenomenon that has been widely discussed, researched and analyzed, with initiatives to be promoted in all fields and levels of human interest.

After the rise of feministic movement in a sense of fight for female rights to vote, educate and work in order for a woman to achieve 'political and economic equity' with men in a society (Sommers 1995, 22), women started to develop different career paths. Today, despite making up half of the population and 47% of the labor force, women remain highly underrepresented in the top echelons of business. Only '5% of the richest billionaires are women, 6% of S&P 500 companies have women CEOs and 20% of Fortune 500 board members are women' (Desjardins 2018). 'In Western Europe, only 17% of executive-committee members are women, and women comprise just 32% of members of corporate boards for companies listed in Western Europe's major market indexes. In the United States, the figures are 17% for executive committees and just under 19% for boards' (Devillard et al. 2017). At tech companies, according to a 2017 study by the market research firm TechEmergence, '60% of chief HR officers and 50% of chief marketing officers were women, compared with just 13% of CEOs and less than 10% of chief technology officers' (Abouzahr et al. 2018).

What can be seen out of these figures is existence of an evident gender gap in business in overall. The consequences of the unequal gender representation in the global workforce are extensive, and they primarily branch off of the concept of heightened thought diversity. 'Women bring different approaches to leadership style, investment strategy, industrial design, conceptualization, management, delegation and mentorship amongst other functions assigned to those in leader-

ship roles' (Skroupa 2016). In addition, 'boards with more diverse members, including varied backgrounds and genders as well as specialty areas and skills, engage in more robust discussions and explore a greater range of strategies and solutions' (Skroupa 2016). There are many arguments that can be made for closing this gender gap, but the most compelling one is very simple: 'there is a growing body of research that shows that gender diverse companies make more money' (Desjardins 2018). 'If women were to play an identical role in labor markets to that of men, as much as \$28 trillion could be added to the global GDP by 2025', according to a study by McKinsey Global Institute (Woetzel et al. 2015).

Despite the reasons for promoting gender diversity, Skroupa (2016) states that 'women still continue to be grossly undervalued and underrepresented'.

The gender gap elaborated above based on relevant recent researches, can be stressed on a special way in the industries that are still predominantly masculinum, such as the STEM area, among which - construction industry. This is a world ranged issue, regarding the relevant research analyzed (Equate Scotland et al. 2015, Galea 2017, Peters & Allison 2011).

Galea (2017, 5) states that 'the construction industry in Australia is third largest employer and a central economic player in the Australian economy. Despite this, construction remains unyielding as Australia's most male dominated industry.' Similarly, it is stated throughout Equate Scotland et al. (2015) research that 'despite this increase in the rate of skills shortages, the proportion of women working in the UK construction sector has remained relatively unchanged since the mid-1990s. Less than 2% of construction trade workers are women, and approximately 10% of professionals, so there is potential for a substantial increase in female participation in the sector.'

Additionally, the main problems from not adopting gender diversity approach in construction are given. 'The continuous rely on a recruitment base that is predominantly young, white and male will increasingly cause problems for the construction industry because:

- The industry misses out on the majority of the population, thereby limiting the choice of applicants available to it. This may lead to both skills shortages and to a lower overall quality of employee being recruited;
- The industry's workforce does not reflect the majority of the population who use the built environment and hence is unlikely to satisfy client needs;
- The industry misses out on the acknowledged benefits of diverse workforces and teams such as more innovative problem solving, improved productivity and more motivated employees' (Agapiou 2002 according to Equate Scotland et al. 2015).

The positive effects of gender diversity, as well as the fact that many world companies include gender diversity inside their business strategies have already been mentioned. Nevertheless, women stay less likely to become a member of construction business. Why is that so?

It is stated through Equate Scotland et al. (2015) report that there is 'little hostility to women entering the construction workforce. There is a general feeling that women are capable of performing well in a wide range of construction tasks, although there is still some doubt about their suitability for heavy lifting work.'

Peters & Allison (2011, 10-11) found that:

- 'There is a perception that construction work is dirty and unpleasant;
- Careers in the construction sector are not promoted early enough within schools;
- There is the perception that construction work is low paid;
- There is the perception that flexible working opportunities are not widely available within the sector for employees with young families.'

Galea (2017, 5) found that 'rigid work practices, narrow career pathways and informal talent management operate across the career landscape in construction to undermine women's participation and success in the sector. Also, the same practices couple to undermine the enjoyment, health, and wellbeing of all construction professionals - men and women.' Galea (2017, 5) also states that 'a tolerance of sexism exists in construction that undermines women's enjoyment, success and attraction.'

These problems exist on all levels of managing construction projects.

Women in construction management positions perceive bias against them in the form of skepticism and indifference from the industry purely as a response to their gender. 'Being female does not help when a construction management professional's performance is assessed' (Chun, Arditi & Balci 2009, 11).

What can be concluded out of the given literature review is the following:

- There are worldwide problems with not reaching the gender gap in business overall, and especially in predominantly male industries, such as construction.
- There are evidences on better results in gender diverse environment.
- There is an evident need of attracting a larger number of female professionals in construction industry in order to solve different issues within it.
- Gender diversity is a significant topic for conducting additional research.

In accordance with a last conclusion, a research elaborated in continuation was conducted.

### 3 RESEARCH DESIGN

In order to make a preliminar analysis of the range of possible problems emerging from the absence of gender diversity in managing projects in construction industry in Croatia, a research was conducted. Eight women and eight men working in the industry as project managers today were asked to answer different questions regarding their perception on the topics given below:

- Topic 1: Jobs in construction that suit better/do not suit better to man/women.
- Topic 2: Characteristics of man/women by which they could influence on positive / negative manner on construction projects' successes.
- Topic 3: Perception on gender diversity throughout different project phases.
- Topic 4: Experiences with gender discrimination in carrier.
- Topic 5: Thoughts on the need of gender diversity promotion within construction.

The questions are given in table 1.

**Table 1 Questions within semi-structured interview**

Topic	Question
Introduction	Can you please tell me which age group You belong to? How long is Your working experience? In which project phases have You worked in Your career?
Topic 1	Do You believe that there are some jobs in construction that are more suitable (more convenient, more natural) to men or women? Do You believe that there are some jobs in construction that are just not suitable (convenient, natural) to men or women?
Topic 2	Which characteristics You believe men have by which they might influence positively on project outcomes? Which characteristics You believe women have by which they might influence positively on project outcomes? Which characteristics You believe men have by which they might influence negatively on project outcomes? Which characteristics You believe women have by which they might influence negatively on project outcomes? Do You believe that men and women are capable of doing any job in construction industry with the same level of quality?
Topic 3	How do You perceive ratio between men and women in different phases of construction project lifecycle (conception, planning and design, execution, maintenance)?
Topic 4	Have You ever felt discriminated on the gender base in Your career? If yes, could You share Your experience?
Topic 5	What do You think about gender diversity in construction projects management and industry as general? Do You believe that women in construction need to be empowered? If yes, how?

The respondents were asked the questions through semi-structured interview. The respondents were recorded (with their permission), and the records were transcribed. They are labeled with IDs consisting of: F (female) and M (male), and a corresponding number. The average length of the interview was 30 minutes. The answers of the respondents were analyzed and systemized within topics area listed above (Crabtree & Miller 1999), and results of this process are discussed below.

Most of the respondents had between 30 and 50 years in age (56%), and between 10 and 30 years of working experience (63%). In their carriers, they have all worked in conception and planning phase, 63% of them have also worked on site in project's execution phase, 6% have worked in maintenance phase and 12% of them have worked in all phases of a construction project.

## 4 RESULTS AND DISCUSSION

Gender diversity is a significant theoretical and research topic, which becomes quite accent in area of human fields that were, and maybe still are, predominantly and traditionally considered as areas of male vocations. When considering these fields within project management, construction industry stands out on a special way.

Based on the relevant literature review, it was confirmed that there is an evident gender gap throughout different phases of construction projects. Although the gender gap is measured in business generally, among which construction also, and researches offered evidence of advantages of embracing gender diversity strategies in companies, many of them fail to do so due to number of reasons.

In order to research the situations dealing with gender diversity while managing construction projects, a set of 16 semi-structured interviews were conducted among constructions professionals in Croatia. Those interviews combined questions in order to light up people perception on 5 different areas of gender diversity.

The interviews conducted revealed a lot on those topics. For further generalization of findings, a deeper analysis on a larger sample should be made. But, based on the qualitative analyses of answers, thoughts, beliefs, feelings and experiences given, following elements may be stated. Although all of the relevant thoughts, views, expressed feelings and experiences of respondents were cited in their own words in researcher's base, in order to strengthen the credibility of the research (Patton 2002), due to size limitation of this paper, those are not quoted here.

### 4.1 Suitability of jobs in construction in relation to gender

People mostly believe that there are jobs that are more suitable for men (construction site) and women (project management, planning, design, administration, paper work). They think that reasons for such division are: historical and traditional, perception of labor workers on site, inborn gender colored typical characteristics, rough conditions on site, which are findings consistent to certain extent with those of Peters and Allison (2011, 10-11). There are both male and female engineers among this group.

A smaller group thinks that there is no such thing as gender-based suitability of a job, and that the suitability is a question of character, not gender. More male engineers belong to this group.

Based on these results, it would be interesting to research further reasons lying in unwillingness of female engineers to work on site, and deeper beliefs lying under the unsuitability of site as a working place for a woman. These constructs are surely part of traditional macho culture in construction, but also could be linked with perception of female roles in society in general. Another possible direction of further research is exploration of stated belief that project management is more suitable for women.

### 4.2 Relations between gender colored characteristics (if any) and project's success

A larger group of respondents defined some "gender typical" behaviors, characteristics or beliefs that may influence on project success. On the other hand, a smaller group of respondents did not find it appropriate to generalize character to any extent on the bases of gender.

The first group gave some "typical" male and female characteristics which they thought may influence positively or negatively on project outcomes, some of which are given in the table 2. They gave reasons for this way of thinking that were experience based.

**Table 2 Perception on male and female characteristics in managing construction projects**

	Male	Female
Advantages	Simplicity Practical Solution-oriented Natural authority Determined Austerity Goal getters	Multitasking Precise Project-oriented Pedantic Through Neat Communicative Social Harmony-oriented Persistent Team players Emphatic
Disadvantages	Superficiality Sloppiness Hastiness Aggressiveness Stubbornness Egocentrism Rowdiness	Complex Intimidated Less authoritative Weaker Less political support Insecure Hectic More emotional

A smaller group disagreed with the first one, sharing a thought that a question of characteristics and personality is not attached to gender to any extent.

Future direction of the research could explore deeper evidence in searching of existence of correlation between characteristics mentioned above and sex, through personality tests and other suitable instruments within the industry context.

#### 4.3 Perception on gender diversity throughout different project phases

Generally, respondents experience more women in design and planning phase, and more men in all of the other phases, execution phase especially.

They mostly agree that the construction industry is still a men's world, although they believe that both men and women are capable of doing all jobs in it equally (except the hard-physical work). The latest is consistent with Equate Scotland et al. (2015), and the general fact of having more men in industry is also in line with Galea (2017).

#### 4.4 Experiences with gender discrimination

Regardless the last conclusion, according to which it would be expected that gender discrimination does not exist within the industry, every woman interviewed felt discriminated only on the base of her gender, in comparison with one male respondent who shared similar experience. This kind of 'tolerance towards sexism' in industry is in line with findings of Galea (2017, 40) and Chun, Arditi and Balci (2009, 9). This is a warning sign, that as a society we still need to work hard on stopping discrimination of any base, here in precise the gender one among the industry. These findings may help in creating a more effective way to prevent discrimination of any kind.

#### 4.5 Gender diversity promotion within construction

Despite of the discrimination experiences of mostly female engineers, only 56% of respondents think that women position in construction should be empowered, which is a majority, but a thin one. It would be interesting for a future research to underline reasons behind these conclusions, particularly because they are not in line with proven benefits of gender diverse groups in business. Respondents gave some proposals, among which the most interesting ones deal with anti-discrimination programs, educational empowerment, role modeling of high quality and obligatory equalized parental rights for both parents.



## 5 CONCLUSION

Gender diversity remains an interesting and significant research topic within construction and other industries. The findings given in this paper may become a base for further research on the field in exploration of existence of certain correlations, social constructs and development of gender diversity and anti-discrimination programs and actions. Findings from this study may be useful both for project managers in understanding gender diversity, as well as researches for further explorations of the area, and educators in empowering young women to start an engineering or project management career.

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## **BUILDING REGULATION FOR 3D PRINTING IN CONSTRUCTION - CASE STUDY: LEGISLATION FOR A 3D PRINTED HOUSE – PROJECT “CABANA”**

### **ABSTRACT**

*This paper presents a case study of building regulation for the 3D printed house – Project “Cabana”. For the purpose of obtaining a building permit, two experts were interviewed and the measures to be taken into account when obtaining a building permit were discussed. The first potential case was in Augsburg (Germany) and the second in Zagreb (Croatia). No major differences between the two countries have been observed, which, although on a small sample, shows that the situation is very likely to be similar to other European countries. Although both respondents agree that there should be no difference with classic materials (wood or concrete), it is nevertheless concluded that obtaining documentation in relation to classical construction would be much more expensive, more problematic, with great certainty, almost impossible. However, because to the 3D printing a bright future can be foreseen, it is necessary to educate experts (architects, builders...), it is also necessary to educate members of the city administration, to qualify materials and to standardize processes. Furthermore, it is mandatory to define the success factors of the implementing the 3D printing technology and methods for verifying them. The following research should go in this direction. Only with standardization and methods of success verification can be expected a more serious role of 3D printed buildings in the real estate market. In the end, cost effectiveness is likewise directly linked to the standardization and automatization of the process, since multiple 3D printed objects mean that 3D printing might be more cost effective, as it is with modular designs.*

**Key words:** 3D printed house, building regulation, standardization and classification, obstacles, profitability, future



## INTRODUCTION

Factors affecting 3D printing technology adoption in construction", 3D printing technology could offer multiple advantages over traditional techniques, including less material and energy usage (Berman, 2012; Khajavi et al., 2014; Labonnote et al., 2016; Walter et al., 2004), onsite production with fewer resource demands and lower related CO<sub>2</sub> emissions over the entire product life cycle (Gebler et al., 2014). It also induces changes in labor structures, including a safer working environment, and generates shifts towards more digital and localized supply chains (Ghaffar et al., 2018). From an architect's point of view, 3D printing technology can shorten design and development cycles; allows customers to co-design products that can perfectly fit their demands and ambitions; enables the realization of the complex designs and quickly conducting design changes (Berman, 2012; Ghaffar et al., 2018; Khajavi et al., 2014; Labonnote et al., 2016; Walter et al., 2004). Until very recently, the construction industry was one of the most unfamiliar R&D fields for the robotics and automation community, despite the fact that this industry is one of the oldest and represents the largest economic sectors (Balaguer, Abderrahim, 2008). However, in recent years, the construction industry has become one of the most important research areas in the field of service robotics (Balaguer, Abderrahim, 2008). Nevertheless, building regulations do not follow the development of the need for 3D printing, and the legalization of 3D-printed buildings is still a fairly unknown term. This is supported by the fact that the first 3D house in America was only legalized in 2018. (Rivera, 2019). Due to my interest in 3D printing in construction, I decided to do a case study of comparing building regulations for 3D printed houses in Germany and Croatia. An interview is conducted to collect the data and two experts were interviewed, one from Germany (Ms. Johanna Stueckl) and one from Croatia (Mr. Vjeko Katic). For the purpose of this case study, it is proposed to build a cottage of approx. 52 m<sup>2</sup>, both in Zagreb (Croatia) and Augsburg (Germany). The focus was on comparing the necessary requirements in comparison with traditional construction, obstacles, challenges and potential proposals for easier legalization and a step towards developing a standard procedure for such facilities in the future.

### The purpose and objective

The purpose of this research is to delve a little deeper into the relatively unknown topic of 3D printing, in this case, its essential component - the legalization of such buildings. The assumption is that, compared to traditional construction, there are many more questions, challenges, and problems related to the regulation of 3D printed buildings. If 3D printed structures will play an important role in the future in the real estate market, it is necessary to standardize the processes in obtaining a building permit, as well as to clarify the open and confusing issues that are, in my personal and respondents' experience, currently very much present. Guided by this, I made a case study of obtaining a permit to build a house of ca. 52 m<sup>2</sup>, fully 3D printed in Augsburg (Germany) and Zagreb (Croatia) with the goal of contributing new knowledge to this topic. I consulted two experts from Munich (Germany) and Zagreb (Croatia) and for all necessary pre-work as well as possible problems. Details about them, the building itself and the questions for this case study are below.

## METHODS

In this article the case study was used as a research method. Although case study methods remain a controversial approach to data collection, they are widely recognised in many social science studies especially when in-depth explanations of a social behaviour are sought after (Zainal, 2007)

Specifically, this article is about obtaining a building permit for the 3D printed building of approximately 52 m<sup>2</sup> entitled: *Case study: legislation for a 3D printed house – Project "Cabana"*.

### Project "Cabana" - Basic data of the conceptual design

**Location:** Augsburg (Germany) / Zagreb (Croatia)

**Area:** approximately 52 m<sup>2</sup>

**Supporting structure:** lattice supports

**Materials used:** extrudable concrete consisting of cement, sand, geopolymers, and fibers

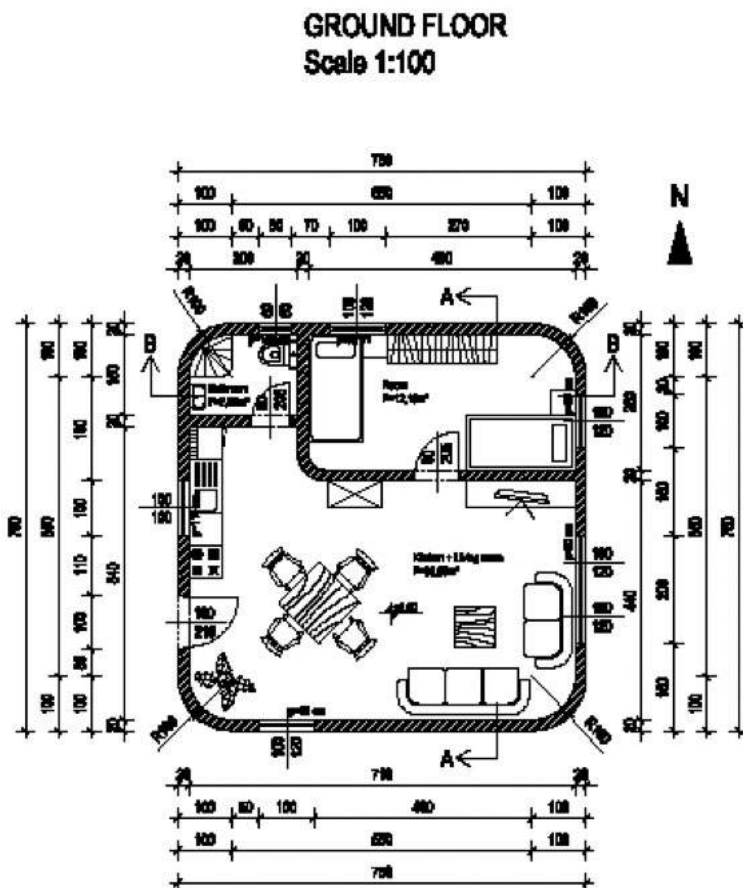
**Purpose:** vacation house

**Short description:** the idea is to build a holiday home of 52 m<sup>2</sup>, fully implemented in 3D technology. The assumption is that land has already been secured in Augsburg (Germany) and Zagreb (Croatia) and projects have been prepared for which it is necessary to obtain a building permit. As this is still a relatively unexplored topic, the point of this case is to summarize the unknowns regarding legislation, potential obstacles and problems in relation to standard construction, and in the future standardization of the process for 3D printing of objects. All installations, fittings and final details (such as furniture) will in this case be of traditional material and traditional construction. The difference is in the construction and in the construction related critical topics that need to be taken into account when legalizing the building. The role of the respondents is to represent an investor who lacks the technical knowledge and obtain a building permit for legal construction.

**Drafts and photo documentation:**

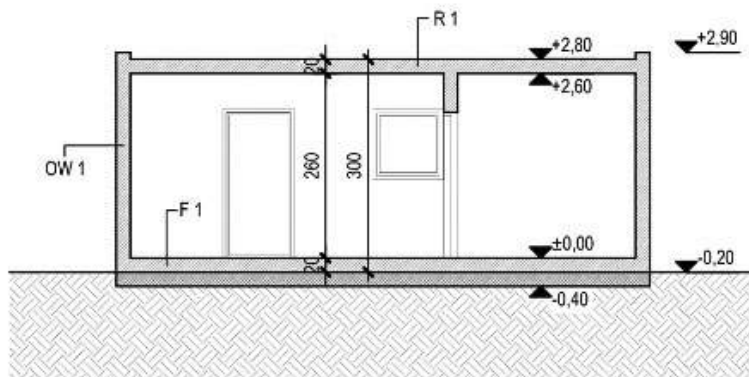
1. Ground floor
2. Cross sections
3. Façades 1
4. Façades 2
5. Photo 1
6. Photo 2
7. Photo 3
8. Photo 4

1) Figure – Ground floor



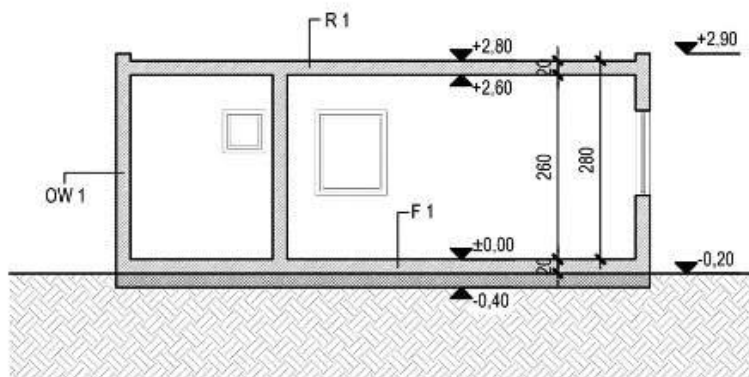
2) Figure – Ground floor

CROSS SECTION A-A  
 Scale 1:100



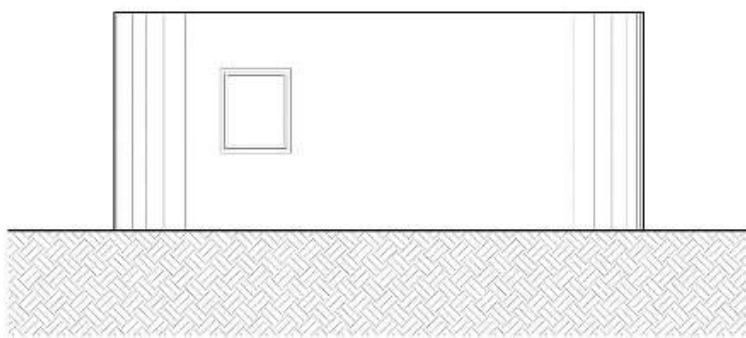
OW 1 (Outern wall)	F 1 (Floor)	R 1 (Roof)
-Modul wall 20.0 cm	-Modul floor 20.0 cm	-Modul roof 20.0 cm
	-RC slab 20.0 cm	

CROSS SECTION B-B  
 Scale 1:100

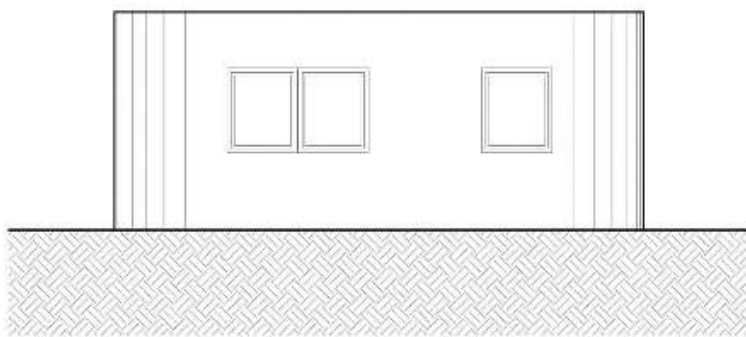


**3) Figure – Façades 1****SOUTH FACADE**

Scale 1:100

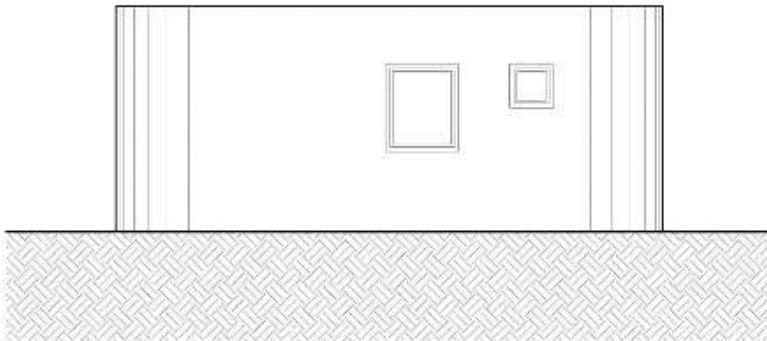
**WEST FACADE**

Scale 1:100

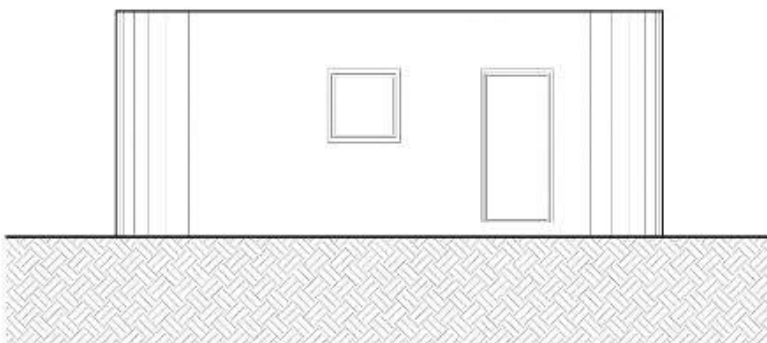


#### 4) Figure – Façades 2

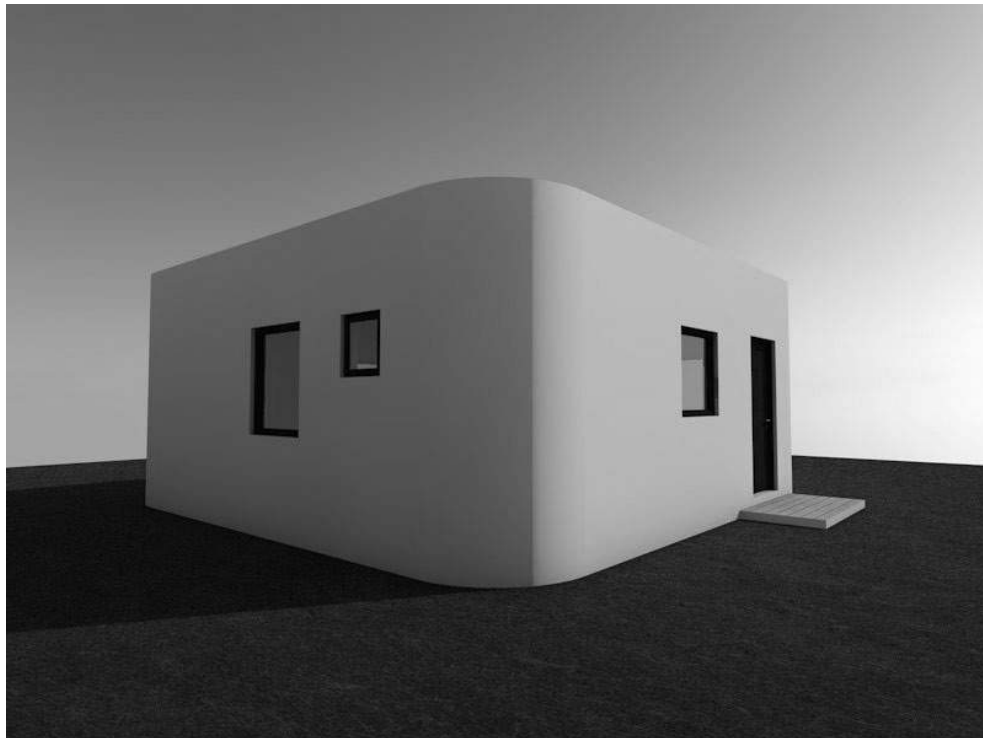
### NORTH FACADE Scale 1:100



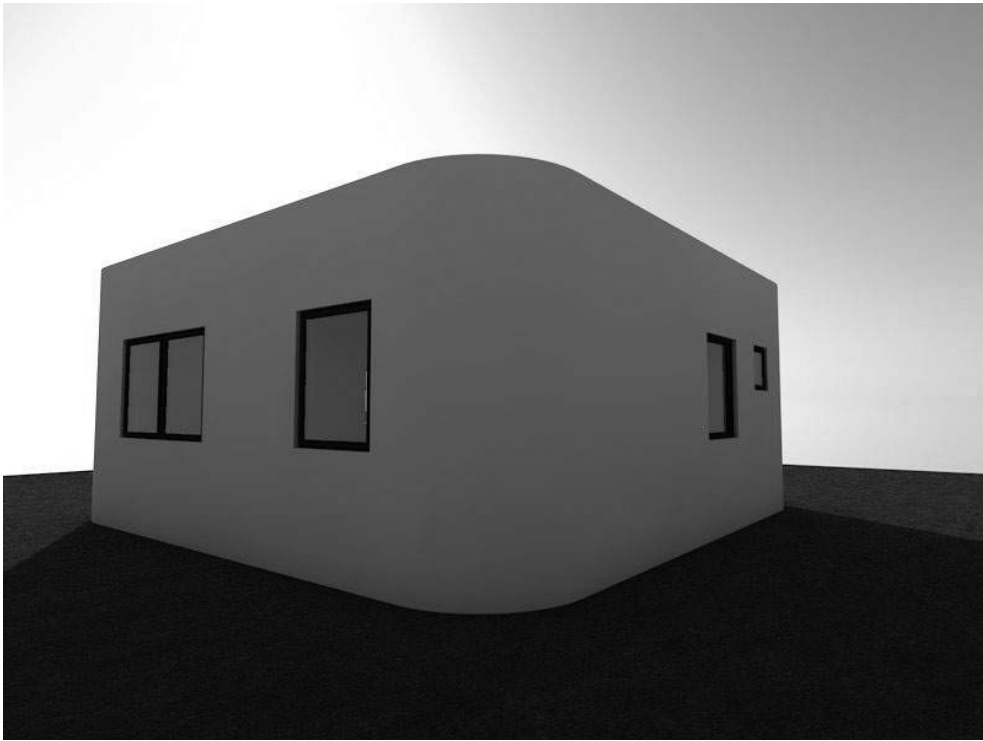
### EAST FACADE Scale 1:100





**5) Figure – Photo 1****6) Figure – Photo 2**

**7) Figure – Photo 3**



**8) Figure– Photo 4**



The interview with the data about house and important questions that were considered necessary for obtaining a building permit was distributed to one expert in Germany (Ms. Johanna Stueckl) and one expert in Croatia (Mr. Vjeko Katic). It should be noted that both respondents have very little experience in the field of research work, but years of experience in practice. Two different countries were deliberately taken to see how standardized the issue is at the European level, what are the differences, and what are the similarities in this challenge. Ms. Johanna Stueckl was born near Munich (Germany), is an employee of an Augsburg (Germany) - based company that deals with construction management, construction supervision, quality management, planning, building consulting, conflict management, energetic renovation, project management and similar. She completed her degree in architecture at the Technical University of Munich and received her master's degree in the domain of energy efficient and sustainable building. Further, she is a member of the Bavarian Chamber of Architecture with approximately 10 years of working experience. On the other hand, Mr. Vjeko Katic is born in Zagreb (Croatia), he graduated from the Faculty of Civil Engineering in Zagreb. He holds a master's degree in civil engineering and is a member of the Croatian Chamber of Civil Engineers and a court expert on construction topics. Onwards, he is the CEO, with more than ten years of experience, of the company that deals with construction, design and construction supervision, and energy certification.

## QUESTIONNAIRE / INTERVIEW

1. How familiar are you with the topic of 3D printing in construction and what do you think subjectively about it (advantages, disadvantages, obstacles, challenges...)?
2. Have you had any experience with building permit documentation / producing of the documentation for 3D printed objects so far? If you had experience, what stage was it at (conceptual, start of construction, completed construction)?
3. When designing building permit documentation compared to classic construction, what would you pay particular attention to in terms of *mechanical resistance and stability*?
4. When designing building permit documentation compared to classic construction, what would you pay particular attention to when it comes to *fire safety*?
5. When designing building permit documentation compared to traditional construction, what would you pay particular attention to in terms of *hygiene, health and the environment*?
6. When designing building permit documentation compared to classic construction, what would you pay particular attention to in terms of *noise protection*?
7. When designing building permit documentation compared to classic construction, what would you pay particular attention to in *terms of technical regulations*?
8. How much do you think the people within the city administration are familiar with the topic and what potential problems / obstacles they might point out in relation to the traditional construction of the building?
9. Do you expect additional costs for the preparation of the building permit documentation in relation to the traditional construction, and if so, what justify the discrepancy?
10. What kind of future do you expect for 3D printing in the construction industry and do you think it may play a more significant role in the real estate market in the near future (by 2025)?

## RESULTS

### 1) INTERVIEW RESULTS:

Ms. Johanna Stueckl (Augsburg, Germany)

Mr. Vjeko Katic (Zagreb, Croatia)

**1. How familiar are you with the topic of 3D printing in construction and what do you think subjectively about it (advantages, disadvantages, obstacles, challenges...)?**

**Ms. Stueckl:** My only experience with 3D printing was during my studies, as we sometimes used it to create our architectural models. I have no experiences in larger scale. I see an advantage in prefabricating. Once the details are figured out and digitalised you can "reprint" the house as often as you like. The more you print it the more cost efficient the project gets. A disadvantage could be that the buildings measurements are limited to the printer range.

**Mr. Katic:** I have seen 3D printing of small models or small parts of bigger objects but I haven't seen making construction of normal size building made by 3D printing. But if I imagine probably the biggest advantages are flexibility of modelling and it will be great advantage for architects. Disadvantages could be problems with construction, I don't know the way how to make reinforced concrete by 3D printing. One of the challenges will be how to make it faster for building and better in insulation characteristics.

**2. Have you had any experience with building permit documentation / producing of the documentation for 3D printed objects so far? If you had experience, what stage was it at (conceptual, start of construction, completed construction)?**

**Ms. Stueckl:** No, I have very little experience with the building permit documentation of such buildings. Nonetheless, as part of one project, the investor was interested in the construction of a 3D printed, 25-cm-thick corrugated polycarbonate sheets plastic - finished façade. In this action, according to the cost benefit analysis, the costs definitely outweighed the benefits, but the investor was still only interested in the desire for innovation and representation. Unfortunately, this remained only in the conceptual phase (sketches only). The biggest problem is that it was necessary only for this action to produce a separate and very specific machine for 3D printing.

**Mr. Katic:** I haven't had experience with permit documentation of 3D printed objects so far or producing documentation. What I suppose that in producing documentation for mechanical resistance and stability it will be many problems in calculations.

**3. When designing building permit documentation compared to classic construction, what would you pay particular attention to in terms of mechanical resistance and stability?**

**Ms. Stueckl:** The building itself doesn't strike me a mechanically challenging. Also from a structural point a few it is an "easy" building. I just don't know how the roof is printed in 3D. As part of our projects, we have often discussed the possibility of permitting and constructing flat roofs for such small structures. But with some similar examples (student bungalows at Olympia Stadium, Munich), I guess that won't be a problem here either.

**Mr. Katic:** When designing building permit documentation in terms of mechanical resistance and stability for 3D printed houses it will be bigger problem to calculate because it is not a standard material and it has different compressive and tensile strengths so it will be problems with assuming what factor of safety to use. Also it will be problems with boundary conditions in calculations.

**4. When designing building permit documentation compared to classic construction, what would you pay particular attention to when it comes to fire safety?**

**Ms. Stueckl:** To build in Munich the building has to fulfill all the regulations according to the "Bavarian building code". By the first look of it, I don't see any problems. The escape routes are there and the used materials aren't flammable.

**Mr. Katic:** I think that problems with fire safety will not be in part of evacuation, but the problem could show up in part of classification of fire resistance of materials and supporting fires on surface if it is not specified for material that is house made of.

**5. When designing building permit documentation compared to traditional construction, what would you pay particular attention to in terms of hygiene, health and the environment?**

**Ms. Stueckl:** I can't see a difference to a traditional construction once the building is finished. When you want do address the environmental issue you have to compare it during construction and the used materials, I think. Nevertheless, some questions need to be answered as what is the expected lifespan, what is the grey energy of extruded concrete compared to normal concrete etc.? Well, you might have to compare it to a timber structure which is way more environmental friendly and would be the classical material to build such a cabin.

**Mr. Katic:** I really don't see difference when designing building for 3D printed building or traditional construction because hygiene, health and the environment is more in correlation with installations not with construction. So I suppose that installations for water and plumbing will be in traditional way so it will be the same as in traditional building.

**6. When designing building permit documentation compared to classic construction, what would you pay particular attention to in terms of noise protection?**

**Ms. Stueckl:** A deeper analysis is needed here, e.g. from what? Noise coming in, or going out? Or the room acoustics inside? The soundwaves bounce off hard materials, so when there are no soft materials used like curtains, carpet etc; I can imagine the acoustics inside is pretty awful. Protection from surrounding noise is succeeded by using the right windows and doors, this shouldn't be a problem and has nothing to do with the 3D printing.

**Mr. Katic:** I think that it could be some problems with determining technical characteristics of materials the house is made of. So we could have problems with house noise protection classification. Potentially there could be problems with percussive sound when someone is walking on the upper floor but this house has only one floor so it won't have that kind of problem.

**7. When designing building permit documentation compared to classic construction, what would you pay particular attention to in terms of technical regulations?**

**Ms. Stueckl:** I can't see why a 3D printed building should be different at least as far as the procedure is concerned. As far as classification is concerned, it is still one big unknown.

**Mr. Katic:** Technical regulations is for me big problem if we use some new non classified materials, special if we don't have any data of material when we need to calculate if house is good in all seven important conditions for house.

**8. How much do you think the people within the city administration are familiar with the topic and what potential problems / obstacles they might point out in relation to the traditional construction of the building?**

**Ms. Stueckl:** I think people in the city administration have no experience at all. And I don't think they need to. During the building permit process all they check is:

- is this building according to zoning plan (development plan: usable area, floor area, residential units etc.)?
- does it fit in the surroundings (the flat roof and round corners might be a problem here)?
- how is this building connected to water, power, sewage?

**Mr. Katic:** I don't think people within the city administration are familiar with this topic at all. And every difference that appears that is not the same like in traditional construction will be a big administrative problem because they probably won't know how to classify that building and they will not give us permission to start building.

**9. Do you expect additional costs for the preparation of the building permit documentation in relation to the traditional construction, and if so, what justify the discrepancy?**

**Ms. Stueckl:** No, I don't expect that although a detailed analysis of all potential problems should also be made prior to the issuance of the offer, i.e. acceptance of the contract. But I doubt it would get a permit.

**Mr. Katic:** If some investor comes to our office and asks us to prepare the building permit documentation for 3D printed building we won't be sure what would be the price and probably would refuse him. If we would need to give an offer to make that kind of documentation the price would be double of normal price for traditional. We would justify it because it takes much more time to do it non-traditional way and takes a lot of time to specify all needed norms.

**10. What kind of future do you expect for 3D printing in the construction industry and do you think it may play a more significant role in the real estate market in the near future (by 2025)?**

**Ms. Stueckl:** Reinforced concrete is the least sustainable building material. So, personally, I hope the building industry comes up with a better solution. Economically speaking, I think 3D printing might be more cost efficient, when used again and again, as it is with modular designs.

**Mr. Katic:** By 2025 I don't expect it to play significant role in Croatia, but maybe one day it will be in us because of faster building when it becomes standard.

## DISCUSSION

Quite similar for both respondents, they had very little experience with 3D printing, mainly in the study phase or in printing smaller models. As they both have approximately ten years of experience, it is to be expected that many knowledge and facts have changed since their study. A potential advantage is the cheaper cost of construction, but only when all the processes are standardized, i.e. the more printing is more cost effective. In doing so, one can see the clear fears of the respondents regarding the classification and standardization of the process.

It is also common for both respondents to have very little or no experience with the topic of legislation of such objects. All conversations were mostly at the conceptual stage, as a potential solution and a eventual better idea than traditional construction. Pending implementation usually not occurred since the potential costs were too high, and open questions were still too risky to engage in this »adventure«.

As far as the mechanical resistance and stability is concerned, according to Ms. Stueckl building is not particularly complicated and there should be no problem as long as all the conditions prescribed by the city administration are satisfied and all dilemmas are clarified (such as the problem of flat roof in such small buildings) Mr. Katic lists potential problems for the statistician when calculating because these are relatively unknown materials and, accordingly, unknown safety factors that need to be considered.

A similar situation is with fire safety, it should not be a problem as long as all the previously prescribed conditions are met. Nevertheless, there are quite a few unknowns about the classification of the material.

In terms of hygiene, health and the environment, there are no major differences from standard construction, and this aspect does not depend so much on the construction itself but later on the final details (insulation, installation, etc.).

Further, in both of the following questions Ms. Stueckl does not state any significant difference from standard build, and Mr. Katic emphasizes once more the concern and need for material classification, which could play a crucial role in satisfying all the necessary conditions.

A major potential problem is evident in the concern of both respondents that the city administration has very likely almost no experience in granting permits for 3D printed buildings. Part of the legalization comparable to traditional construction would probably not be a problem, but all new and unknown details could be an insurmountable obstacle to obtaining a permit.

When it comes to accepting work for that action, Mr. Katic points out that, because of all the unknowns, he would very likely not have accepted this assignment, and the potential costs would very likely have risen to double the amount of documentation for classic construction. Although Ms. Stueckl is not sure whether and how much the real costs would exceed those of a classical construction, she express her doubt that a permit would be obtained at all, and thus doubt that she would even embark on such an obligation.

Despite all the obstacles mentioned above, it is to be expected that 3D printing could have a bright future. Both examiners agree that potentially the 3D printing might be more cost efficient, when used again and again, as it is with modular designs. However, this requires a standardization of the process, which is very optimistic to expect in the near future.

## CONCLUSION

On all the above issues relevant to obtaining building permits (mechanical resistance and stability, fire safety, hygiene, health and the environment, noise protection, technical regulations), it seems at first glance that there are no special differences in comparing 3D printed houses with traditionally constructed materials (e.g. wood or concrete). All conditions prescribed by the city administration must be satisfied, regardless of the material and method of construction involved. However, it concludes that there are still many unknowns when designing 3D printing documentation. The unknown is common to both German and Croatian experts. Although this is a small sample, it can be said with caution that it is very likely that similar situations are in other European countries. The main problems and uncertainties are related to the lack of classification and standardization in 3D prin-

ting, the lack of specific knowledge closely related to this topic within city administration, as well as relatively little, almost no expert experience (except in the conceptual phase and smaller models), of the same experts who have about ten years of experience in traditional construction. This results in their skepticism about whether this endeavor is at all realistic and feasible, and the cost of their work in representing investors would almost certainly multiply exceed the cost in standard construction. Nevertheless, with a dose of caution, a bright future for 3D printing in the construction sector can be foreseen, as it offers certain advantages over traditional construction. A necessary prerequisite for this is the standardization of the process, the classification of materials, and the education of both city administration and experts involved in the preparation of construction permit documentation. This is also the direction in which future research and licensing efforts should go. Also, many other factors (e.g. microlocation, reference projects, additional technical requirements, cost benefit analysis, etc.) need to be taken into account in order to start the project mentioned in this case study at all. Accordingly, success factors for 3D printing in construction and methods for measuring them must be elaborated. Until that big step, nowadays everything remains in the conceptual phase as something that has a lot of potential but is still not standardized and researched. It is the responsibility of both theorists and practitioners to identify any potential advantage over traditional construction, to investigate, to define, to solve problems and to implement for potentially cheaper, easier and more environmentally friendly construction.

## LITERATURE

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## **PROJECT TEAM MEMBERS EMOTIONAL INTELLIGENCE (EI<sup>1</sup>): AN ESSENTIAL CAPABILITY FOR PROJECT MANAGEMENT SUCCESS THROUGH MEDIATING VARIABLES EFFECTS**

### **ABSTRACT**

*Almost 88% of project managers consume more working time on managing, understanding, and solving project team people's side issues (Aziz 2019). Researchers found challenges and complexity in projects primarily associated with emotions rather than technical ones. Emotion act as one of the critical factors in assessing project team capability while managing projects. It is required to analyze whether project team members EI leads to better project management performance along with the increased efficiency to deliver project outputs. Therefore, to examine project team members EI and project management success link through a mediating role of motivation and relationship management; a hypothesis and research framework is formulated. The research model has analyzed the project team member's EI impact on project management success through project team member's motivation and relationship management as mediating variables effect. An online survey consisting of a questionnaire is used to test the research model empirically and gather responses from the respondent project team members. A Structural Modelling Equation (SEM) is employed for multiple mediator variables measurement model which examined the relationship of mediating factors on project management success. The results and findings help project managers become aware of the importance of project team member's motivation and relationship building, which can boost performance in a complex and dynamic project environment. The results are adding on to a project team members EI behavioural and emotional impact in project organizations of project management literature. Moreover, this research study has covered a gap of mediating variables effect on project management success.*

**Key words:** Project team members, Emotional Intelligence (EI), Motivation, Relationship management, Project management success

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1 Emotional Quotient (EQ) and Emotional Intelligence (EQ) are interchangeable terms



## INTRODUCTION

In the project management trends of 2020, EQ is gradually turning as an influential determinant within project teams to manage project management success with high team performance and team satisfaction. It is necessary to examine and confirm that project team members EI can improve project management performance by meeting and fulfilling the requirements of the iron triangle. Also, there is a need to assess whether team member's EQ is apt depending upon the different project management attributes. A profound study of EI competencies in non-managerial context is crucial for project organisations. Many projects fail with an underlying issue of not addressing and demonstrating proper communication, negotiation, relationship management, and integrity within teams. People side issues are given less importance and this in turn affects the project management performance to gain the short term project targets. This study will contribute to knowing specific people management solutions and help resolve people's competencies complications in the project portfolio. It is important to assess whether project team members within projects have a positive or negative impact on project management success based on the mediation role of constructs such as motivation and relationship management. It is important to note the relationship between both and find out whether they have a direct relationship or indirect link existing through mediator variables.

*Following is the research question to be answered to fulfill the research goal:*

Do project team members EI contribute to project management success through mediating variables effects?

### Research objective:

To critically analyze project team members EI impact on project management success through mediating variables effect

A review exhibits the latest findings of research articles from 2010-2020 in the last decade of project management literature. Almost A\* and A ranked primary journals are chosen from the Australian Research Council (ARC) journals, FT50<sup>2</sup> journals, Australian Business Deans Council (ABDC) journals list (Chavan 2020).

Jordan and Lindebaum (2015) study of 42 IT projects found more than 65% of problems existing due to non-technical reasons and people issues leading to project management failure whereas only 35% accounted technical causal issues (P. J. Jordan 2015). Predominantly, the chief reason is the project leaders's inability to deal with the team members effectively and a need of team coordination in majority of the cases has escalated failure rate of IT projects. In formulating a key argument of this research, the role of emotions is been highlighted as a significant aspect in leading and managing teams on an everyday basis. Mazur et al. (2014) argue the theory of high EI enabling peers to communicate better and mitigating conflicts within project team members. Even though EI strategies and solutions are offered to improve people's management, its fundamental mechanism of affecting the project team member's EI and project management success relationship is unknown (Mazur 2014). Rezvani et al. (2016) pointed out the non-managerial employee EI contribution and its impact on project management success. Further, he suggests studying different project work characteristics environment and EI relation (Rezvani 2016).

Thus, this proposal tends to extend these findings by inspecting the influence of project team members EI on project management success in a non-managerial context. An analysis of the literature reveals no previous studies found to test the relationship between Emotional Quotient (EQ) attributes of project team members in particular and project management success. Different EQ competencies are more likely to attain project objectives successfully for different categorization of projects. Also, the general management context suggests that different leadership styles are appropriate in a different context and they do influence organizational project performance (R. a. Müller 2010). Likewise, they stated EQ competencies appropriateness to attain project objectives of different project types. A research study investigated different project management approaches of moderating or mediating constructs for different project categories (Androniceanu 2015). Quinn & Wilemon (2010) demonstrated a framework reflecting the relationship between the effectiveness of project

2 FT50 journals is a 50 journal's list prepared by the financial times to assess research quality and compile the Business School Research rank and research quality

group EI and people skills which can help manage a project team (Quinn 2010). At the same time, group members EI can result in high performing teams and effective communication for different projects (Aziz 2019).

Further, emotion management can help to understand, perceive, and manage emotions of both project manager and team directing work attitudes and behaviors in positive directions and influence project management success (Maqbool 2017). Lack of EI and negative emotions within a team can lead to poor performance in project settings. In more recent research, motivation and Internal Relationship Management (IRM) scored highest among leadership competencies for driving project tasks and having a greater impact on project management performance (Meng 2017). Taking these aspects into consideration and no details on literature for interlink between project team members EI and project management success through the mediation process, it is important to study the relationship between them using mediating variables.

## METHODS

### Research Question

Does project team members EI influence project management success through mediator variables namely, motivation and relationship management within the project team for different project types?

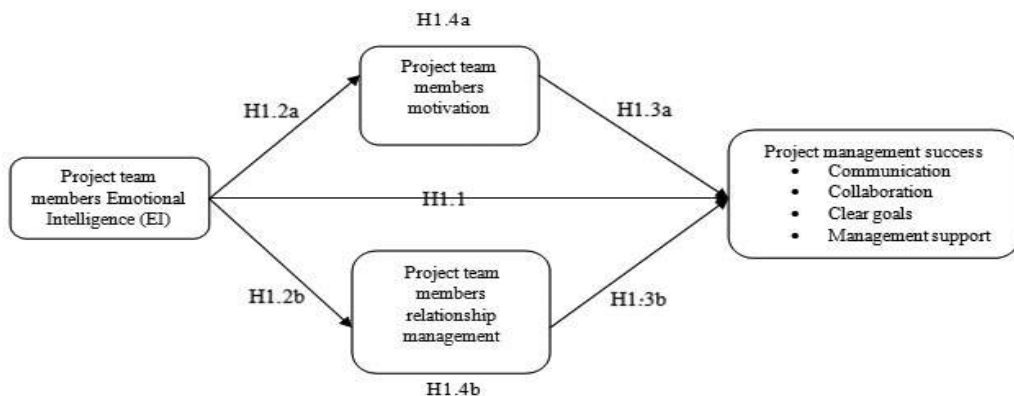
### Research Objective

To examine the project team members EI and project management success link through the mediating role of motivation and relationship management.

### Design of the Study

A wide and extensive interpersonal soft skills related to literatures in project management are studied. This has helped to enlist pivotal group EI competencies of project team members which acts as a mediator in improving overall project management performance and success.

It is required to investigate the project team member's EI impact on project management success, project team member's motivation, and project team member's relationship management. This will gather reasonable evidence and prove the significant role of cohesive EI on different elements of the project team. Accordingly, the research model in Figure 1 is proposed for the research study.



**Figure 1. Research model**

The research model is based on the mediation theory between project team members EI and project management success aligned with the principles of Affective Events Theory (AET) (Rezvani 2016) (Weiss 1996). A test model links group members EI to project management success and examines the mediating effects of project team member's motivation and relationship management on this link.

Based on the built research framework, the following hypotheses are formulated to answer the research question and fulfill the research objective:

To test hypothesis, it will be required to hypothesize:

**H1.1** Project team members EI is positively correlated to project management success

**H1.2** Project team members EI is positively related to a) their motivation and b) their relations

**H1.3** Project team members a) motivation and b) relationship management is positively related to project management success

**H1.4** Project team members attitudes, namely a) motivation and b) relationship management mediates the relationship between project team members EI and project management success

### Evaluative variables

Following are the critical variables considered for study:

1. Project management success is defined as per (Mazur 2014) people-related factors such as open communication, collaboration, clear goals, and management support
2. Project team members EI demonstrating team effectiveness for project management success are paramount
3. Motivation theory to know team members work attitudes of autonomy support, job satisfaction, and work environment
4. Relationship management constituting of high-quality relations and trust within team members

### Sampling procedure

To collect data, an online survey was preferred to test the research model empirically. Human Resource (HR) department of organizations was asked to make an online survey link available to non-managerial employees- project team members of ongoing projects within an organization to complete the questionnaire. This gathered the response from mainly non-managerial respondents. Several project-based companies of worldwide nations, namely India, Australia, and the USA were targeted for different industries projects such as IT, Construction, Aerospace, Defence, Project consultancy. Firm size was kept 100 to 2,000 personnel with projects ranged from \$3-\$30 million. Projects characterised by a high level of complexity in management, technicality and stakeholder arrangements were considered most. A pilot study was conducted for two weeks for the final analysis of the questionnaire. Further, questionnaire was kept open for 6 weeks and within the 14 companies surveyed, 287 responses were returned and considered valid responses with a respondent rate of 20.5%. The research was focusing on working attitudes of project team members and thus managerial responses were not part of the study. Within collected responses from different companies, there were 6 IT projects with 93 responses, 4 construction projects with 78 responses, 1 each for aerospace & defence with 33 & 57 responses and 2 were project consultants with 26 responses. Table 1 below exhibits project classification, total projects and collected responses details. Demographics measures of the respondents such as job designation & project experience, educational qualification & certifications, age, gender and nationality were considered. Moreover, the respondent's email address were collected to mail them the results obtained.

**Table 1. Project types and collected responses details**

Project type	Total projects	Responses
IT	6	93
Construction	4	78
Aerospace	1	33
Defense	1	57
Project consultant	2	26
<b>Total</b>	<b>14</b>	<b>287</b>

### Important measures for the questionnaire:

Substantive and published measures are used for the contextual constructs of the research model. Seven-point Likert scale ranging from 'strongly disagree (1)' to 'strongly agree (7)' was chosen for participants to rate scale items of each variable.

1) Project team members EI self-report measure is designed using 16-item Wong and Law Emotional Intelligence Scale (WLEIS) within a team context, which explained four specific components of EI namely; Self Awareness of emotions (Sulaiman 2013) (P. J. Jordan 2015) sample question, "I understand my own emotions for team members I feel". Social Awareness of emotions sample question, "I have a good understanding of my team member's emotions and feel sensitive towards them". Self Management of emotions, sample question, "I can explain exactly what other team members are feeling". Social Management of emotions sample question, "I can make team member's happy when they are sad".

2) For Project management success, a 20-item scale developed by (Pinto 1990) is selected to investigate team member's assessments of four project management success elements. A communication sample question, "There is open communication and transparency related to work structure within a team". Collaboration sample question, "There is consistent sharing of work and exchange of information between team members". Clear goals sample question, "My team members are completely aware of project requirements and work towards them with a shared & common goal". Management support sample question, "We constantly gain encouragement and rewards from management as a source of motivation for our work accomplishment".

3) For motivation, Work-related Extrinsic-Intrinsic Motivation Scale (WEIMS) and Self Determination Theory (SDT) of 18-item scale at work (Ryan 2000) was selected which defined team member's mindset and positive workplace outcomes. A sample question, "We have full autonomy at work and mutual support from our team members".

4) For relationship Management, the 6-item scale of the Rotated Component Matrix Scale of Internal Project Relationship Management is preferred (Meng 2017). A sample question, "The strong interpersonal skills of negotiation, trust, high-quality relations, and conflict-management coexist within team members".

### Analysis and Mediation Test

To perform analysis, Structural Equation Modeling (SEM) was more appropriate for multiple mediators variables rather than traditional statistical regression analysis. Statistical software packages SPSS version 26 and SPSS AMOS version 26 are used to conduct analysis. SEM allowed us to study both unobserved (latent) and observed (measured) variables. SEM software made it easier to choose several estimation methods discussed by (Byrne 2013) such as ordinary and generalized least squares, maximum-likelihood, and bootstrapping. Extension of a simple mediation model such as parallel multiple mediation is applicable to assess mediating constructs and project management success relation (Preacher 2008) (MacKinnon 2008).

This approach offered the benefits of reduced parametric bias and multiple mediators control during inter-correlation between mediators variables of the research model. This method allowed us to see and tests: 1) Independent variable (project team members EI) effect on the dependent variable (project management performance) 2) How independent variable (project team members EI) affects the mediator variables (motivation and relationship management) and lastly, 3) Mediators variables (motivation and relationship management) effects on the project management success when variable project team members EI is controlled. If the mediating variables mediate path totally, then the link between project team members EI and project management success is not significant. To test SEM, AMOS 26 was used in this research (Byrne 2013). AMOS directly generates confidence intervals which are bootstrapped and bias-corrected with maximum-likelihood evaluation. Both of these methods are utilized in this research considering Preacher and Hayes (2008) suggestion of using at least 5000 resamples for the bootstrap.

## RESULTS

### Measures Validation

A Confirmatory Factor Analysis (CFA) is conducted to examine variables validity. While carrying out CFA, the research model generates an appropriate fit for values and a sound approximation to real confirmed measurement factors. After assessing the theory-based model with the reality model using chi-square test, it provided  $\chi^2/df$  degree of freedom ratio of 2.46 which is recommended to be  $\leq 3.0$ , a Comparative Fit Index (CFI) of 0.92; recommended value  $\geq 0.90$ , Root Mean Square Residual (RMR) of 0.06; recommended value  $\leq 0.08$ , Root Mean Square Error of Approximation (RMSEA) of 0.04; recommended value  $\leq 0.08$ , Non-normed Fit Index (NFI) of 0.90; recommended value  $\geq 0.90$ . These readings corroborated the measurement model fit-for-data statistics purpose. Table 2 below manifest fit-for-statistics obtained data.

**Table 2. Fit-for-data statistics**

$\chi^2/df$	CFI	RMR	RMSEA	NFI
2.46	0.92	0.06	0.04	0.90

Besides, convergent and discriminant validity suggested by (Hair 2012) was adopted for all variables and measurement items of scales which included Cronbach Alpha  $\alpha$  value; recommended value  $> 0.70$ , Composite Reliability (CR); recommended value  $> 0.70$  and Average Variance Extracted (AVE); recommended value  $> 0.50$  and factor loadings (t-value) confirming high validity of convergence as all item values of scale are significant at  $p < 0.05$  level. All of these recommended criteria were fulfilled by the measurement model. Discriminant validity is examined by taking the square root of the AVE for each of these variables which shows that the square root of the AVE is higher than the constructs of bivariate correlations. Table 3 below is aligned with the criterion of descriptive statistics for constructs present in our study.

**Table 3. Convergent and Discriminant Validation results**

Constructs	Cronbach Alpha ( $\alpha$ ) value	Composite Reliability (CR)	Average Variance Extracted (AVE)	Square root of the AVE
Project team members EI 16-item scale	0.88	0.84	0.53	0.72
Project management success 20-item scale	0.93	0.83	0.63	0.79
Motivation 18-item scale	0.86	0.82	0.52	0.72
Relationship management 6-item scale	0.84	0.83	0.51	0.71

\* Recommended values for each construct are suggested by (Hair 2012)

## RESULTS ANALYSIS

We begin to test our hypotheses using the research structure model in two phases. In phase 1, we studied the link between project team members EI and three constructs namely, team members motivation, team members relationship management and project management success. It can be seen in Figure 2 (Research model A) that these all individual relationships were significant and valid, which supported hypotheses 1.1, 1.2a and 1.2b respectively. Further, the effects of project team member's motivation and relationship management on project management success are assessed. Both constructs path analysis had positive path co-efficients with significant value of 0.43 (Project team members motivation  $\rightarrow$  Project management success) and 0.27 (Project team members relationship management  $\rightarrow$  Project management success) respectively. Consequently, these path coefficients supported hypotheses 1.3a and 1.3b respectively. The research model was not changing when other demographics measures job title, qualification, gender, age and nationality were controlled.

In phase 2, multiple mediators variables effects of motivation and relationship management are identified on the dependent variable when the independent variable project team members EI is controlled. To indicate effects, we compared research models in Figure 2 and Figure 3 where research model B has the association links between the mediator variables (project team members motivation and project team members relationship management) and the dependent variable (project management success). If project team member's motivation and relationship management mediate the path between project team members EI and project management success, the direct link between project team members EI and project management success should be insignificant.

To verify and evaluate the statistical significance of multiple mediation variables effect in the SEM, we first used maximum-likelihood estimation in AMOS 26. In Figure 3 of research model B, the existing link from project team members EI and project management success became insignificant. This demonstrates the complete mediating role of both project team member's motivation and relationship management between project team members EI and project management success.

Another complementary test of bootstrapping was conducted with 5000 samples and a bias-corrected confidence interval of 95% (Efron 1994). Appropriate confidence limits of mediator variables are provided by this reasonable method (Preacher 2008). In concering to Table 4, the lower and upper bounds of these indirectly mediated constructs have no zero whereas the direct variable effect from project team members EI to project management success has zero. Therefore, the findings supported hypotheses H1.4a and H1.4b of mediator variables effect (project team members motivation and project team members relationship management) and H1.3a and H1.3b of mediator variables relation to project management performance.

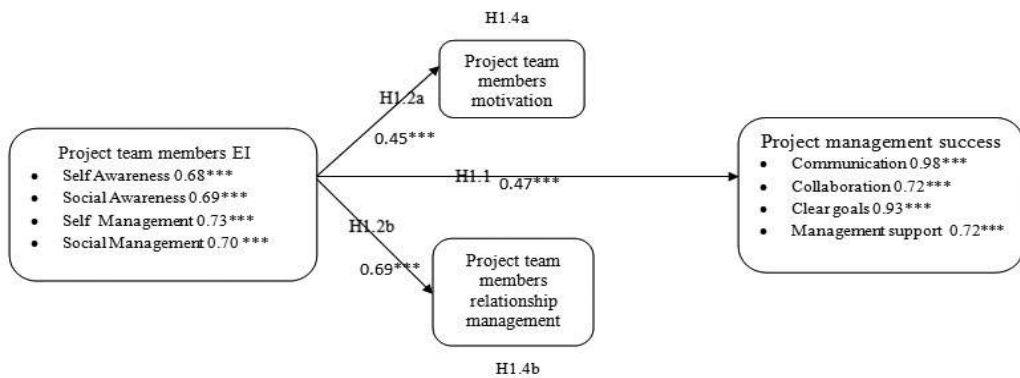


Figure 2. Research Model A

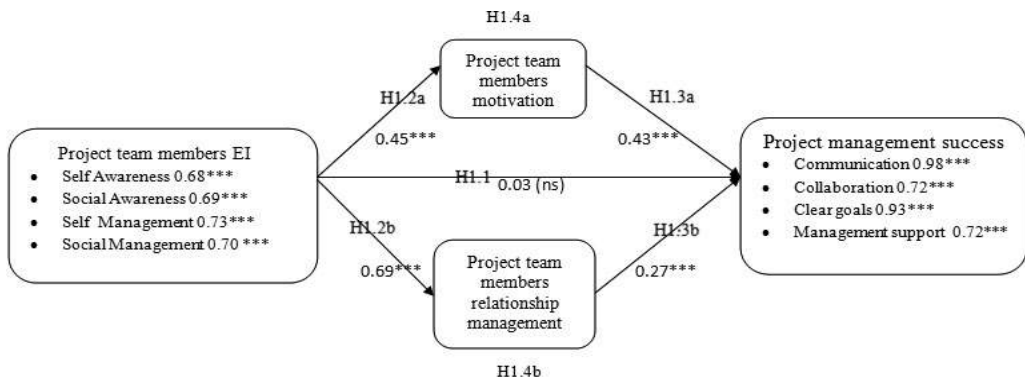


Figure 3. Research Model B

**Table 4. Bootstrap analysis outputs**

Construct Links	Bias-corrected Confidence Intervals		p-Value
	Lower bound	Upper bound	
Project team members EI → Project management success	- 1.180	0.517	0.864
Project team members EI → Project team members motivation	0.415	0.937	0.000
Project team members EI → Project team members relationship management	0.257	0.561	0.000
Project team members motivation → Project management success	0.341	0.712	0.000
Project team members relationship management → Project management success	0.212	0.834	0.026

\*  $p < 0.05$  = If bias-corrected confidence intervals have no zero, the estimate is significant at the 5 % level

## DISCUSSION

At present in a complex project environment and project-based setting, it is important to examine the critical factors contributing to better project management performance linked with project team members EI. Findings exhibit that straightforward and direct link between project team members EI and project management success is complicated and not explanatory through direct relation. The underlying mechanism of project team members EI and project management success is assessed based on emotions theory and referring their theoretical research framework, we argued and inferred that link between team members EI and project management success can be mediated by two alternative paths. Rezvani studied moderating effects of trust and job satisfaction on project outcomes which demonstrated a positive effect on project performance (Rezvani 2016). Aligned with this mechanism, we tried to explore additional components and personal attitudinal team member's characteristics impact on the EI-project management success link.

Even previous studies focused on managerial responses and samples to investigate the relationship between manager's EI and project success and therefore we decided to consider non-managerial responses in this research and study its effects on the short-term perspective of project management success for different project types. Project team members develop intrinsic motivation within the team when they are satisfied with work, support and emotionally encouraged, they do establish strong reflection on project management performance. Moreover, another mediating variable of relationship management helps in improving team evaluations in terms of relationship handling between team members affecting project management success. Thus, our study describes a valid response to Muller & Jugdev (2012) call of discussing more study on mediating variables related to attainable project management success for delivering project deliverables (R. a. Müller 2012).

As per our knowledge, this study is one of them who has applied Affective Events Theory (AET) principles (Weiss 1996) and its behavioral reaction theory at the workplace. Even it shed light on insights into the detailed relation between emotionally intelligent teams and their working attitudes. These findings are consistent with the preceding research relationship between EI and working attitudes within project organisations. Team members with high EI reflect higher resilience within negative surroundings of stress and conflicts to bring out productive results. Many times within complex organisational processes historical data are lacking attention both empirically and in theory for project team members EI. Our analysis and results have been guiding a futuristic and improved mechanism for enhancing projects and business success in the dynamic phase of the workforce and working dispositions. Mediation effects analysis is regulated using both mediating variables simultaneously to reduce the issue of constructs estimation bias that would have occurred when one mediator variable is inspected at a time. This has contributed to the research methodology perspective recommended by Preacher and Hayes (2008) for obtaining correct and viable results (Preacher 2008).

## CONCLUSION

This research will help project managers and project team to execute correct and selective EI competencies through mediating constructs on different application areas of project types. It will identify core EI facets that trigger and increase the possibility of project management success rate because of team member's EI in practice. Project managers will be more aware of the importance of project team member's motivation and relationship building which boost project management performance in complex situations. Managers will be aware of the project needs in their organization and will develop individual and team pool of available project members with befitting EQ competencies for projects. This in turn will help to select and recruit employees from that pool with suitable EQ attributes for the projects at hand. EI training can be practiced especially when multicultural workforce and virtual teams are involved in projects which demand strong group cohesion. This can help raise team efforts, satisfaction and channelize them using mediation links for increased project benefits, its realization and project satisfaction.

The results and findings might guide a new approach of research that intends to enhance and capture potential business effects of EI and positive work attitude in an unstable and changing project environment. Very little experimental research is present on the project management success positive mindset and psychology. The conducted research study will add to the existing literature on behavioral and emotional implications of EI in project management organizations. Widely project management literature database has overlooked the project team's contribution and their EQ competence link to project management success through mediators. Project management literature recommends limited circumstances for the different projects EQ competencies appropriateness. This study has covered a gap of mediating variables effect on the multidimensional concept of project management success related to the delivery of tangible outputs.

We admit that our study has few limitations to emphasize, which offers fruitful and potential opportunities for the upcoming research. The data was collected in worldwide organizations but was kept restricted to three countries project-based organizations where the study can be extended further to increase generalisability of result analysis in a wide international settings. Possibly there might some other mechanisms existing between team EI and project management success or else project success using different mediator variables or moderating variables. For future research work, it will be interesting to see and study project team EI and project teamwork performance relation using moderating construct project types.

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## **PROJECTIFICATION AND ITS IMPACT ON SOCIETAL DEVELOPMENT IN GERMANY**

### **ABSTRACT**

*The number and importance of projects is growing in Germany. A study by the German Project Management Association (GPM) published in 2015 shows a growth in the share of project work to approx. 40% in 2019. The share differs significantly from sector to sector, e.g. project work is more important in industry than in the public sector. Examples such as the still unfinished major airport in Berlin shows the potential professional project management still has in the public sector in Germany. In 2015, the large number of refugees has posed major challenges for German politics, society and above all for local communities. Both examples illustrate the role projects and project management play for societal development.*

*This article sheds some light in the recent developments of projectification and its impact on societal development. It is based on the research question »Does projectification have impact on societal development?« and clarifies relevant terms in regard to the projectification. The insights provided are based on literature research and a qualitative case study of developments in Germany. The increase in project work is calling for a large number of institutions, e.g. project management associations such as the GPM, whose activities help society to adapt to and deal with the new demands. The few studies on the impact of projectification at the macro level suggest that there can be both, positive and negative effects. However, further research is needed to assess the full impact. An international research programme initiated by the Alma Mater Europaea is aimed at achieving this.*

**Key words:** Projectification, Projectified Society, Project Society, Societal Development



## INTRODUCTION

Projects have existed since the beginning of mankind. Unfortunately, we lack documents from the early days that would explain the purpose of the projects, the process and aspects of what we now call project management. Since the end of the 17<sup>th</sup> century, however, there have been publications that not only emphasize the great importance of projects for society, but also provide descriptions of the way in which projects are carried out. Daniel Defoe describes the 17<sup>th</sup> century in the introduction of »An Essay upon Projects« as the »Projecting Age« (Defoe 1697) and sets projects in the context of societal developments: »Projects of the nature I treat about are doubtless in general of public advantage, as they tend to improvement of trade, and employment of the poor, and the circulation and increase of the public stock of the kingdom«.

In Germany it took more than half a century longer for someone to come to grips with the term »project«. In 1761 the German Philosopher Johann Heinrich Gottlob von Justi describes his understanding of projects as follows: »In my opinion, a project is a detailed draft of a certain undertaking, whereby our own or other people's temporal bliss is to be promoted; at which end all the means and measures to be taken, together with the difficulties and obstacles to be feared and the way to remove them, are clearly presented in such a draft.« (Krajewski 2004) He even claimed that all people are project makers.

The world of work has changed dramatically through the various stages of industrialisation. Projects play an essential role in the efficient implementation of technical innovations and organizational changes. The paradigm of »efficiency« determines the application of management methods and tools. »Modern« project management originated in the 1950s in the context of Aerospace and Defense projects. The approach was based on »Operations Research«, a mathematical approach to problem solving which, with the first computers, facilitated planning of large projects and conquered the world of projects relatively quickly. In recent years, development has not stopped at project management. Project management is developing dramatically and, in addition to industrial applications, is increasingly finding its way into public service and other areas of our society.

## PROJECTIFICATION

If one traces the developments of project work since the early beginnings, then one clearly recognizes a pattern which starts with the »management of projects«, i.e. the implementation of individual projects, leads via »management by projects«, i.e. entrepreneurial action by projects, to »project-oriented organizations«, which provide the predominant part of their delivery in form of projects (Lang/Wagner 2019).

In 1995 Christophe Midler coined the term »Projectification«, based on an analysis of organizational changes at the car manufacturer Renault. Since the 1960s the number of projects at Renault has increased significantly. Projects were aimed at steadily expanding the product portfolio in order to gain new market shares and to continuously broaden the technological base. The increase in project work naturally raised the question as to how roles would be distributed between the projects (temporary organization) and the previously dominant specialist departments (permanent organization). Midler writes: »The firm effected a transition from the classical functional organization in the 1960s to project coordination in the 1970s, and since 1989 to autonomous and powerful project teams. Search advanced project management has profound and destabilizing effects on the other permanent logics of the firm (task definitions, hierarchic regulations, carrier management, functions and supplier relations). The process of projectification is still under way, to adapt these permanent processes to the new context« (Midler 1995) Projectification describes, on the one hand, the significant increase in projects that penetrate wide areas of an organisation and, on the other hand, the resulting change that has an impact on the entire organisation.

Rolf Lundin, a prominent representative of the Scandinavian School of Project Studies (Sahlin-Andersson/Söderholm 2002) has described the development of projectification from the level of individual organisations to the level of society since the 1990s. In the preface to the seminal publication »Managing and Working in Project Society« he writes: »Project thinking is spreading to most parts of society, including industrial enterprises, governmental organizations, educational institutions, and volunteer groups. Not only do people relate to projects and to project organizing in their working

lives, but they even speak and think of their daily activities in project terms.« (Lundin et al 2015) However, Lundin regrets that there is relatively little data on project work at the societal level, its significance for economic as well as social development, and that furthermore there is a lack of theoretical underpinning for this development (Lundin/Söderholm 2002).

In a study on macroeconomic measurement of project activity in Germany, the GPM has published figures. They confirm what many had already suspected but never concretely formulated: More than one third of the gross domestic product in Germany in 2013 was generated by projects. This is based on the proportion of working time spent in projects. At that time, this corresponded to a share of the gross value added of 877 billion euros. The study also shows that this share will rise to over 40% by 2019. (GPM 2015) and concludes: »Projects play an important role in value creation not only in traditionally project-oriented industries, but also in supposedly »non-project« economic sectors such as the public sector. Companies with a high proportion of project activity have a significantly higher innovation success across sectors than companies with a low proportion. In an innovation-based economy, projects should therefore also be given more attention from the point of view of competitiveness and job security.« International comparative studies show similar developments in other countries (Schoper et al 2018).

Although the share of project work in the (Western) countries studied is comparable overall, the figures differ in terms of sectoral comparability. In Germany, for example, the share of project work in the agricultural sector (agriculture, forestry and fishing) is with approximately 4% relatively low, whereas in Norway due to the fishing industry the share of project work amounts to almost 30%. Studies into the situation of Croatia, as a developing country, show that the number of projects there has also risen sharply, but the nature and complexity of the projects is different from larger and more developed countries. The fact that Croatia is a relatively new country in the European Union (EU) and that it has been projectified through corresponding projects is certainly also important: »High projectification in a smaller country could be explained by needs for grow, change and development which is typical for country of any profile. It is also sure that globalisation, and latest EU membership also pushed projectification in many smaller countries due to EU project co-funding programs.« (Radujkovic/Misic 2017). The influence of the EU on the individual countries is certainly of particular interest from the perspective of projectification. A study in Poland on the influence of the implementation of EU policies through projects and programmes shows that this directly causes changes in organisational structures (e.g. public labour market organisations) at both national and local level (Jalocha 2012).

## THE IMPACT OF PROJECTIFICATION ON SOCIETAL DEVELOPMENT

When we think about the impact that projects have on the societal level, the first thing we have to do is examine the characteristics of projects. Projects are temporary, that is, they are projects that are limited in time, have a specific outcome, and are limited in duration and cost. Projects are mainly used where something new is involved, the development of new products and services, their introduction or organisational changes. The organizational form used for projects is therefore different from the »Business as Usual (BaU)« organization, which is characterized by routine processes.

Projects are typically superimposed on the BaU organization and in a certain way represent a »disturbance« of operational processes. The more the number and importance of projects increases, the more urgent the pressure for change on the conventional organization becomes. If one understands society as a complex, social system, with a multitude of individuals, institutions and other influencing factors, then the question arises how the increasing projectification will impact the development of a society. Rolf Lundin mentions several views on projectification in society (Lundin 2016) that are interrelated and appear in various forms:

- Activities organized in another way will be somehow called and realized as projects;
- Projects are stipulated as a »new work form« and mechanism for change (see the EU-funded projects and programs), forcing the participants to adopt project management regulations, frameworks and practices;
- The context, projects are performed in may be adapted to the needs of projects, including but not limited to Governance, organisational structures and culture;

- Projects may be stipulated as mechanisms for learning from previous projects, using a standard methodology or copying previous behaviours and procedures;
- Delivering projects may be intended to implement strategic goals, piloting new ways of working, developing new strategies and shaping the future for the society through innovation and joint learning, and
- Projects may be simply used for dealing with controversial issues that the permanent organization does not want to deal with.

In order to understand the effects of projectification, it is important to know which stakeholders or institutions are affected and involved by projectification and how the process of projectification contributes to the development of society. Institutional theory offers insights in the way, social activities are structured by formal as well as informal arrangements, e.g. through labour laws and unions in temporary organisations. According to Richard Scott the term »institutions« comprise of regulative, normative, and cultural-cognitive elements that - together with associated activities and resources - provide stability and meaning to social life (Scott 2014). Institutions can be seen as »actors«, interacting in a network of others and influencing the development of society (Michael 2017). During the projectification of society a multitude of institutions may be involved, e.g. governmental bodies, educational institutions and networks of people (e.g. »Fridays for Future«) or organisations (e.g. PM Professional Associations).

They may prescribe the »rule of the game«, or help to assist developing the norms, rules and regulations, they may provide legitimacy, exercise governance or support learning processes. However, involvement of institutions in projectification of society isn't unidirectional. Projectification of society will also influence institutions and may cause them to change. If we further broaden our horizon of the impact institutions might have on the projectification of society, then a number of other contextual factors will institute a considerable influence, such as the historical development path, cultural values, beliefs and traditions (Mutch 2019). Thus, the study of institutional theory brings interesting perspectives to the consideration of the projectification of society in so far as the role of certain institutions and their influence on the projectification can be explored in conjunction with the procedural aspects of the interactions.

One institution is certainly of particular interest in the context of projectification, namely the professional project management associations. These formulate appropriate standards and actively participate in the development of norms and regulations that must be observed during project implementation. They offer standards and services in the field of training and further education in project management and act as networkers to bring experts together and facilitate the exchange of experience. Professional project management associations are advisors to governments at all levels of the social structure and, if required, also take on tasks such as auditing projects or certifying project personnel. In England, the Association of Project Management (APM) was a few years ago awarded »Chartered Profession« status by Her Majesty the Queen. This has given a great deal of attention to the profession of project managers, which is still little established in other countries. What impact this has on the success rate of projects and the development of society, however, still needs to be investigated.

## PROJECTIFICATION IN GERMANY AND THE IMPACT ON SOCIETAL DEVELOPMENT

Project work plays a major role in Germany, especially in the business world, projects are indispensable nowadays. In a much acclaimed scenario analysis in 2007, Deutsche Bank Research highlighted the importance of projects for social and economic development in Germany. The study entitled »Germany 2020 - New challenges for a land on expedition« (DB Research 2007) predicts the following: »The »project economy« will generate 15% of value added in Germany in 2020 (in 2007 it was 2%). »Project economy« stands for mostly temporary, extraordinarily cooperative and often global value-added processes. It is based on the breeding ground of traditional economic activity and mature information technologies. German small and medium-sized enterprises (SME) in particular benefit from it«. Division of labour in the form of projects is not sought on the basis of efficiency gains, but because it allows better response to complex, changing conditions. The SME structure of the German economy seems to be particularly suitable for this form of division of labour. Globally active corporations are expanding their capacities and know-how to include specialized suppliers in order to supply customers worldwide with high-quality products in a short time and at reasonable cost.

The cooperation takes place in projects, i.e. across a large number of legally independent companies. If no consortium is formed for the project, then a central coordinator is needed for the cooperation. The project manager often has this role. In the strongly networked automotive industry, one of the key industries in Germany, project management is becoming network or supply chain management (Hab/Wagner 2016). Clusters focused on specific economic sectors form the breeding ground for cooperation and innovative product solutions. In addition to universities, start-up companies and established suppliers, corporate groups are also represented in clusters. These groups play a key role as promoters of scaling innovation and with their broad market access. State funding, e.g. in the form of financing, tax breaks or stable framework conditions, helps the cooperation to survive in international competition.

A study by the Institute for Employment and Employability (IBE) from 2010 shows that the increasing importance of project work has a major impact on corporations. The study summarizes the findings as follows: »Corporate project management has long been part of everyday life in most companies. Three-quarters of the decision-makers surveyed stated that project management structures are already being used in their company. The mean value shows that around 37 percent of all work processes in corporations are now organized in a project-oriented manner.« (IBE 2010) Projects are used primarily where the development and introduction of new products and services, the introduction of new IT systems or generally the change of existing company structures or cultures are concerned. In administration and production-related areas, on the other hand, relatively little work is still done in project form, where the focus is more on routine and stable processes. The increase in number and importance is changing companies and shifting the focus of operational attention from permanent to temporary organisation (Lang/Wagner 2019).

In macroeconomic terms, the manufacturing industry in Germany, such as the automotive industry or mechanical and plant engineering, plays a prominent role in the country's performance. Project work also gained a foothold in Germany in the 1960s, particularly in the context of the aerospace industry (e.g. Dornier), the automotive industry (e.g. Bosch) or in international plant construction (e.g. Uhde), and gradually spread to other economic sectors. It is therefore not surprising that, according to the GPM study on projectification in Germany, almost 50% of working time in the manufacturing industry is spent on project work (GPM 2015). Only in the construction industry (80%) and in business service providers (60%) the values are higher. In contrast, the area of »Public Service, Education and Health« is rather lagging behind with just over 20% of project work. The sector »Agriculture, Forestry, Fisheries« is even further behind with only 4% of working time in projects.

On the initiative of some large industrial companies, standards for project management were developed as early as the 1960s (Waschek 2014). This work was later continued within the German Institute for Standardization (DIN). Currently, there are two series of standards for the management of projects, the DIN 69901 series of standards for the management of individual projects in five parts and the DIN 69909 series of standards for the management of multiple projects in four parts.

DIN also participates in the development of international (ISO) standards on project management, translates them into German and makes them available to users in the country. There are further standards for project management in specific sectors, e.g. for the construction sector or the development of complex systems on behalf of public authorities. Experts from Germany were also significantly involved in the foundation of IPMA in the mid-1960s and also kicked off GPM at the end of 1970s. GPM aims to actively promote project management in Germany. Important activities are, for example, the networking and exchange of experts from all areas of society, the qualification and certification of project personnel and the support of all persons in the application of the available project management know-how. Through the umbrella organisation of IPMA, GPM also makes the internationally available know-how available for Germany and helps interested German companies to prepare for cooperation with international project partners.

A large number of specialized project management service providers help managers and employees concerned to better meet the increasing challenges of project work through consulting, training and coaching. Such services have recorded above-average growth rates in recent years and now account for a turnover of more than 4 billion euros (BDU 2018). Software firms have also specialised in project management and offer companies tailor-made systems for project handling and the cooperation of distributed supply chains, the planning and control of internal processes in project form, and increasingly also solutions for artificial intelligence in project management (Tiba 2020).

In contrast to Great Britain, however, in Germany there is neither an occupational profile for project managers nor an institution at government level that would take care of the systematic development of project management. Some authorities, cities or even municipalities have set up staff units, a PMO or a specialist department for project management, but different to the economy, project management is only weakly developed in the public sector. It is not by chance that the GPM study on Projectification in Germany shows one of the lowest success rates in this area. Only 65% of the projects achieve the agreed results within the framework of deadlines and costs according to a self-assessment. In terms of stakeholder satisfaction the situation is even worse (GPM 2015). Three major projects prompted the German government in 2013 to convene a Reform Commission to draw up proposals for improving project management. Among the projects considered were Berlin's major airport, the Elbe Philharmonic Hall in Hamburg (»Elbphilharmonie«) and the relocation of Stuttgart's main railway station underground. A brief summary of the main findings is given here: »The complexity of large projects rather requires a competent and efficient builder-owner, intensive planning using digital possibilities, an honest and well-founded handling of time, costs and risks, clear incentives for all parties involved to achieve the same goals and open communication with the citizens. From demand planning to use, a partnership-based cooperation between the building owners, planners, contractors, consultants and users is necessary. In order to make major projects more successful in the future, the Reform Commission therefore calls for a fundamental cultural change in the planning and implementation of major projects.« (BMVI 2015)

On the basis of the recommendations of the Reform Commission, a »Action Plan for Major Projects«, a »Manual for Civil Participation« and a comprehensive »Guide for Major Projects« were developed. All of this is intended to help ensure that major projects in the public domain are planned, organised and implemented in a way that is exemplary and sets an international benchmark. In addition, specific models for the handling of complex projects have been developed in recent years, for example in the form of »Engineering-Procurement-Construction (EPC)« (Ritsche et al 2019) and secured by financing elements of the Kreditanstalt für Wiederaufbau (KfW). KfW offers tailor-made financing solutions for large-scale projects in Germany and for expansions, exports and new projects abroad.

Other fields of application show that project management in Germany can be successful not only in an industrial context. For example, in urban development in Berlin (Wagner 2018) or in overcoming the refugee crisis in 2015, volunteer project managers were able to successfully organize civic involvement in the service of arriving refugees, to professionally support the planning of cities and communities through a »master plan« or to provide concrete help on site using smart IT solutions. GPM regularly awards prizes for outstanding achievements in project management, including, for example, project management for the 2006 Football World Cup or the establishment of the Tsunami Early Warning System in South-East Asia.

That projectification has an impact on both economic and social development is nothing new. However, there are still very few studies that prove the nature of the influence and the actual effect. Henning and Wald have studied the impact of projectification on economic development in Germany by extending standard input-output modeling and analyzing the static and dynamic effects of projectification. The results indicate that projectification can have positive macroeconomic implications for innovativeness, employment and income that differ across economic sectors. However, projectification may also result in negative impacts. »For agriculture, increasing projectification reduces innovativeness, which leads to less employment and a decrease in income. Therefore, increasing use of projects as a temporary form of organizing cannot be recommended without reproach, and a 'wiser' form of projectification, i.e. an optimal mix of project and non-project work, must be found.« (Henning/Wald 2019)

The increasing number and importance of project work in Germany (and many other countries as well) means that people and a large number of institutions have to deal with the new requirements and find new solutions. Through research in the field of project management by GPM and many researchers and research institutions, the understanding of project work and the corresponding need for action is increasing. These needs for action mean changes for people, organisations and institutions in Germany. The former can be prepared for these challenges by specialized service providers in the form of qualification and certification. For example, GPM in Germany qualifies and certifies more than 5000 people in its competence model every year. This helps on the one hand to complete projects more successfully and on the other hand to prepare people for the future.

Organisations and institutions are also facing change. Increasing projectification is challenging traditional approaches, organizational structures and processes, and culture. Specialized service providers help these organizations to successfully manage this change on the basis of proven standards and norms and to prepare themselves for project work in a future-proof manner. Projects are also used at the macro level of society in Germany to address challenges such as the refugee crisis. This requires cooperation at all levels, i.e. as became clear in 2015, from civic involvement to voluntary work by associations and the professional work of state institutions.

As shown above, projectification can also lead to more innovation, employment and growth. However, the exact impact of project work on economic and social development requires significantly more research work in order to understand the demands on all participants and to translate them into concrete measures. This also includes the analysis of the negative side effects of projectification. What are the consequences of project work on the working time of employees? What does temporary employment in projects mean for the so far rather permanent employment in companies? How are people involved in the decision to select and prioritize projects at the societal level? What scope of action do project participants have and are they able to deal with it in a meaningful way? Many open questions that arise in the context of projectification. This offers the opportunity to find answers collectively within the framework of research initiatives such as the international research programme »Capabilities for delivering projects in the context of societal development (CaProSoc)« initiated by the Alma Mater Europaea (Wagner 2020).

## CONCLUSION

Project work and project management have gained significantly in importance for our society in recent years. Not only in the economy, but also in the public service and in many other areas of our society, projects have become part of everyday life. These changes, also known as »projectification«, have a significant impact on everyone involved, from the micro to the macro level of society. Although number and importance of projects in the context of society continues to increase, there is still relatively little research on the impact of this development on the society and its development. Indeed, the spread of the project-based form of work not only leads to changes in forms of organisation, but also to changes at the societal level, including the institutions concerned. This article deals with the developments in Germany as an example. The findings are therefore not directly transferable to other countries or as general developments. Since there are relatively few studies on project work at the societal level, the findings presented here are certainly not complete and require further, in-depth research. This is precisely the aim of further studies by the author and an international research programme initiated by the Alma Mater Europaea.

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## **POVEZAVA MED ZADOVOLJSTVOM Z DELOM IN MOTIVACIJSKIMI DEJAVNIKI ZA POVEČANJE PRODUKTIVNOSTI V PROJEKTNEM IT PODJETJU THE LINK BETWEEN JOB SATISFACTION AND MOTIVATIONAL FACTORS WITH INCREASING PRODUCTIVITY IN PROJECT IT COMPANY**

### **POVZETEK**

Članek zajema študijo, katere cilj je bil raziskovanje vpliva zadovoljstva zaposlenih in njihovih motivacijskih dejavnikov na povečanje produktivnosti podjetja. Pojasnjeno je, kako zadovoljstvo in posamezni motivacijski dejavniki vplivajo na zaposlene in kako se to odraža pri njihovem delu. Predstavljene so tudi ustrezne teorije zadovoljstva in motivacije ter razlaga posledičnega vpliva na izvajanje tovrstnih praks in njihove učinkovitosti kot primer strategije za povečanje produktivnosti podjetja. Glede na današnje zelo konkurenčno okolje je pomembna osredotočenost na dejavnike, ki zaposlene spodbujajo, saj gre za osnovo, ki je pomembna za napredek podjetja.

V izvedeni študiji smo s pomočjo empirične raziskave razvili konceptualni model, ki zajema strategije za povečanje zadovoljstva in motivacije zaposlenih. Preizkus delovanja tega konceptualnega modela je opravljen v podjetju FlawlessCode. Konceptualni model je bil razvit s pomočjo študije teoretičnih ugotovitev na obravnavanem področju, predvsem pa na podlagi rezultatov pridobljenih s pomočjo analize anketnega vprašalnika in intervjujev, s pomočjo katerih je bil pridobljen vzorec, ki je razkril številne pomembne dejavnike. Anketni vprašalnik je zajemal vprašanja, ki smo jih sestavili tako s pomočjo ugotovljenih teoretičnih izhodišč obravnavanega področja, kot s pomočjo praktičnih izkušenj, ki izhajajo iz delovne prakse analiziranega podjetja. Končni model, ki smo ga preizkusili v praksi smo oplemenitili tudi z lastnimi kreativnimi idejami, ki izhajajo iz delovnih izkušenj na področju zadovoljstva zaposlenih v podjetju ter tudi iz motivacijskih strategij, ki smo jih v analiziranem podjetju že uporabljali in preizkušali.

Analiza področja, pridobljeni podatki in razvit konceptualni model pomembno prispevajo k znanosti, saj spodbujajo dvig stopnje zadovoljstva zaposlenih na delovnem mestu, uporabo motivacijskih strategij ter možnost uporabe modela za povečanje produktivnosti tudi v drugih podjetjih. Ugotovitve so sicer specifično namenjene segmentu trga na IT področju, vendar pa omogočajo osnovni model, ki ga je mogoče nadaljnjo preizkušati, preučevati ter stabilizirati tudi za druga področja.

**Ključne besede:** zadovoljstvo zaposlenih, dejavniki zadovoljstva, motivacijski dejavniki, produktivnost, konceptualni model

## ABSTRACT

*The article includes a study aimed at researching the impact of employee satisfaction and their motivational factors on increasing company productivity. It is explained how satisfaction and individual motivational factors affect employees and how this is reflected in their work. Relevant theories of satisfaction and motivation are also presented, as well as an explanation of the consequent impact on the implementation of such practices and their effectiveness as an example of a strategy to increase company productivity. Given today's highly competitive environment, it is important to focus on the factors that motivate employees, as this is the foundation that is important for a company's progress.*

*In the conducted study, with the help of empirical research, we developed a conceptual model that includes strategies to increase employee satisfaction and motivation. A test of the operation of this conceptual model was performed at FlawlessCode. The conceptual model was developed through the study of theoretical findings in the field, and especially based on the results obtained through the analysis of the questionnaire and interviews, which provided a sample that revealed a number of important factors. The questionnaire included questions that were compiled both with the help of the established theoretical starting points of the considered area, as well as with the help of practical experience arising from the work practice of the analyzed company. The final model, which we tested in practice, was also enriched with our own creative ideas, which derive from work experience in the field of employee satisfaction in the company, as well as from motivational strategies that we have already used and tested in the analyzed company.*

*The analysis of the field, the obtained data and the developed conceptual model make an important contribution to science, as they encourage an increase in employee satisfaction in the workplace, the use of motivational strategies and the possibility of using the model to increase productivity in other companies. The findings are specifically intended for the market segment in the IT field, but they enable a basic model that can be further tested, studied and stabilized for other areas as well.*

**Key words:** *employee satisfaction, satisfaction factors, motivational factors, productivity, conceptual model*

## 1 INTRODUCTION

It is often assumed that the only way to motivate employees is to offer them more money. The problem arises when, say, such a way of motivation is not even possible. This is also the case in the company we analyzed. The company is engaged in the field of software project development, and the payment depends on the size, type and complexity of the project. This means that some projects are more profitable than others, which of course also has a financial impact on employee pay. This raises one of the key questions, namely how to maintain the high productivity of an employee who performs work on less profitable projects? Among other questions we asked ourselves in the study is how to maintain but then increase employee satisfaction, what motivational factors we can use to help increase productivity in the company. According to the field of the analyzed company, we asked the main and specific question in the research, namely: What are the factors of employee satisfaction and motivational factors that will help increase productivity in a software development company in Slovenia?

The study also focused on analyzing individual factors in employee jobs and their impact on employee motivation and satisfaction. In this way, we determined whether employees are focused more on financial rewards, more on material goods in the implementation of the project or more on the skills and experience that the implementation of an individual project brings them. Past studies have already shown that one of the key elements is employee engagement (Menon 2015, 6) and that there is a strong link between job satisfaction and performance (Bakotić 2016, 126), which in turn affects company productivity. There is also practical evidence that greater employee engagement increases overall performance, creates a more productive environment, and ultimately increases overall company productivity. Nevertheless, employers still face the challenge of how to determine what employee engagement actually represents, what are the values that contribute to satisfaction, as there are countless theories that ultimately do not define these factors quite clearly (Saks and Gruman 2014, 157).

The theories that define motivation and its strategies actually explain what attitude an employee has toward their work. At the same time, they try to show or give us an understanding of why an individual behaves in a certain way, why he does his job as he does and what motivating factors determine how he will do his job. Given that there is no human activity that is not somehow encouraged and motivated, the main goal of motivational theories is to explain the decisions of the individual that they will make based on different possibilities of action (Červ 2012, 33). Some authors, such as Ahmed (2011, 94), however, define that the concept of motivation in the workplace is difficult to define because it is too complex. He thus defines motivation only as a concept that has the characteristics of an individual and a given situation, and the perceptibility of that situation by that individual. He also explains that motivation significantly influences the character traits of an individual, as it interacts with other cognitive processes. The importance of motivational factors is also expressed by Verle and Markič (2010, 143), who in the findings of their research emphasize that the company can achieve success and efficiency only with the help of motivated employees who see their work as an opportunity for further development, their superiors to see someone who knows how to listen to them and encourage them.

Theoretical starting points as motivating factors thus highlight mainly: employees' trust in management; care for the needs of employees; employee involvement and independence; understanding employees what is expected of them; the opportunity to gain additional skills and the opportunity to advance; employee pride in the success of the company; self-confidence of employees in performing their work; team well-being and understanding among co-workers; the company's efforts to understand, consider and further train employees; management relationship with employees, etc. (Bin Shmailan 2016, 4). According to the theory, employees must be motivated enough to focus on the implementation of the project and to recognize the positive aspects of the process, but it is completely human that employees are also focused on other aspects and benefits of implementation individual project.

With our study, we also focused on the possibilities of influencing the thinking of employees through appropriate incentives that relate not only to financial profitability but also to the fact that employees look at projects from a positive perspective, that they enjoy their work, that we reward them, with small but significant rewards that consequently also help reduce their stress in the workplace.

The study in the first part presents the evaluation of the research problem by summarizing the key theoretical findings of the studied field. Scientific theories are presented, as well as the already studied methods and motivational strategies on the basis of which certain assumptions were used, which we used in the case of our research. In the second part, the empirical research, the analysis of the results obtained with the help of a questionnaire completed by 100 respondents of employees in individual companies in the research area and the results of interviews of 20 employees (5 employees in different IT companies) is presented. The analysis is followed by a presentation of the conceptual model, which was developed on the basis of the obtained sample of results, on the basis of theoretical findings and on the basis of practical knowledge and creativity arising from management in the selected company. The conceptual model represents a basic model that offers the possibility of taking into account the above strategies and motivational factors as an approach to increase employee satisfaction and increase company productivity. The model is specifically focused on the IT field, and its strategy is based on the need and knowledge of the analyzed company FlawlessCode, where it was also tested for the purpose of obtaining practical results.

### 1.1 Purpose and goals

The purpose of the study was to investigate or actually find factors that bring satisfaction and motivation to employees and at the same time directly affect the increase in productivity in the IT company. By performing a practical analysis of the developed conceptual model in the selected IT company, the issues of the field were also evaluated and verified. The objectives of the study in the research area were focused on:

- Acquiring findings or increasing employee satisfaction in an IT company by introducing certain strategies in general has a significant impact on increasing productivity in the company.
- Obtaining findings on the level of employee satisfaction in the selected IT company and whether we were able to increase it by using a conceptual model and whether employees are consequently more productive as a result.
- Determining the priority factors motivating employees to carry out projects in the studied company, whether it is the acquisition of knowledge and skills and the desire to implement and complete projects or whether it is more about obtaining a certain financial income that employees receive after the project.
- Determining the degree of influence of selected factors on employee satisfaction and the degree of influence of motivational strategies used in an IT company, thus determining which are the factors that determine differences in the level of satisfaction and those that motivate employees the most.
- Preparation and development of a conceptual model, which we also developed with the help of the results obtained through the answers of participating respondents and contains strategies that define how to increase employee satisfaction in an IT company and how to better motivate them to increase productivity in company.
- Testing of the developed conceptual model in the analyzed company, with which we managed to obtain practical and definitive findings of the possibility of successful use of the developed model for IT companies.

In the study, we sought an answer to the main research question of the analyzed company: How to motivate employees participating in a less profitable project to remain highly productive? We also tested the argumentation of previously set hypotheses, which included:

H1: Employee satisfaction, which will consequently affect the company's higher productivity in the IT environment, derives mainly from the non-financial reward system.

H2: The most important motivating factors in an IT company relate to the employee's sense of importance to the company.

H3: Concern for the mental and physical well-being of employees in an IT company has a concrete impact on higher motivation and job satisfaction.

H4: Providing continuous training in the IT field more engages the employee to focus on the quality of work performed in an individual project.

## 1.2 Methods

In the theoretical part of the study, a comparative method was used to compare similar facts and processes in the field of employee satisfaction, the use of motivational strategies and the impact on increasing productivity. We identified different approaches and listed their similarities and differences. Using the compilation method, we reviewed and summarized the results of relevant publications of foreign scientific research. Modern ICT tools (semantics, web) were used, with the help of which we semantically analyzed the used contributions. Data for the theoretical part were also obtained through online research by using related terms to form sets of important terms, which were then used to review the literature and analyze it. Contributions on research related to our field of research were obtained with the help of bibliometric networks, which contained newspapers, research and individual publications of foreign scientific articles. The analysis of important terms was performed and presented with the help of the software tool VOSviewer, which is specially developed for the analysis and visualization of bibliometric networks. The relevant literature used, which was thoroughly analyzed in the theoretical part, was used to upgrade the empirical part of our research.

In the empirical part of our study, we used quantitative research conducted using the survey method and the interview method. Both methods used or the questions they contained were compiled with the help of established and established theoretical starting points and on the basis of work experience in the selected company. The purpose of our research was to obtain data or results with the help of which we were able to further develop a conceptual model, which we then analyzed in practice. We also used our creative ideas for questions, which we acquired in the field of employee satisfaction in managing a selected company and on the basis of motivational strategies that we have already managed to use in the company. We were also helped by data from already established quality guidelines and targeted data that corresponded to our research goals.

In obtaining the results, we were interested in, among other things, which are the factors that are most important for employees and, on the other hand, which are the factors with which employees are not the most satisfied and the correlation between individual factors. The results obtained with the help of a questionnaire and conducted interviews were processed with the help of the statistical program for data processing SPSS, presented in tabular or graphical form and evaluated in more detail.

The survey method contained a survey questionnaire answered by 100 respondents employed in various companies engaged in the IT field. The main part of the questionnaire covered four categories, which covered aspects of satisfaction, motivational factors, workplace relationships and productivity. Individual claims related to employee engagement, psychological approach, when employees recognize the positive effect that motivates them to become or remain more connected to the company, the impact of benefits that employees gain from their work (financial and non-financial) and selected components that respondents had to assess in terms of how important they were to them. The questions in each category were designed in such a way that the respondents had to evaluate or define the stated statements according to their importance for them or to classify them according to their importance.

In these four categories, we opted for the type of question where respondents had to give a grade defined by the 5-point Likert scale in response to the above statements, as we considered that with closed question types where only answers are given, only by selecting only -they would not get enough accurate results. Namely, in such a case, the respondents would only choose one of the answers, which would fail to determine how important this factor is for the respondent. The Likert scale was defined according to the type of statements it covered, as follows:

- In the case of the category of questions on employee satisfaction, we included four individual sets of statements that respondents had to evaluate. As part of the first allegations, these related to aspects of satisfaction that respondents had to assess with one of the above assessments, where on the one hand it was assessed that the respondent was very dissatisfied with this aspect, and on the other hand the assessment that the respondent is very satisfied with this aspect. In the case of the next three sets, which related to job satisfaction, financial satisfaction and working time satisfaction, the respondents had to choose between assessments, which on the one hand were defined as an assessment that the respondent did not agree with the statement at all. others that the respondent fully agrees with this statement. In the case of a category of questions

related to expectations in the workplace, respondents had to choose one of the five assessments for each statement, which was defined on one extreme page as an assessment where the respondent expressed that he was very satisfied with the above, on the other hand, an assessment where the respondent expresses that he is not satisfied with the above at all.

- In the case of the category of questions regarding motivational factors, we ranked three sets. As part of the statements about the influence of motivational factors on work, the respondents had to evaluate these statements by choosing an assessment, which was defined on the one hand as disagree at all and on the other as a completely agree. The second set included 6 motivating factors: salary, additional financial benefits, additional non-financial benefits, shorter working day on Friday, the possibility of working from home and benefits at work (tea, juice, fruit, healthy snacks), which respondents had to classify according to their importance, where the number 1 represented the factor that the individual respondent perceives as the most important for him, and the number 6 represented the factor that the individual respondent perceives as the least important for him. The third set in this category referred to claims about the importance of motivational factors for the job, where respondents had to assess these claims by choosing a grade that was defined as disagree at all on the one hand and strongly agree on the other as a grade.
- In the case of the category on workplace relationships, one set of statements concerning workplace relationships was identified, which respondents had to assess by choosing an assessment that was defined at one extreme as disagreeing and on the other as an assessment I totally agree.
- In the case of the productivity category, one set of arguments was identified relating to the assessment of productivity in the company, which respondents had to assess by choosing an assessment that was defined on the one hand as disagree at all and on the other as assessment I totally agree.

In the category that represented an additional part of the questionnaire, the questions referred to the definition of demographic data, namely: gender, age, length of service in the company, type of employment and type of education. In the analysis, we also linked demographic data with satisfaction and motivation, as we wanted to obtain data on the connection between individual demographic data and the research area. Thus, we also determined the connection between satisfaction and age structure in order to determine in which age structure we have the most satisfied and motivated employees and whether the increase in age structure increases or decreases satisfaction. We also examined the correlation with the factors favored by a particular structure, so is the younger age structure more focused on the financial benefits of their work, while the older one values other benefits of the job higher when doing the job? This created a profile of employee competencies in IT companies, which allows us to see the highest profile of the employee, in the case of the employee who is most satisfied with his job and who can directly and indirectly contribute to increasing productivity in the company.

In the empirical research, we also added to the results of the questionnaire the data obtained with the help of 20 interviews of employees in individual IT companies (5 interviews per company).

## 2 DISCUSSION

The essence of any successful company is therefore the relationship between motivation and job satisfaction, but we must clearly define an individual concept, as these are related concepts, which, however, cannot be equated. Job satisfaction is only one part of the motivational process. While motivation is primarily concerned with goal-oriented behavior and job satisfaction in connection with fulfillment, which is obtained through various benefits at work or work activities. Namely, there is a possibility that the employee is satisfied with his work, but his motivation is low and vice versa, that the employee is highly motivated but dissatisfied with his work. Although some authors argue that a highly motivated employee who contributes to achieving company results is also generally satisfied with his or her work (Ahmed 2011, 95).

Basically, all the findings and claims come from needs theory, which explains the factors that make individuals work better and more. Two such basic theories are Maslow's theory of the hierarchy of needs and Herzberg's theory of two factors. In his theory, Maslow identified five basic needs of individuals, namely: physiological, security, belonging, self-confidence, and self-actualization. Herzberg's two-factor theory is based on factors that motivate employees and on factors that sa-

tisfy or motivate employees or do not satisfy and motivate them. In the conducted experiments, they found that the factors that do not motivate employees include labor policy, salary, administration, working conditions, relationships with superiors, etc. Factors that motivate employees and encourage them to work more include achievement, visibility, work itself and demanding tasks (Ahmed 2011, 95).

Previous studies and research have shown that companies like to use different motivational strategies for employee satisfaction, such as: pay-per-effect, profit sharing, co-ownership, knowledge rewards, flexible working hours or various other material rewards (travel, tickets for sporting events, etc.). At the same time, numerous researches have shown that employees are most motivated by their success and personal choice of how to perform the task, while they can use their creativity (Verle and Markič 2010, 137). Daft (2010, 338) also states in its findings that the factors for increasing motivation do not refer only to financial or other material rewards, but to raising the self-confidence of employees and enabling them to feel important to the company. As Yukl (2013, 8) explains, the possibility of participating in decision-making, expressing one's opinion and views, and thus creating a sense of importance and the possibility that employees can also influence the achievement of company goals, has a great influence on job satisfaction and motivation.

The analysis of job satisfaction in the case of the researched company, performed by Verle and Markič (2010, 147), is showed that employee dissatisfaction stems mainly from poor communication with superiors and poor information of employees by superiors, basically from dissatisfaction with the organization of the company. In this case, too, the employees did not pay more attention to financial work, but to the values related to cooperation, communication and flexibility at work.

In the case of our study, we proceeded from theoretical findings, recent research and modern approaches, on the basis of which our hypotheses were also set.

*Hypothesis H1: Employee satisfaction, which will consequently affect the company's higher productivity in the IT environment, stems mainly from the non-financial reward system, we proceeded from the point of view that in the case of an IT company it is a rather demanding field of work the final payment of the employee is also appropriate. The realization we have substantiated is also that it is necessary to offer the employee a sufficiently good and fair payment, which enables him financial stability without the employees having to worry about money. In the case of pay that meets only the basic legal criteria, the company primarily saves on employee costs, but such a principle is very questionable in terms of, as the employee will be able to meet greater financial needs sooner or later in their lives. Poor financial security can actually even force an employee to try to make better use of their skills and knowledge in a competitive company. However, it is enough to provide only adequate pay according to the required skills of the employee, as many studies have shown that despite first thinking about the financial aspect of the job, high-paid employees are not necessarily satisfied with their work or not, motivates to such an extent that it would have an impact on the results and success of the company. Nowadays, employees have been shown to set other priorities for job satisfaction and motivation much higher than just focusing on the level of salary. In our research, we examined the importance of the financial and non-financial reward system and other benefits that the company would offer to employees, based on which we were able to enter into the conceptual model approaches for which we already had results to be well accepted by employees.*

*With hypothesis H2: The most important motivating factors in an IT company relate to the sense of importance of the employee for the company, we proceeded from the findings on the importance of factors that enable employees to strengthen their self-confidence and abilities. If the company allows employees to give their opinion, express their wishes, it also supports their creativity, which they might not otherwise express. Employees thus feel more connected to the company, they care about different aspects of the company, such as. achieved goals, increase the success of the company, satisfied customers, higher productivity, which means that they will also ensure the correct direction of the company's costs and care for certain costs (will not unnecessarily overspend administrative material, just because the company will lack take care of stocks, they will also take care of unnecessary uses of energy sources, such as excessive consumption of electricity when they do not need it or in a place where they do not need it at the moment, etc.), as they will take the company*



more for their own. Regarding the environment in the company, they will be aware that it is an environment in which they spend a good part of their lives and therefore represents an important aspect in their lives, so they will make sure that it is a positive environment where they feel good, safe and comfortable.

With hypothesis H3: *Concern for the mental and physical well-being of employees in an IT company concretely affects higher motivation and job satisfaction*, we proceeded from the findings of how important it is to care for the well-being of employees in the IT field. This is a type of work where employees spend most of their time sitting, and their arms and legs are in repetitive positions, which is required by the nature of their work. Lack of movement and activity in employees leads to a decrease in motivation, so in the analyzed company already takes care of intermediate training to keep employees slightly active and to provide healthy snacks at the table, so that during the work of employees there is not too much energy drop to eat and unhealthy snacks, which in turn leads to drowsiness and lack of motivation to continue working. In order for employees to remain in long-term form, it is necessary for the company to take care of, for leisure activities outside working hours, any organization of relaxation or sports activities in nature (such as a trip or sports activity organized by the company). However, in such a case, these are only occasional activities, as employees value their personal free time very much. However, for better mental and physical well-being of employees, for whom this type of work poses a greater risk for the musculoskeletal system and vision problems and high stress, the company can provide co-financing for activities that employees would choose: a course or training, attending a yoga class, attending meditations or other ways of relaxation, attending massage parlors, etc.

Hypothesis H4: *Providing continuous training in the IT field more engages the employee to focus on quality work performed in an individual project*, we assumed that this is an area of operation that is constantly changing, as the main tool or necessary technological equipment is constantly evolving. Advances in technology also bring new approaches and new software tools that require additional training. If the company ensures that it constantly encourages employees to further education, it ensures the dissemination of employees' knowledge, as well as the expansion of its sales channels and the improvement of the quality of service provision. One of the innovative approaches is that the company provides the employee with a budget of a certain amount, which an individual employee can use independently and decide on his own initiative which course in his field he will take or what additional knowledge he wants to acquire in his field. At the same time, it is ensured that employees in their field are always aware of the latest developments in their field, while the company allows employees to independently decide when and how to use the benefit, which increases their awareness of trust in the company and consequently greater employee loyalty to company. At the same time, it is of course necessary to ensure that most of the acquired new knowledge and skills are completed within the required working hours, as employees will not have adequate motivation if they have to do demanding work first and then spend extra time on training. It is also about the nature of work, which sometimes requires a greater presence at work, which could convince a long-term employee not to take extra personal time, even if he would dedicate it to disseminating knowledge. For the company, this does not bring additional costs, as on the other hand it is a big gain, employees become more motivated by upgrading their knowledge and transfer new knowledge to the implementation of projects. Giving creative opinions about a new approach or new methods, shorter implementation of a certain project that will achieve the same or even higher quality contributes a lot to the ever-increasing success of the company and, consequently, to higher productivity.

### 3 CONCLUSION

Management in IT companies would certainly agree that today, due to the rapid development of technologies and ever new market demands, requires much greater efficiency and productivity than ever before. Companies strive to increase performance by trying to handle a number of challenges that allow them to make their business more successful than a competing company. Today, we are helped by a number of techniques developed by researchers and scientists, as well as a number of concepts that can contribute to better ways to help a company on its way to success in various fields. Already at the beginning of the second half of the 20th century, many authors have come to a number of findings in the area of contributing benefits in increasing organizational performance.

With their work and findings, they contributed a lot to the improvement of business processes in the company and the company's operations. Even today, many of these concepts, tools, models, and strategies are used to plan, implement, and monitor desired changes in the quality of leadership in a company. However, the need to ensure employee satisfaction and motivation is changing or the field requires more and more approaches with new and innovative ideas.

Thanks to increasingly advanced technology, companies today are able to use newer and more advanced operating techniques. However, technology is also constantly evolving, which also poses certain challenges for business management. Thus, we can be sure that today it is difficult for companies to implement only traditional management systems or use only techniques that were developed decades ago. Therefore, it is important and will be even more important for companies to resort to new approaches and keep employees who are satisfied with their work, who are highly motivated and, of course, also professionally and technically well trained.

Management needs to pay more and more attention to employees as employees increasingly expect a higher degree of independence and autonomy in the workplace. Based on research and reviewed studies, and based on our research, we can therefore assume that companies will have to adapt to new job requirements if they want to become successful, which can only be achieved with employees who are satisfied with their job and motivated, to stay or become highly productive. These new requirements relate primarily to such an organizational form that allows employees greater connectivity, cooperation, additional education and training, and at the same time a sense of belonging to the company and importance for the success of the company, which employees must provide their superiors.

We also found that to date we do not know of a generally accepted definition of employee satisfaction in the workplace, probably also because the principles have been changing more and more in recent years. Increasingly, we find consensus and connections between different authors regarding different concepts of corporate governance and the inclusion of new principles to enable employee satisfaction in their work and the assertion of motivational factors that lead to concrete results. In fact, we are also seeing more and more new research in this area, which has already developed some clear and acceptable new concepts and strategies in recent years. Research to date has shown that two-way communication is among the most important, so communication between management and employees and management's interest in the mental and physical well-being of employees. Studies also show that employees pay less and less attention to financial rewards or the amount of pay for work. However, it should be noted that these are studies that have examined the cases of companies located in countries with a better economic situation. The question that can be asked here is how the correlation between job satisfaction and financial importance would be reflected in third world countries. There are also still some unexplored influences between individual factors, such as the efficiency of the employee's work and the provision of benefits for the employee that affect his working atmosphere (meal offer, parking space, etc.), which we tried to explore in part presented in the research.

Given the complexity of the field, we decided on a specification in the field of researching employee satisfaction and motivational factors, which led us to create a model to increase productivity in the selected IT company. The obtained results and data represent the opinions of employees in the IT segment, which means that they are intended primarily for this market segment, which is covered by the selected company, but nevertheless represent the basis for further development of the conceptual model for other markets.

The contribution of our science study was to obtain data on the basis of which we compiled a conceptual model that can be used as a strategically oriented model to increase employee satisfaction, which also includes the identification of important motivational factors and is useful in IT. This added our contribution to further research in this area. We contributed to the deepening of theoretical and empirical knowledge in the field of learning to obtain new information to link employee satisfaction and motivational factors, which in turn affect productivity, which today is an extremely important knowledge for many companies. With this contribution, we also helped organizations and companies in their development of a conceptual model for employee satisfaction in conjunction with higher productivity. The developed conceptual model was tested in a selected company, but it can also be used in other IT companies or it can be studied, upgraded and further tested and stabilized for other areas.

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# **DIGITALNE TEHNOLOGIJE**



## **NAGOVOR VODJE ŠTUDIJSKIH PROGRAMOV SPLETNIH TEHNOLOGIJ IN ZNANOSTI**

Sprememba, ki jih je v vsakdanje življenje v minulih dveh desetletjih prinesel splet, je za sabo potegnila neslutene posledice razvoja družbe. Še več. Z razvojem novih paradigem umetne inteligence in velikih podatkov je civilizacija prvič pred novimi možnostmi, ki spreminjajo filozofsko misel in pogled na človeka z vidika zunanjega opazovalca, kar nikoli prej v zgodovini ni bil mogoče. S tem so povezane tudi nastajajoče spremembe v izobraževanju, spremembe pri razvoju novih digitalnih storitev, ki spreminjajo načine komuniciranja in dela v tako imenovani digitalni transformaciji. V zborniku pred vami so predstavljeni nekateri znanstveni prispevki, ki umeščajo področje informacijskih tehnologij v vlogi digitalne transformacije ter z njimi povezanih novih tehnologij na različnih področjih njihovega vpliva ter tudi nekateri prispevki s pogledom premagovanja posledic okrevanja gospodarstva pri COVID-19, ki jih prinašajo digitalne tehnologije.

izr. prof. dr. Matej Mertik





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## **PATENTNA ZAŠČITA MEDICINSKEGA PRIPOMOČKA ZA POSAMEZNEGA UPORABNIKA, NAMEŠČENEGA NA TELO**

### **POVZETEK**

*V prispevku je predstavljeno področje patentne zaščite medicinskega pripomočka, nameščenega na telo uporabnika, predvsem s področij ortotike in protetike udov. Namen raziskave je prispevati k razvoju kakovosti patentne zaščite s pomočjo evropskega patenta na tem področju.*

*Patenti so pomemben del intelektualne lastnine, saj spodbujajo tehnično ustvarjalnost, obenem pa lahko predstavljajo določena tveganja pri standardizaciji in dostopnosti uporabnikom. Če želi posameznik ali pravna oseba zaščititi svoj izum, ga registrirati kot patent, ima na voljo več možnosti. Pri tem mora vedeti, katera je bolj smiselna in hkrati finančno sprejemljiva. Prva možnost je pridobitev nacionalnih patentov za posamezno državo. Drugi način je mednarodna pot na podlagi Pogodbe o sodelovanju na področju patentov (PCT). Tretja možnost je pridobitev evropskega patenta po Evropski patentni konvenciji (EPC) za eno ali več evropskih držav. Poleg naštetih osnovnih poti so možne tudi različne njihove kombinacije.*

*V prispevku analiziramo potrebe trga, strukturo vrst patentiranih medicinskih pripomočkov, strukturo prijaviteljev patentov na preiskovanem področju, ter njihovo geografsko razporejenost. Ugotavljamo, da se največ patentnih prijav nanaša na serijsko izdelane pripomočke oziroma sestavne dele, sledijo jim metode. Med prijavitelji prevladujejo posamezne korporacije, predvsem Otto Bock in Ossur, med državami prijaviteljicami pa ZDA, Kitajska in Nemčija. Vzrok takšne strukture so visoki stroški in zahtevnost priprave prijave patenta.*

*Analiziramo tudi prijavo patenta medicinskega pripomočka za posameznega uporabnika po Evropski patentni konvenciji, vključno s postopkom, stroški in posebnostmi. Ugotavljamo, da je patent sicer primerna možnost za zaščito intelektualne lastnine na področju razvoja pripomočkov za posameznega uporabnika, vendar ima ta možnost veliko pomanjklivosti, predvsem v smislu specifičnosti, stroškov in težavnosti kasnejšega uveljavljanja pravic iz patentnega varstva.*

**KLJUČNE BESEDE:** intelektualna lastnina, izum, patent, Evropska patentna konvencija, medicinski pripomočki

## 1 UVOD

Vsakemu bolniku se z nastankom bolezni ali funkcionalne oviranosti življenje v zelo kratkem času popolnoma spremeni. Sprejeti mora nov način življenja in uporabo pomagala in vsakdanu, še posebno v primeru gibalne oviranosti. Takega bolnika glede na področje motoričnih izpadov spremljajo motorične in senzorične okvare, in ne nazadnje tudi psihološki dejavniki. Nekatera bolezenska stanja zahtevajo specifično obliko zdravljenja. Da bi izboljšali kakovost življenja oziroma pripomogli k zdravljenju, si v današnjem času lahko pomagamo z medicinskimi pripomočki, izdelanimi za posameznika, ki jim velikokrat rečemo tudi ortopedski pripomočki. Izdelava in s tem ponudba medicinskih pripomočkov, ki so nameščeni na telo predvsem gre za ortoze in proteze za ude (v nadaljevanju O&P), je v Republiki Sloveniji regulirana, zato je proizvajalcev malo. Plačnik tovrstnih pripomočkov je v veliki meri Zavod za zdravstveno zavarovanje Slovenije. Po odločitvi oziroma izboru, kateri izdelek razvijati, je treba najprej izdelati analizo trga. Natančna analiza trga bo pokazala, kje nas čakajo pasti, ki jih moramo zaobiti, da bo izdelek uspešno zadovoljeval potrebe kupcev in zahteve stroke. Poleg poznavanja zahtev in potreb kupcev je treba pri načrtovanju novega pripomočka natančno poznati konkurenčne proizvode, njihove slabosti odpraviti in tako ustvariti popolnoma nov proizvod, ki bo dejansko zadovoljeval potrebe uporabnikov. Za doseganje dolgoročne konkurenčne prednosti je treba proizvod zaščititi. V okviru tega je na voljo institut patentne zaščite s katerim se zavaruje izum. Zakon o industrijski lastnini (ZIL-1D) v 18. členu imetniku patenta, ki mu ga na podlagi utemeljene zahteve, opisa izuma in dovoljenja za objavo pisno potrdi ustrezna državna ustanova, zagotavlja ekskluzivno prepovedno pravico izdelave, prodaje, uporabe izdelka ali postopka s strani tretje osebe brez njegovega soglasja, s tem pa omogoča veliko ekonomsko moč. Podjetjem v določenih primerih predstavlja pomembno konkurenčno prednost (Pretnar 2011). Patenti so gonilna sila za spodbujanje rasti, inovacij in konkurenčnosti (Langinier in Moschini, 2002, str. 5). S tem, da ima imetnik patenta izključne pravice za njegovo izkoriščanje, patent ustvarja nekakšen monopol, kar lahko poraja razmere, ki imajo negativen vpliv na učinkovito uporabo novih znanj (Langinier in Moschini, 2002, str. 7–10).

Predmet patentnega varstva ne morejo biti odkritja, znanstvene teorije, matematične metode, pravila, računalniški programi (razen če rešijo tehnični problem), načrti, metode in postopki za duhovno aktivnost, ker ne štejejo za izume, ter izumi na področju kirurškega in diagnostičnega postopka ali postopka zdravljenja, ki se uporablja na živem človeškem ali živalskem telesu. Prav tako »se ne da zavarovati izuma, katerega uporaba je v nasprotju z javnim redom in moralo« (Jolly in Philpott, 2009; Malešević, 2007).

Ljudje so skozi zgodovino svoje naloge in zadolžitve vedno želeli opravljati čim lažje, ceneje in čim bolj učinkovito. Zato so iskali načine za izboljšanje tehnik in orodja, posledično pa izumljali nove predmete in metode.

Prve ideje o zaščiti znanja, tudi izumov, so se utrile že zgodaj, saj obstajajo pisni viri iz 4. st. pr. n. št. o razpravah Aristotela in Hipodamusa (Berce 1998, 20). Prvo zaščito s patentom zasledimo v Italiji, v Benetkah, v 11. st., ko so rokodelci lahko izvažali svoje izdelke, vendar niso smeli izdati svojega védenja o postopku izdelave. V 13. st. je bila podeljena državna patentna zaščita, v 15. st. pa se je začela izvajati. Leta 1474 je Beneška republika sprejela akt znan kot *Parte Veneziana*, ki velja za prvi dokument v strokovni literaturi. Vseboval je večino načel, ki jih bolj ali manj še danes vsebujejo patentni zakoni povsod po svetu« (Pretnar 2020, 6).

Tekom zgodovine se je patentno varstvo razvijalo, bilo je sklenjenih veliko sporazumov, protokolov, pogodb in konvencij. Najbolj pomembne za razvoj patentnega varstva so leta 1870 sprejeta patentna zakonodaja, ki je leta 1883 spodbudila nastanek Pariške konvencije (Pretnar 2002, 79) in je eden od pomembnih temeljev današnje ureditve patentnega varstva. Sledijo Strasbourska konvencija, Pogodba o sodelovanju na področju patentov (PCT), imenovana tudi Madridski protokol, Konvencija o ustanovitvi Svetovne organizacije za intelektualno lastnino (*WIPO Convention*) leta 1967, Sporazum o trgovinskih vidikih pravic intelektualne lastnine TRIPS (angl. *Agreement on Trade-Related Intellectual Property Rights*) (TRIPS 1995), Evropska patentna konvencija (EPC) in Zelena knjiga o patentu Skupnosti in patentnem sistemu iz leta 1997 v katerem je komisija predstavila številne predloge sprememb patentnega varstva v Evropi.

Pomemben premik predstavlja Predlog Uredbe o patentu Skupnosti leta 2000 ki poziva k uvedbi enotnega patenta. Pravno podlago za uvedbo enotnega patentnega varstva v Evropski uniji predstavljajo Uredba 1257/2012, Uredba 1260/2012 (Rodriguez 2012, 407) in mednarodni Sporazum o enotnem sodišču za patente (februarj 2013). Namesto prvotno predvidenega enotnega patenta EU prinaša Uredba o unitarnem patentu nov termin unitarnega patenta. »Bodoči enotni patent bo evropski patent z enotnim učinkom, to je evropski patent, ki ga podeli Evropski patentni urad v skladu s pravili in postopki EPK in ki ima po podelitvi enoten učinek na vseh ozemljih držav članic Evropske unije, ki sodelujejo v projektu enotnega patenta« (URSIL 2018, 11). Nova ureditev obstoječega sistema ne nadomešča, temveč dodaja raven patentnega varstva na območju Evropske unije, ki bo dostopna izumiteljem ne glede na njihovo bivališče ali državljanstvo (Callens in Granata, 2013, str. 22).

Patent je eden od načinov zaščite intelektualne lastnine, ki se pogosto uporablja tudi na različnih področjih medicine in obsega tako proizvode in procese na področju biotehnologije in farmacije kot medicinskih pripomočkov.

Za zaščito izuma, oziroma registracijo patenta, ima posameznik na voljo več poti. Pri tem mora seveda sam vedeti, katera pot je zanj smiselna in hkrati finančno sprejemljiva. Patent se lahko pridobi na nacionalni ravni za vsako želeno državo posebej. Mednarodna prijavo temelji na podlagi Pogodbe o sodelovanju na področju patentov (PCT). Tretja možnost je pridobitev evropskega patenta po Evropski patentni konvenciji (EPC) za eno ali več evropskih držav z eno samo prijavo pri Evropskem patentnem uradu (Konvencija o podeljevanju evropskih patentov (EPC) 2007, 23). V prihodnosti bo v Evropski uniji mogoče uporabiti tudi institut unitarnega evropskega patenta, ki pa kljub vsem predvidenim prednostim, ki jih prinaša, še vedno ni veljaven.

V družbi je splošno znano, da farmacevtska podjetja in proizvajalci diagnostičnih naprav s patentom pogosto zaščitijo intelektualno lastnino. Manj znanega o patentiranju je s področja medicinskih pripomočkov, izdelanih za posameznika.

### 1.1 Namen in cilj raziskave

Namen raziskave je prispevati k razvoju kakovosti patentne zaščite s pomočjo evropskega patenta na področju patentne zaščite medicinskega pripomočka O&P. Cilj raziskave je analizirati slovenski in evropski patentni pravni red, predstaviti postopek patentne prijave medicinskega pripomočka O&P, oblikovati kritična stališča na tem področju in podati svoje mnenje o morebitnih pomanjkljivostih.

### 1.2 Raziskovalna vprašanja

V prispevku smo postavili naslednja raziskovalna vprašanja:

- R1: Ali je postopek patentiranja po Evropski patentni konvenciji ustrezen način zaščite medicinskega pripomočka O&P?
- R2: Ali pri patentnih objavah medicinskih pripomočkov O&P med prijavitelji patentov prevladujejo posamezna podjetja?
- R3: Ali pri patentnih objavah medicinskih pripomočkov O&P prevladujejo posamezne države glede na število prijaviteljev?
- R4: Ali enotni evropski patent omogoča večjo dostopnost zaščite intelektualne lastnine?

## 2 METODE RAZISKOVANJA

Pri raziskavi smo se oprli predvsem na metode raziskovanja prava kot metode pravne znanosti in svoja teoretična spoznanja preverili s kvalitativno metodo, ki skozi analizo konkretnega postopka podaja celostno sliko obravnavane tematike.

Najprej s pomočjo zgodovinske metode in njej pripadajoče sistematične metode na kratko predstavimo zgodovino patentnega pravnega varstva ter njegov razvoj. Z uporabo te metode so vidne tendence razvoja patentnega varstva skozi čas.

S pomočjo deskriptivne in analitične metode v nadaljevanju obravnavamo ter razčlenimo nacionalno, evropsko in mednarodno pravno podlago za ureditev patentnega varstva. Induktivni in deduktivni pristop prideta v poštev predvsem pri obdelavi pojmov in izpeljavi splošnih sklepov na podlagi najprej uporabljene analitične metode, ki ji pridružimo kvalitativno metodo s pridobljenimi praktičnimi vidiki. S pomočjo normativno-dogmatične metode raziskujemo pravo kot normativni

pojavnost. Osnovno načelo je načelo normativnega pripisovanja (ob pojavu nekega dejanja sledi določena pravna posledica). To metodo nekateri avtorji poimenujejo metoda raziskovanja značilnosti pozitivnega prava.

Velikokrat je uporabljena tudi primerjalna metoda, predvsem v tistem delu, kjer ureditev pred uvedbo unitarnega evropskega patenta primerjamo z ureditvijo patentnega varstva s t. i. unitarnim evropskim patentom. Namen takšne primerjave je, da izpeljemo ugotovitve o pozitivnih in tudi o morebitnih negativnih vidikih nove ureditve patentnega varstva.

Sintetično metodo, ki se ukvarja s spajanjem in združevanjem ugotovitev v celoto, uporabimo pri končnih odgovorih na zastavljena vprašanja. Z uporabo te metode nato ugotovitev, ki smo jih dobili z zgoraj navedenimi metodami, združimo v smiselno celoto in izpeljemo ustrezen zaključek.

Podatke za analizo patentnih prijav v RS smo dobili v iskalniku SIPO-DS nacionalnega urada na spletni strani, v skupini mednarodne patentne klasifikacije A61F, za analizo patentnih prijav v tujini pa v bazi prijavljenih in podeljenih patentov Espacenet, ki je dostopna na spletni strani Evropskega patentnega urada. Patente smo iskali s ključnimi besedami, kot so *limb prosthesis, limb prosthetics, limb orthosis, ancle foot orthosis, AFO, knee ancle foot orthosis, scoliosis brace, scoliosis corsets*, in po IPC klasifikaciji A61F.

### 3 REZULTATI

#### 3.1 Analiza trga medicinskih pripomočkov

Iz Poslovnega poročila Zavoda za zdravstveno zavarovanje Slovenije, (v nadaljevanju ZZS) (ZZS 2018) slika 1, razberemo, da so potrebe v RS sorazmerno majhne, proteze za ude se na letni ravni predpiše okoli 600. Ortoz je predpisanih okoli 10.300, vendar so v navedbah zajete tudi serijsko izdelane ortoze.

Slika 1: ZZS poslovno poročilo 2018

Šifra skupine MP	Naziv skupine medicinskih pripomočkov	Število vseh izdanih naročilnic (VN)			Število izdanih obnovljivih naročilnic (ON) v vseh naročilnicah			Delež (%)	
		2017	2018	indeks	2017	2018	2017	2018	
		1	2	3=2/1	4	5	6=4/1	7=5/2	
1	proteze udov	591	626	105,9	-	-	-	-	
2	estetske proteze	6.969	7.013	100,6	-	-	-	-	
3	ortoze	10.315	10.379	100,6	-	-	-	-	
4	ortopedska obutev	4.985	5.354	107,4	-	-	-	-	

Vir: (ZZS 2018, 53)

Pomemben podatek za analizo trga v Sloveniji je tudi cena, ki jo izdelki dosegajo. Po podatkih ZZS (ZZS, 2018) slika 2, je povprečna cena proteze za ud 2.200 evrov, ortoze pa 170 evrov. Skupni razpoložljivi znesek za tovrstne pripomočke na letni ravni se torej giblje okoli 3.000.000 evrov, za vse druge pripomočke pa 69.000.000 evrov.

Slika 2: ZZS poslovno poročilo – cene izdelkov

Skupina	Povprečni strošek na zavarovano osebo po skupinah medicinskih pripomočkov			Stroški izdanih medicinskih pripomočkov (v evrih)		Delež stroškov		Indeks stroškov izdanih medicinskih pripomočkov 2018/2017
	2017	2018	Indeks	2017	2018	2017	2018	
	Proteze udov	2.189,36	2.267,48	103,6	1.317.996	1.412.640	1,91	
Estetske proteze	112,45	114,32	101,7	606.670	625.224	0,88	0,86	103,1
Ortoze	174,28	169,88	97,5	1.671.906	1.646.943	2,42	2,27	98,5
Ortopedska obutev	95,62	95,27	99,6	494.904	510.250	0,72	0,70	103,1

Vir: (ZZS 2018, 54)

Na svetovni ravni je stanje tako pri številu proizvajalcev kot pri cenovnem vrednotenju izdelkov drugačno (Ottobock SE&Co. KGaA 2019). Globalno gledano se velikost trga povečuje. Poročilo Grand View Research, Inc. (2018) navaja, da bo v obdobju do leta 2025 rast donosa področja medicinskih pripomočkov 5,1 % (angl. *Compound annual growth rate – CAGR*), dosegla naj bi 12,28 milijarde ameriških dolarjev. Ključni dejavniki rasti trga so povečanje pojavnosti športnih poškodb, naraščajoča pojavnost osteosarkoma in staranje populacije. Povečanje geriatrične populacije po vsem svetu je postalo eden ključnih dejavnikov, ki spodbujajo povpraševanje po protetiki in ortotiki. Po podatkih Združenih nara-

dov naj bi npr. delež ljudi, starih 60 let ali več v razvitih državah, do leta 2050 porasel na 33 odstotkov, v nerazvitih pa naj bi dosegel 20 odstotkov vsega prebivalstva (Združeni narodi: Do leta 2050 bo na svetu devet milijard ljudi 2009). Vse več je primerov amputacij, povezanih s sladkorno boleznijo.

Po podatkih enega vodilnih svetovnih podjetij za svetovanje na področju tehnologij Technavio je za svetovni trg ortopedske protetike značilna prisotnost ključnih prodajalcev, ki imajo pomemben tržni delež in ponujajo široko paleto konvencionalne in tehnološko napredne protetike udov. Trg je visoko koncentriran, ključni akterji pa imajo prevladujoč delež. Raziskava, ki jo je leta 2017 izvedlo podjetje Technavio, je glede na obseg prodaje in prihodke uvrstila Otto Bock Healthcare in Össur na prvo in drugo mesto. Ti dve podjetji imata široko geografsko prisotnost, vrhunške kanale distribucije in dolgoročne pogodbe z vladnimi organizacijami, kot so vojaške in nepridobitne organizacije. Sledijo jim Blatchford, Fillauer in Ohio Willow Wood. Ta podjetja imajo sredstva in veliko možnosti za spodbujanje inovacij (Technavio Research 2017). To potrjuje tudi nedavna objava na spletni strani Evropske komisije o investicijskem planu Evropske investicijske banke (EIB), ki podjetju Otto Bock za razvoj novih pripomočkov in izboljšave v obdobju 2019–2022 zagotavlja financiranje v vrednosti več kot 100 milijonov evrov. Posojilo je podprto z jamstvom iz Evropskega sklada za strateške naložbe (EFSI), osrednjega naložbenega načrta za Evropo – Junckerjevega načrta –, v okviru katerega EIB in Evropska komisija sodelujeta kot strateški partnerici in financiranje EIB pospešuje konkurenčnost evropskega gospodarstva (EC 2019).

### 3.2 Analiza patentnih prijav

O zaščiti intelektualne lastnine na področju izdelave protez in ortoz za ude in telo v RS lahko na podlagi analize patentnih prijav v bazi (SIPO-DS), kjer smo našli 369 zapisov trdimo, da je slaba. Po pregledu vseh zapisov smo našli zgolj osem primerov, vsi last različnih lastnikov, ki so bili podeljeni v letih med 2000 in 2018 in se nanašajo na naš predmet iskanja. Veljavna sta le še dva patenta, od tega je avtor in lastnik enega patenta slovensko, drugega pa švicarsko podjetje. Dva patenta sta prenehala veljati v letu 2019, drugi že prej. Vsi drugi patenti se nanašajo na kirurške instrumente in higienske pripomočke.

V svetovnem merilu na področju O&P smo našli 3807 patentov. Podrobnejši pregled pridobljenih podatkov je pokazal, da so bili posamezni patenti zaradi podobnosti ključnih iskalnih besed podvojeni. Po odstranitvi podvojenih vnosov je ostalo 3035 patentov, od tega 1385 s področja ortotike in 1650 s področja protetike.

Analiza dobljenih podatkov za celotno obdobje od leta 1918, ko je bil podeljen prvi patent za to področje, do vključno 2019 je pokazala, da je bilo največ patentov (skupaj za obe področji) podeljenih na patentnem uradu v ZDA (1345), sledi patentni urad Kitajske s 604 in WIPO (WIPO) s 227 patenti. Za posamezno področje je vrstni red zastopanosti prvih treh patentnih uradov enak, razlika je predvsem v razmerju med področji. Urad v ZDA in WIPO sta podelila več patentov s področja protetike (63 %), urad na Kitajskem pa s področja ortotike (57,8 %). Od evropskih patentnih uradov se je najvišje, na 4. mesto, uvrstil patentni urad Nemčije s 112 patenti, od tega 58,9% iz ortotike.

Podatki za obdobje od leta 2015 do 2019 kažejo trend občutnega povečanja prijav patentov glede na obdobje med leti 1918 do 2019 na Kitajskem patentnem uradu (16 %). Prav tako se je zvišal delež pri WIPO, korejskem uradu in EPO. Občuten padec je na uradu ZDA (8,64 %) in pri nemškem uradu (3,58%). V primerjavi deleža ortotike in protetike se v zadnjih petih letih glede na celotno obdobje kaže povečanje patentnih prijav na področju protetike za 4,96 %.

Za celotno obdobje (1918-2019) podatki kažejo, da največ prijaviteljev prihaja iz ZDA (1189 prijav), sledi Kitajska (585 prijav) in Nemčija (282 prijav). Večina patentov (86,7 %) se nanaša na serijske pripomočke. Metode meritev ali izdelave so zastopane v 11 %, pripomočki za posameznega uporabnika pa le v 2,2 %. Razlike med protetikom in ortotikom so minimalne (1 %) v korist ortotike. Za patentne prijave za posameznega uporabnika lahko poleg Nemčije (14 prijav) in vodilnih ZDA (19 prijav) postavimo še s sedmimi prijavami Francija.

Med prijavitelji izstopata Otto Bock (Nemčija) s 110 patentnimi objavami, kar predstavlja 3,6 % vseh patentnih objav med leti 1918 do 2019 in Össur (Nizozemska) z 3%. Sledijo štiri podjetja iz ZDA, ki imajo delež manjši od 1%. Na visokem 8 mestu z 19 patenti je Blatchford (Velika Britanija). Druga podjetja in posamezniki imajo 15 ali manj patentnih objav. Vseh prijaviteljev je 1713, največ prijaviteljev ima eno objavo (712), kar predstavlja 41.56% vseh prijaviteljev in 23,46 % vseh objav patentov (Priloga1, Tabela 4).

Do leta 1990 je bilo prijav sorazmerno malo in tudi rast je bila počasna. Prvi večji skok je opaziti v letu 1984, ko je število prijav naraslo na 20. Od leta 1991 do 2009 je kljub nihanjem število objav z manjšimi odkloni počasi naraščalo, po letu 2010 pa je opaziti hitrejšo rast. Graf nam kaže velik skok v letu 2019, tako na področju ortotike kot protetike. V letu 2019 je bilo skupaj kar 392 prijav, kar je tudi največ v zgodovini baze Espacenet. Število patentnih prijav in objav v Biltenu se je v zadnjem desetletju neprestano večalo, kar kaže na zavedanje pomembnosti zaščite intelektualne lastnine.

### 3.3.3.3 Postopek priprave patentne prijave

Postopek priprave evropske patentne prijave je enak kot za izume ostalih področij, torej mora biti izum novost, inovativen in industrijsko uporaben. Oblika prijavnih dokumentov, oblika in vsebina vloge ter zahteve za opis izuma so določene. Dokumentacijo sestavljajo prijavnii obrazec, opis izuma, patentni zahtevki, skice in povzetek. Tehnični problem, ki naj bi ga izum razrešil, njegova rešitev in vse prednosti izuma glede na stanje tehnike morajo biti navedeni v razkritju. Opisane morajo biti morebitne skice in najmanj en način izvedbe izuma, za katerega se zahteva varstvo. Navesti je treba, »kako je izum mogoče industrijsko uporabljati v smislu 57. člena« (URSIL 2018, 28). Zahtevki, ki je lahko eden ali jih je več, natančno opredeljuje izum v smislu tehničnih značilnosti, za katere se zahteva varstvo. »Sklicevalne oznake, ki povezujejo patentne zahtevke s skicami, so zapisane med oklepaji in se nanašajo na tehnične značilnosti, navedene v zahtevkih« (URSIL 2018, 31). Vložnik prijave je lahko ena ali več fizičnih ali pravnih oseb, iz ene ali več različnih držav pogodbenic (URSIL 2018, 19). Državljanstvo, prebivališče ali sedež podjetja pri tem nimajo vloge. Vse države članice EPC, ki so na dan vložitve prijave polnopravne članice EPC, so ob vložitvi evropske patentne prijave samodejno imenovane. Prijava se lahko vloži na nacionalnem uradu ali neposredno pri Evropskem patentnem uradu v Münchnu, pri njegovi podružnici v Haagu ali pri uradu v Berlinu, v elektronski obliki, preko pošte ali osebno, v katerem koli jeziku, s tem, da jo je treba v dveh mesecih od datuma vložitve prevesti v enega od uradnih jezikov EPO, ki so angleščina, nemščina in francoščina« (URSIL 2018, 20).

Načeloma predstavljajo strošek patentne zaščite pristojbine v fazi prijave, strošek prevajalcev in letne pristojbine za vzdrževanje in obnovo zaščite, kar pomeni prijavna pristojbina za vlogo prek spleta 210 evrov in za poizvedbo 1.300 evrov. Strošek preverbe je 1.635 evrov. Skupni strošek v fazi vloge znes 3.100 evrov.

Visok strošek predstavlja prevajanje v jezike držav članic, po navedbah Društva znanstvenih in tehniških prevajalcev Slovenije je priporočena cena 52,51 evrov brez DDV/stran A4. Za manj zahtevno vlogo je to približno 250 evrov za posamezno državo, torej približno 7.500 evrov.

Nacionalno potrjevanje v vseh državah članicah podpisnicah znes dodatnih 22.230 evrov (38\*585).

Pristojbine za obnovo oziroma podaljšanje se plačajo za tretje in vsako nadaljnje leto od datuma vloge in z vsakim letom naraščajo. Za pravico iz patentnega varstva desetih let, znaša pristojbina 8.340 evrov/državo, za 38 držav skupaj 316.920 evrov.

Skupni stroški ob predpostavki, da postopek poteka gladko in ni dodatnih stroškov, kot so pristojbine za ugovor in podobno, znašajo za deset let in 38 držav najmanj 349.750 evrov.

## 4 RAZPRAVA

V raziskavi smo predstavili teoretična in pravna izhodišča področja patentne zaščite medicinskega pripomočka izdelanega za posameznega uporabnika z iskanjem odgovorov na naslednja raziskovalna vprašanja :

- R1: Ali je postopek patentiranja po Evropski patentni konvenciji ustrezen način zaščite medicinskega pripomočka O&P?
- R2: Ali pri patentnih objavah medicinskih pripomočkov O&P med prijavitelji patentov prevladujejo posamezna podjetja?
- R3: Ali pri patentnih objavah medicinskih pripomočkov O&P prevladujejo posamezne države glede na število prijaviteljev?
- R4: Ali enotni evropski patent omogoča večjo dostopnost zaščite intelektualne lastnine?

Po Zakonu o medicinskih pripomočkih (2009) in opredelitvi Javne agencije Republike Slovenije za zdravila in medicinske pripomočke (JAZMP) je medicinski pripomoček: »instrument, aparatura, naprava, programska oprema, material ali drug predmet, ki se uporablja samostojno ali v kombinaciji z dodatki, vključno s programsko opremo, ki jo je proizvajalec ali proizvajalka medicinskih pripomočkov predvidel izrecno za uporabo pri diagnostiki oziroma v terapevtske namene in je potrebna za pravilno uporabo tega pripomočka, in ki ga je proizvajalec medicinskih pripomočkov predvidel za uporabo na ljudeh za diagnosticiranje, preprečevanje, spremljanje, zdravljenje ali lajšanje bolezni ter diagnosticiranje, spremljanje, zdravljenje, lajšanje posledic poškodb ali okvar ali kompenziranje okvare ali invalidnosti«. Izdelek mora izpolniti pogoje definicije v direktivi 93/42 EGS (1993), ki je nekakšen izhodiščni predpis obravnavanega področja. Posameznih tipov medicinskih pripomočkov je okoli 23.000.

Ponudba serijsko izdelanih medicinskih pripomočkov za telo in ude v Republiki Sloveniji (v nadaljevanju RS) je ustrezna, večino jih ponudniki dobavljajo od veletrgovcev in proizvajalcev iz tujine. Stranke tovrstne pripomočke dobijo v specializiranih trgovinah.

Drugačno stanje je na področju medicinskih pripomočkov, izdelanih za posameznega uporabnika, ki po diktaciji Zakona o medicinskih pripomočkih pomeni »medicinski pripomoček, ki je posebej izdelan z načrtovanimi lastnostmi v skladu s pisno zahtevo zdravnika in je namenjen izključno uporabi pri tem uporabniku« (Zakon o medicinskih pripomočkih, 2009). V to skupino spadajo individualno izdelane proteze in ortoze za ude in telo. O protezi za ud govorimo, kadar nadomeščamo človeški ud z umetnim, o ortozni pa pripomočku, ki pomaga udu do ustrezne funkcije (Burger 2010). Tovrstne pripomočke mora v skladu z Zakonom o medicinskih pripomočkih predpisati pooblaščen zdravnik. V Evropski uniji so medicinski pripomočki vključno s protezami in ortozami za ude predmet prostega pretoka blaga, zato imajo državljani RS pravico nabave tovrstnih izdelkov v kateri koli članici Evropske unije tudi na stroške obveznega zavarovanja, ki je v pristojnosti ZZS (Pravila obveznega zdravstvenega zavarovanja 1994) (Spremembe in dopolnitve Pravil obveznega zdravstvenega zavarovanja 2018). Glavni del inovativnosti pri tovrstnih izdelkih je v načinu in metodah izdelave. Za slovenska podjetja to glede na izjemno nizke cene končnih pripomočkov v primerjavi s tujimi ponudniki in evropsko primerljive cene materialov in komponent pomeni, da so sredstva, namenjena raziskavam in razvoju novih izdelkov in metod za izdelavo protez in ortoz, minimalna oziroma jih praktično ni. Inovacije so plod entuziazma posameznikov.

Pod medicinske pripomočke spadajo tudi serijski sestavni deli protez, kot so protezna stopala, kolena ter razni sestavni deli ortoz, npr. kolenski ali gleženjski sklepi z ustrešno funkcijo pomoči udu ali njegovo stabilizacijo, ki se vgradijo v individualno izdelan pripomoček. V RS proizvajalca serijskih sestavnih delov za individualno izdelane proteze in ortoze ni, medtem ko je v svetu kar precejšnja konkurenca. Za potrebe slovenskih uporabnikov se sestavni deli dobavljajo od večjih, uglednih tujih podjetij, predvsem iz Evropske unije (Otto Bock, Blatchord, Össur), pa tudi ZDA.

Odgovor na prvo raziskovalno vprašanje smo našli v z analizo patentnih objav glede prijaviteljev in predmetov prijave in z analizo vloge patentne prijave po EPC. Primarna korist, ki jo patentno varstvo prinaša medicinskemu pripomočku, je moč varstva, ki jo zagotavlja patentno pravo. Ko je patent podeljen, daje izumitelju vrsto upravičenj v zvezi z njegovim izumom. Oblast, monopol in izključna pravica do uporabe izuma so gotovo najmočnejša orožja, ki jih pravo intelektualne lastnine lahko nudi imetnikom intelektualnih stvaritev. Patent kot začasno podeljeni monopol ponuja izumitelju možnost finančne nagrade kot spodbude za naložbo v izum. Imetnik patenta je monopolist, ker mu patent omogoča, da na pravno nesporen način onemogoči svojim konkurentom vstop na trg, hkrati pa jih spodbudi k ustvarjanju novih invencij. Do določene mere je to dovoljena in neizogibna posledica patentnega sistema. Ker pa imata medicina in farmacija naravno težnjo k monopoliziranju, imajo patenti še večji učinek na monopolizacijo te industrije. V tem pogledu lahko nosilci patentov uporabljajo patentno varstvo proti drugim na agresiven način, da jih zadržijo zunaj industrije, kot na primer vlagajo neupravičene tožbe glede kršitev svojih patentov ali grozijo s tožbami in s tem odvrčajo konkurente. Predvsem v ZDA se pojavljajo t. i. »patentni troli«, kakor nekateri imenujejo podjetja, ki ničesar ne proizvajajo, ampak zgolj vlagajo tožbe zaradi domnevnih kršitev svojih patentov. Četudi nasprotne stranke tožbo dobijo, ima to zanje lahko hude finančne posledice. Patent je torej v tem primeru pregrada, ovira ali konkurenčno orodje, ki ga je mogoče sodno uveljavljati. Patenti so spodbuda za inovativnost. Z razvijajočo se tehnologijo se večja tudi število izumov. Raziskave in razvoj, ki jih mora izumitelj opraviti, da

ustvari in komercializira svoj izdelek, so lahko ogromne, tako s časovnega kot finančnega vidika. S podelitvijo patenta so izumitelji spodbujeni h kreativnosti, vlagatelji pa raje vlagajo v takšne naložbe, kajti dejstvo, da so izumi patentirani, predstavlja zanje dodatno zavarovanje. Patenti so podeljeni v zameno za to, da postane izum javen in s tem služi kot učinkovito sredstvo za prenos znanja in informacij o trenutni najnovejši tehnologiji.

Čeprav naj bi bili učinki patentov v družbi zaradi spodbujanja in omogočanja inovativnosti pozitivni (Ilić 2006), določeni avtorji trdijo, da ni nujno tako, saj naj bi zaznali negativen vpliv t. i. strateškega patentiranja, ki omejuje oziroma onemogoča širjenje znanja, tehnologije in konkurence v družbi ter s tem inovacije (Science/Buisiness 2016).

Patenti medicinskih pripomočkov lahko negativno vplivajo na standardizacijo. Nevarnost se v realnosti kaže pri uveljavljanju določene tehnološke industrijske rešitve kot dejanskega standarda in na tej podlagi pobiranje licenčnine od vseh, ki te rešitve uporabljajo. Če se rešitve res uveljavijo kot standardi, si podjetja s tem zagotovijo pomembno konkurenčno prednost (Boldin in Levine, 2013).

Ker zaradi specifične narave medicinskih pripomočkov, ki služijo telesno oviranim ljudem pri nujnih opravilih, obstaja precej razlogov proti njihovemu patentiranju, je bila ta tematika v zadnjih nekaj desetletjih zelo pereča. Razvila so se celo združenja, ki se zavzemajo za ukinitve patentov, predvsem zaradi njihovega negativnega vpliva na možnosti, da bi bila taka sredstva dostopna vsem, predvsem kadar so individualno izdelana. Patentov, ki ščitijo pripomočke, izdelane za posameznika, je malo; v glavnem so zaščiteni serijski pripomočki, materiali oziroma sestavni deli ter metode izdelave, saj predstavljajo kar 87 % vseh patentov na tem področju.

Vsako lahko vloži patentno prijavo, tako izumitelji posamezniki, majhna, srednja podjetja in velike korporacije. Patentne prijave so sicer drage in treba je presoditi, ali bodo prinesle pričakovane koristi. Iz analiziranih podatkov vidimo, da mora imetnik patenta za desetletno zaščito skupaj plačati v posamezni državi več kot 8.000 evrov, kar za mnoge ni majhen znesek. Če k temu prištejemo še stroške prijave in stroške preizkusa, dobimo vrtoglave zneske. To za mnoge izumitelje pomeni veliko oviro. Zaradi visokih stroškov patentne zaščite prevladujejo velike korporacije iz ekonomsko močnih držav, manjša podjetja pa iščejo alternativne poti zaščite. Alternativa je zaščita z označbo poslovna skrivnost. Gre za nerazkritje oziroma pametno zakritje funkcije. Ta način je najcenejši (Patent Pilot 2019).

Imetniku patenta daje evropski patent enako pravno varnost kot za druga področja industrije, vendar je zaradi specifičnosti namembnosti izdelka ta način zaščite primeren predvsem za serijsko izdelane pripomočke. Ti podatki kažejo, da je možnost zaščite po EPC sicer ustrezna, imetniku patenta daje enako pravno varnost kot za druga področja, vendar je draga in zamudna.

Med proizvajalci je svojo intelektualno lastnino največkrat zaščitilo nemško podjetje Otto Bock, sledita Ossur in Ohio Willow Wood. Patentno zaščito si lahko privoščijo sorazmerno malo proizvajalcev, predvsem so to velike korporacije, ki imajo veliko finančno zaledje. S tem smo odgovorili na drugo raziskovalno vprašanje.

Ugotovili smo, da je skupno število prijaviteljev objavljenih patentov največje iz ZDA in Kitajske, sledi Nemčija, torej ekonomsko močnih držav. Delež ostalih posameznih držav je manjši od 10%. Velik porast prijav je zaznati pri azijskih prijaviteljih, predvsem iz Kitajske in Južne Koreje. S tem smo pozitivno odgovorili na tretje raziskovalno vprašanje.

Na četrto raziskovalno vprašanje smo odgovorili z analizo enotnega evropskega patenta. Podjetja se čedalje bolj zavedajo pomembnosti in moči zaščite intelektualne lastnine, kar kaže tudi porast patentnih prijav v letih 2018 in 2019 v primerjavi s prejšnjimi leti. Uvedba enotnega evropskega patenta bo nedvomno zaradi cenovne dostopnosti povečala zanimanje in omogočila zaščito intelektualne lastnine širšemu krogu tudi na področju medicinskih pripomočkov, predvsem bo bolj dostopna za manjša podjetja in posamezne inovatorje.

Z raziskavo smo dosegli zastavljene cilje in odgovorili na zastavljena vprašanja.



## 5 ZAKLJUČEK

Patent je pravica, s katero se zavaruje izum in pomeni izključno pravico fizične ali pravne osebe za izum, ki je nov, na inventivni ravni in je industrijsko uporabljiv. Izum oziroma tehnična rešitev je nova, če je stanje tehnike ne zajema, torej ni bila pred datumom vložitve patentne prijave dostopna javnosti z ustnim ali pisnim opisom, z uporabo ali na kateri koli drug način. Patent šteje kot lastninska pravica, ki se lahko podeli na nacionalni ali širši ravni, lahko se proda ali odstopi kot licenca drugim ali pa je predmet drugačnih pogodb oziroma drugih sporazumov. Patentirati je smiselno, če je razvoj drag, kopiranje pa poceni ali če imetnik pričakuje velik komercialni uspeh. Hkrati pa je patentna prijava uporabna, da imetnik izve, ali že obstaja podobna zaščitena rešitev.

Izumitelj ima v Evropi na voljo več možnosti za pridobitev patentnega varstva, med njimi je pridobitev evropskega patenta po Evropski patentni konvenciji (EPC) za eno ali več evropskih držav z eno samo prijavo pri Evropskem patentnem uradu v 33 evropskih državah pogodbenicah, med katerimi je od leta 2002 tudi Slovenija. Zaščita izuma na področju medicinskih pripomočkov za posameznega uporabnika O&P po Evropski patentni konvenciji je ustrezna, saj imetniku patenta daje pravno varstvo, ni pa idealna, saj so postopki prevajanja, potrjevanja v posameznih državah članicah in vzdrževanje patenta dragi in zamudni in je zato primerna za serijske pripomočke in metode, ter dostopna velikim korporacijam in ekonomsko močnim državam. Manjša podjetja in posamezniki pogosto izberejo alternativne poti zaščite, kot je zaščita z označbo »poslovna skrivnost«. Za individualno izdelane pripomočke lahko zaključimo, da je sam pripomoček težko zaščititi, ker že manjša sprememba oblike ali funkcije, ki je pogojena s funkcionalno potrebo uporabnika, lahko ogrozi pravno zaščito, zato morajo biti patentni zahtevki vsebinsko pripravljene z največjo skrbnostjo.

Evropska unija si že nekaj let prizadeva uvesti poenostavljen postopek. Čeprav naj bi sprva predlagan enotni patent imel učinek v vseh državah članicah Evropske unije, ne bo tako, saj bo učinek enotnega patenta sprva omejen le na države članice Evropske unije, ki bodo ratificirale Sporazum o ESP, kljub temu pa lahko pričakujemo, da bo po uvedbi enotnega evropskega patenta število patentnih prijav glede na finančno dostopnost naraslo.

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**Tabela 1: Patentne objave ortotika in protetika – glede na Urad za industrijsko lastnino**

URAD	obdobje 1: 1918-2019						obdobje 2: 2015-2019						razlika obdobja (%)
	ortotika		protetika		skupaj		ortotika		protetika		skupaj		
	Σ O	% od Σ O+P	Σ P	% od Σ O+P	Σ O+P	% od skupne Σ O+P	Σ O	% od Σ O+P	Σ P	% od Σ O+P	Σ O+P	% od skupne Σ O+P	
US	498	37.03	847	62.97	1345	44.32	90	25.71	260	74.29	350	35.68	-8.64
CN	349	57.78	255	42.22	604	19.90	188	52.51	170	47.49	358	36.49	16.59
WO	84	37.00	143	63.00	227	7.48	30	33.33	60	66.67	90	9.17	1.69
DE	66	58.93	46	41.07	112	3.69	1	100.00	0	0.00	1	0.10	-3.59
JP	68	61.26	43	38.74	111	3.66	22	64.71	12	35.29	34	3.47	-0.19
FR	32	30.19	74	69.81	106	3.49	9	24.32	28	75.68	37	3.77	0.28
KR	66	72.53	25	27.47	91	3.00	25	62.50	15	37.50	40	4.08	1.08
AU	58	81.69	13	18.31	71	2.34	2	25.00	6	75.00	8	0.82	-1.52
ER	21	32.31	44	67.69	65	2.14	0	0.00	0	0.00	0	0.00	-2.14
GB	26	46.43	30	53.57	56	1.85	3	50.00	3	50.00	6	0.61	-1.23
TW	17	34.69	32	65.31	49	1.61	6	37.50	10	62.50	16	1.63	0.02
CA	23	57.50	17	42.50	40	1.32	5	71.43	2	28.57	7	0.71	-0.60
PL	18	69.23	8	30.77	26	0.86	5	71.43	2	28.57	7	0.71	-0.14
UA	9	42.86	12	57.14	21	0.69	1	100.00	0	0.00	1	0.10	-0.59
RU	9	45.00	11	55.00	20	0.66	5	45.45	6	54.55	11	1.12	0.46
MX	3	33.33	6	66.67	9	0.30	2	66.67	1	33.33	3	0.31	0.01
ZA	6	66.67	3	33.33	9	0.30	0	0.00	1	100.00	1	0.10	-0.19
HK	7	77.78	2	22.22	9	0.30	1	50.00	1	50.00	2	0.20	-0.09
SU	0	0.00	8	100.00	8	0.26	0	0.00	0	0.00	0	0.00	-0.26
IE	0	0.00	6	100.00	6	0.20	0	0.00	0	0.00	0	0.00	-0.20
CZ	4	66.67	2	33.33	6	0.20	0	0.00	1	100.00	1	0.10	-0.10
ES	2	40.00	3	60.00	5	0.16	0	0.00	1	100.00	1	0.10	-0.06
NZ	4	80.00	1	20.00	5	0.16	2	66.67	1	33.33	3	0.31	0.14
IN	1	20.00	4	80.00	5	0.16	0	0.00	0	0.00	0	0.00	-0.16
SE	1	25.00	3	75.00	4	0.13	0	0.00	1	100.00	1	0.10	-0.03
RO	3	75.00	1	25.00	4	0.13	0	0.00	0	0.00	0	0.00	-0.13
MY	0	0.00	3	100.00	3	0.10	0	0.00	0	0.00	0	0.00	-0.10
NI	3	100.00	0	0.00	3	0.10	0	0.00	0	0.00	0	0.00	-0.10
IL	0	0.00	2	100.00	2	0.07	0	0.00	1	100.00	1	0.10	0.04
IT	0	0.00	2	100.00	2	0.07	0	0.00	0	0.00	0	0.00	-0.07
CH	1	50.00	1	50.00	2	0.07	0	0.00	0	0.00	0	0.00	-0.07
LT	1	100.00	0	0.00	1	0.03	1	100.00	0	0.00	1	0.10	0.07
LV	1	100.00	0	0.00	1	0.03	0	0.00	0	0.00	0	0.00	-0.03

Vir: Lastno delo

se nadaljuje

**Tabela 1: Patentne objave ortotika in protetika – glede na Urad za industrijsko lastnino (nad.)**

URAD	obdobje 1: 1918-2019						obdobje 2: 2015-2019						razlika obdobja (%)
	ortotika		protetika		skupaj		ortotika		protetika		skupaj		
	Σ O	% od Σ O+P	Σ P	% od Σ O+P	Σ O+P	% od skupne Σ O+P	Σ O	% od Σ O+P	Σ P	% od Σ O+P	Σ O+P	% od skupne Σ O+P	
GR	0	0.00	1	100.00	1	0.03	0	0.00	0	0.00	0	0.00	-0.03
HR	1	100.00	0	0.00	1	0.03	0	0.00	0	0.00	0	0.00	-0.03
HU	1	100.00	0	0.00	1	0.03	0	0.00	0	0.00	0	0.00	-0.03
SG	1	100.00	0	0.00	1	0.03	1	100.00	0	0.00	1	0.10	0.07
BE	0	0.00	1	100.00	1	0.03	0	0.00	0	0.00	0	0.00	-0.03
SI	0	0.00	1	100.00	1	0.03	0	0.00	0	0.00	0	0.00	-0.03
EA	1	100.00	0	0.00	1	0.03	0	0.00	0	0.00	0	0.00	-0.03
<b>Skupna</b>	<b>1385</b>	<b>45.63</b>	<b>1650</b>	<b>54.37</b>	<b>3035</b>	<b>100.00</b>	<b>399</b>	<b>40.67</b>	<b>582</b>	<b>59.33</b>	<b>981</b>	<b>100</b>	<b>4.96</b>

Vir: Lastno delo





Tabela 3: Patente objave ortotika in protetika - glede na naziv prijavitelja

Naziv prijavitelja	država prijavitelja	ortotika	protetika	Skupaj	ortotika	protetika	Skupaj
		kol	kol	kol	%	%	%
<b>Obdobje: od 1918 do 2019</b>							
OTTOBOCK SE & CO KGAA	DE	38	72	110	2,74	4,36	3,62
OSSUR HF	IS	11	80	91	0,79	4,85	3,00
OHIO WILLOW WOOD CO	US		28	28	0,00	1,70	0,92
LIM INNOVATIONS INC	US		27	27	0,00	1,64	0,89
LAGHI ALDO A	US		22	22	0,00	1,33	0,72
ABILITY DYNAMICS LLC	US		21	21	0,00	1,27	0,69
KINETIC ORTHOTICS PTY LTD	AU	19	0	19	1,37	0,00	0,63
BLATCHFORD & SONS LTD	GB		19	19	0,00	1,15	0,63
CHRISTENSEN ROLAND J	US		15	15	0,00	0,91	0,49
TEH LIN PROSTHETIC &	TW		15	15	0,00	0,91	0,49
HOWMEDICA	US		15	15	0,00	0,91	0,49
TOWNSEND DESIGN	US		15	15	0,00	0,91	0,49
UNIV HEBEI TECHNOLOGY	CN		10	10	0,00	0,61	0,33
UKRAINIAN RES INST PROSTHET	UA		10	10	0,00	0,61	0,33
FREEDOM INNOVATIONS INC	US		10	10	0,00	0,61	0,33
GUANGZHOU KANGMEITE	CN		10	10	0,00	0,61	0,33
INNOTHERA LAB SA	FR	10	0	10	0,72	0,00	0,33
DEPUY PRODUCTS INC	US		9	9	0,00	0,55	0,30
MEDI GMBH & CO KG	DE		9	9	0,00	0,55	0,30
WILSON MICHAEL T	US		9	9	0,00	0,55	0,30
CASPERS CARLA	US		9	9	0,00	0,55	0,30
NACE RICHARD A	CR	8	0	8	0,58	0,00	0,26
SCOTT ORTHOTIC LABS INC	US	8	0	8	0,58	0,00	0,26
ANATOMICAL CONCEPTS INC	US	8	0	8	0,58	0,00	0,26
ZIMMER INC	US		8	8	0,00	0,48	0,26
ALPS INTELLECTUAL PROPERTY MAN	US		8	8	0,00	0,48	0,26
PRO LIMB INT CORP	TW		8	8	0,00	0,48	0,26
BIOMET LTD	GB		8	8	0,00	0,48	0,26
UNIV ZHEJIANG SCIENCE & TECH	CN		8	8	0,00	0,48	0,26
PHILLIPS L VAN	US		8	8	0,00	0,48	0,26
COLLEGE PARK IND INC	US		8	8	0,00	0,48	0,26
WATTS ROBERT JOHN	GB	7	0	7	0,51	0,00	0,23
TOWNSEND DESIGN	US	7	0	7	0,51	0,00	0,23
BECKER ORTHOPEDIC APPLIANCE CO	US	7	0	7	0,51	0,00	0,23
RESTORATIVE CARE OF AMERICA IN	US	7	0	7	0,51	0,00	0,23
NAT RES CENTER FOR	GB		7	7	0,00	0,42	0,23
SHAANXI FUYIN PROSTHETIC CO LTD	CN		7	7	0,00	0,42	0,23
KEN DALL ENT PR CO LTD	CN		7	7	0,00	0,42	0,23
AESCULAP AG & CO KG [DE]	DE		7	7	0,00	0,42	0,23
UNIV MALAYA	MY		7	7	0,00	0,42	0,23

Vir: Lastno delo

se nadaljuje

**Tabela 3: Patente objave ortotika in protetika - glede na naziv prijavitelja (nad.)**

Naziv prijavitelja Obdobje: od 1918 do 2019	država prijavitelja	ortotika	protetika	Skupaj	ortotika	protetika	Skupaj
		kol	kol	kol	%	%	%
PROSTHETIC DESIGN INC	US		7	7	0,00	0,42	0,25
POHLIG GMBH	DE	6	0	6	0,43	0,00	0,20
POWASER MICHAEL J	US	6	0	6	0,43	0,00	0,20
DENNEROLL HOLDINGS PTY	AU	6	0	6	0,43	0,00	0,20
MYOMO INC	US	6	0	6	0,43	0,00	0,20
YUNNAN HUIHUANG ORTHOPEDIC	CN	6	0	6	0,43	0,00	0,20
JIANGXI ZHONGKANG	CN	6	0	6	0,43	0,00	0,20
BRIDGESTONE CORP	JP		6	6	0,00	0,36	0,20
NAT RES DEV	GB		6	6	0,00	0,36	0,20
MASSACHUSETTS INST TECHNOLOGY	US		6	6	0,00	0,36	0,20
UNIV XI AN JIAOTONG	CN		6	6	0,00	0,36	0,20
OSTEONICS CORP	JP		6	6	0,00	0,36	0,20
BEIJING GOODOING FENGXING	CN		6	6	0,00	0,36	0,20
BEIJING FUJU TIANCHENG	CN		6	6	0,00	0,36	0,20
GUANGDONG LANWAN	CN		6	6	0,00	0,36	0,20
MODEL & INSTR DEV CORP	US		6	6	0,00	0,36	0,20
OSTALI S 5ALI MANJ		1219	1093	2312	88,01	66,24	76,18
<b>SKUPAJ</b>		<b>1385</b>	<b>1650</b>	<b>3035</b>	<b>100,00</b>	<b>100,00</b>	<b>100,00</b>

Vir: Lastno delo

Tabela 4: Patente objave ortotika in protetika – število prijav na število prijaviteljev

št.patentnih objav / prijavitelja	število prijaviteljev		Σ	Σ število patentnih objav
	ortotika	protetika		
Obdobje: od 1918 do 2019				
110	1	1	1	110
91	1	1	1	91
28	1	1	1	28
27	1	1	1	27
22	1	1	1	22
21	1	1	1	21
19	1	1	2	38
15	0	4	4	60
10	1	4	5	50
9	0	4	4	36
8	3	7	10	80
7	4	6	10	70
6	6	9	15	90
5	5	14	19	95
4	18	25	43	172
3	34	50	84	252
2	154	119	273	546
1	712	535	1237	1247
	935	784	1713	3035

Vir: Lastno delo

Tabela 5: Patente objave ortotika in protetika - glede na leto objave patenta

LETO	Ortotika	Protetika	$\Sigma$
1918	1	0	1
1920	1	0	1
1928	1	0	1
1936	1	0	1
1946	1	0	1
1948	0	2	2
1949	0	2	2
1954	1	0	1
1962	0	1	1
1963	0	1	1
1967	0	2	2
1970	0	1	1
1972	0	1	1
1973	2	6	8
1974	1	6	7
1975	1	5	6
1976	0	8	8
1977	1	11	12
1978	4	3	7
1979	1	9	10
1980	3	6	9
1981	5	4	9
1982	6	6	12
1983	5	2	7
1984	6	14	20
1985	6	7	13
1986	6	3	9
1987	9	8	17
1988	12	7	19
1989	9	14	23
1990	8	9	17

LETO	Ortotika	Protetika	$\Sigma$
1991	13	13	26
1992	10	15	25
1993	10	15	25
1994	11	23	34
1995	8	19	27
1996	17	25	42
1997	18	15	33
1998	19	19	38
1999	18	23	41
2000	15	15	30
2001	20	14	34
2002	29	28	57
2003	19	32	51
2004	28	38	66
2005	44	41	85
2006	44	33	77
2007	33	28	61
2008	49	24	73
2009	54	36	90
2010	49	58	107
2011	64	69	133
2012	85	87	172
2013	72	77	149
2014	85	82	167
2015	81	101	182
2016	68	90	158
2017	69	112	181
2018	107	143	250
2019	155	237	392
$\Sigma$	1385	1650	3035

Vir: Lastno delo

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Alma Mater Europaea - ECM

## **VREDNOTENJE METOD ZA DOLOČANJE PRIORITET PRI ODPRAVLJANJU RANLJIVOSTI NA REALNEM SISTEMU EVALUATION OF METHODS FOR SETTING PRIORITIES IN ADDRESSING VULNERABILITIES ON THE REAL SYSTEM**

### **POVZETEK**

Ranljivosti v programski opremi predstavljajo veliko nevarnost za informacijske sisteme. Pomembno je, da jih odkrijemo in čim hitreje odpravimo. Zaradi omejenih virov in potrebi po čim krajši izpostavljenosti sistema grožnjam, moramo vzpostaviti nek prioritetni vrstni red odpravljanja. Pri določanju prioritete obstaja več metod. V praksi je najbolj razširjena metoda CVSS, ki pa ni najbolj učinkovita, saj ne upošteva dejanskega tveganja, ki ga ranljivost predstavlja za IS. Ugotoviti želimo, katera metoda je primernejša, saj obstaja več načinov ocenjevanja resnosti ranljivosti. Med njimi lahko izpostavimo metode VRSS, HTAC ter kazalnik »Exploitation Ration«. Obstoječe primerjave učinkovitosti posameznih metod pri odpravljanju ranljivosti so se osredotočale na vse odkrite ranljivosti izbranega časovna obdobja. Vrednotenje ni bilo izvedeno v realnem okolju, saj je zaradi številnih dejavnikov, ki lahko vplivajo na izvedbo, kaj takega praktično neizvedljivo. Odločili smo se, da vrednotenje opravimo vsaj na realni konfiguraciji sistema, če že ni možno v realnem okolju. Izbrali smo dva tipična informacijska sistema, ki ju pogosto srečamo v praksi. Prvi je IS podjetja, drugi pa IS spletnega gostitelja. Sistema se razlikujeta tako po številu uporabljenih programov kot tudi po številu odkritih ranljivosti. Ugotovili smo, da se metode različno dobro odrežejo pri posameznih sistemih. Potrdili smo tezo, da je metoda HTAC, ki upošteva lastnosti napadalcev, učinkovitejša od metode CVSS, saj bolj natančno ocenjuje tveganje, ki ga predstavlja izbrana ranljivost. Večje razlike v učinkovitosti se pokažejo v sistemih, kjer imamo veliko število odprtih programskih komponent. Kot najučinkovitejša se je pokazala metoda na osnovi kazalnika »Exploitation Ratio«, ki se pri svojem delovanju opira na dejanske podatke o preteklih izkoriščenih ranljivosti. Ugotovimo lahko, da tudi ta metoda bolje odraža dejansko tveganje, ki ga ranljivost predstavlja za IS.

**Ključne besede:** ranljivost, varnost, tveganje, informacijski sistem, metoda določanja prioritete.

## **ABSTRACT**

*Vulnerabilities in software pose a major threat to information systems. It is important to discover and eliminate them as soon as possible. Due to limited resources and the need to minimize the system's exposure to threats, we need to establish a priority elimination order. There are several methods for setting priorities. In practice, the most widespread method is CVSS. However, it is not the most effective one as it does not take into account the actual risk of the vulnerability for IS. We want to determine which method is more appropriate, as there are several ways to assess the severity of a vulnerability. Among them, we can highlight VRSS, HTAC and the indicator "Exploitation Ration" methods. Previous evaluations of the effectiveness of vulnerability prioritization methods were focused on all identified vulnerabilities in the selected time range. The evaluations were not carried out in real environments due to a number of factors that could affect the implementation of experiment. Therefore, we decided to perform the evaluation at least on a realistic system configuration. We have selected two typical information systems that we often encounter in practice. The first is the IS of the company and the second is the IS of the web host. These systems differ in the number of programs used and in the number of vulnerabilities detected. We found out that the methods achieve different effectiveness on each system. We confirmed our hypothesis that the HTAC method, which takes into account the characteristics of attackers, is more effective than the CVSS method, as HTAC more accurately assesses the risk posed by the selected vulnerability. Larger differences in efficiency of methods revealed on systems with a larger number of open source software components. The method based on "Exploitation Ratio" indicator proved to be the most effective among all evaluated methods. This method relies on actual data on past exploits of vulnerabilities. We can conclude that this method also better reflects the actual risk that the vulnerability poses to IS.*

**Key words:** *vulnerability, security, risk, information system, prioritization method.*



## UVOD

Vsak IS je ranljiv, in sicer na več različnih načinov. Pomembno področje predstavljajo ranljivosti programske opreme (angl. Software Vulnerabilities). Kako pomembno je to področje, se lahko prepričamo ob pogledu na sezname odkritih ranljivosti. Po podatkih podatkovne zbirke NVD (*National Vulnerability Database*), ki beleži ranljivosti vseh pomembnih programskih produktov na globalnem trgu, je bilo od leta 1997 odkritih že več kot 150.000 ranljivosti. Z vidika zagotavljanja varnosti IS je zelo pomembno, da ranljivosti čim prej odkrijemo in jih odpravimo. Ker imamo na voljo le omejene vire in zmogljivosti za odpravljanje ranljivosti, ter želimo hkrati omejiti čas izpostavljenosti informacijskega sistema (IS) grožnjam, moramo ranljivostim določiti prioritete.

Obstaja več metod določanja prioritet ranljivostim pri njihovem odstranjevanju. Danes najpogosteje uporabljena metoda je CVSS (*Common Vulnerability Scoring System*) (Mell, 2007), ki je ime dobila po istoimenskem standardu za kvantitativno ocenjevanje resnosti ranljivosti. Med alternativne možnosti uvrščamo metodi VRSS (*Vulnerability Rating and Scoring System*) (Alhazmi, 2007) in HTAC (*Highest Threat Agent Count*) (Dobrovoljc idr., 2017, 26070).

Tudi učinkovitost metod lahko merimo na različne načine. Primerjave omenjenih metod že obstajajo, a so bile izvedene na splošno nad vsemi evidentiranimi ranljivostmi izbranega časovnega intervala. Idealno bi bilo, če bi vrednotenje izvedli v realnem okolju, a je to zelo težko izvedljivo. Dober kompromis v tem primeru predstavlja merjenje učinkovitosti na modelu realnega sistema.

Da bi se čim bolj približali realnim razmeram, smo v tej raziskavi oblikovali dva tipična primera današnjih informacijskih sistemov. V prvem primeru gre za IS, ki ga sestavlja programska oprema na strežnikih spletnega gostovanja. V drugem primeru je to nabor programskih orodij, ki se uporabljajo v tipičnem slovenskem podjetju. Predlagane metode določanja prioritet ranljivostim smo ovrednotili na obeh IS. Rezultate smo primerjali z ugotovitvami predhodnih raziskav (Dobrovoljc idr., 2017) na lastnem simulacijskem okolju ter ocenili praktično uporabnost predlaganih metod v praksi.

## METODE

Popoln seznam vseh odkritih ranljivosti skupaj z njihovimi ključnimi lastnostmi je na voljo v NVD podatkovni zbirki. Vsaka ranljivost je opisana z lastnostmi v obliki CVSS vektorja in pripadajoče kvantitativne ocene. Na žalost nimamo podobnega vira podatkov o vseh ranljivostih, ki so bile do sedaj izkoriščane v praksi. Kljub vsemu obstajajo nekateri viri, ki omogočajo sklepanja o izkoriščanju posameznih ranljivosti. Eden takšnih, ki se pogosto uporablja v raziskovalne namene, je zbirka EDB (*Exploit-db*).

Spletno gostovanje je storitev, ki jo danes uporablja vse več organizacij in posameznikov. Pri postavitvi svojih spletnih strani lahko izbirajo med številnimi odprtokodnimi in licenčnimi programskimi produkti. Spletna stran *Bitnami* podaja podroben pregled komponent, ki jih običajno srečamo na strežnikih za gostovanje. Na osnovi teh informacij ugotavljamo, da sestavljajo običajen IS strežnika za gostovanje naslednje komponente:

- operacijski sistem strežnika (Linux, Windows idr.),
- spletni strežnik (IIS, Apache, Nginx idr.),
- sistemi za upravljanje podatkov (MySQL, MSSQL, Postgres idr.),
- sistemi za obvladovanje vsebin (CMS, Blog idr.),
- programski dodatki in vtičniki za spletne strani.

Skladno s tem seznamom smo iz zbirke NVD izbrali ranljivosti 342 produktov in njihovih dodatkov (od skupaj 16.069 evidentiranih ranljivih produktov v zbirki NVD). Za omenjene produkte je bilo v obdobju od 2010 do 2016 odkritih in javno objavljenih 2.862 ranljivosti. Opisane so s 108 različnimi vektorji CVSS. 90 % vseh ranljivosti je opisanih s 30 različnimi vektorji CVSS. Na osnovi zbirke EDB smo ugotovili, da je med njimi 253 izkoristljivih ranljivosti.

Za opis tipičnega IS v podjetju smo izbrali večje slovensko podjetje. Na osnovi intervjuja smo pridobili informacije o standardnih produktih, ki jih podjetje dovoljuje v okviru svojega IS, ter oblikovali naslednji seznam:

- operacijski sistem Windows na strežnikih in delovnih postajah,
- programska oprema Microsoft Office,
- programsko orodje Acrobat Reader,
- spletni brskalnik Microsoft IE.

Na osnovi pridobljenih informacij smo prepoznali 11 različnih produktov. V zbirki NVD je bilo zanje v obdobju od leta 2010 do 2016 odkritih in javno objavljenih 2.909 ranljivosti. Opisane so s 67 različnimi vektorji CVSS. 90 % vseh ranljivosti je opisanih s samo 11 različnimi vektorji CVSS. Na osnovi podatkov v zbirki EDB smo ugotovili, da je med temi ranljivostmi 78 izkoristljivih.

Poleg metod CVSS, VRSS in HTAC bomo v eksperimentu ocenili tudi metodo, ki se pri določanju prioritete ranljivostim opira na podatke o izkoristljivih ranljivostih v zbirki EDB. Pri tej metodi dajemo prednost tistim ranljivostim iz zbirke NVD, katerih vektorji CVSS se v večjem deležu pojavljajo v zbirki EDB. Takšna metrika z imenom »*Exploitation ratio*« je predstavljena v (Nayak idr., 2014). Metodo, ki bo pri določanju prioritete uporabljala omenjeno metriko, bomo poimenovali CTRL.

Delež izkoristljivih ranljivosti izbranega vektorja določimo po naslednji formuli, kjer funkcija  $\text{count}(\text{vect})$  vrne število vseh vektorjev CVSS  $\text{vect}$  v zbirki ranljivosti  $x$ .

$$\text{ShareEV}(\text{vect}) = \frac{\text{count}_{\text{EDB}}(\text{vect})}{\text{count}_{\text{NVD}}(\text{vect})}$$

Učinkovitost navedenih metod bomo ocenili na obeh opisanih IS tako z vidika predvidevanja izkoristljivih ranljivosti (*ExposureEV*) kot hitrosti zmanjševanja tveganja (*RiskMitigation*). Omenjena kazalnika smo opredelili (Dobrovoljc idr. 2017, 26070). Z eksperimentom ne moremo v popolnosti zajeti realnih razmer. Naš pristop na primer ne upošteva, da nekdo lahko uporablja varnostne mehanizme in s tem zmanjša možnost izkoriščanja.

## REZULTATI

Rezultati vrednotenja metod na IS spletnega gostovanja so predstavljeni v tabeli 1, rezultati vrednotenja metod na IS podjetja pa v tabeli 2. Na sliki 1 je prikazana razlika v tveganju med metodo CTRL, ki se je izkazala za najučinkovitejšo, in metodo CVSS. Razlika v tveganju na sliki 1 je izmerjena z metriko *RiskMitigation*.

**Tabela 1. Rezultati meritev učinkovitosti metod na IS za spletno gostovanje.**

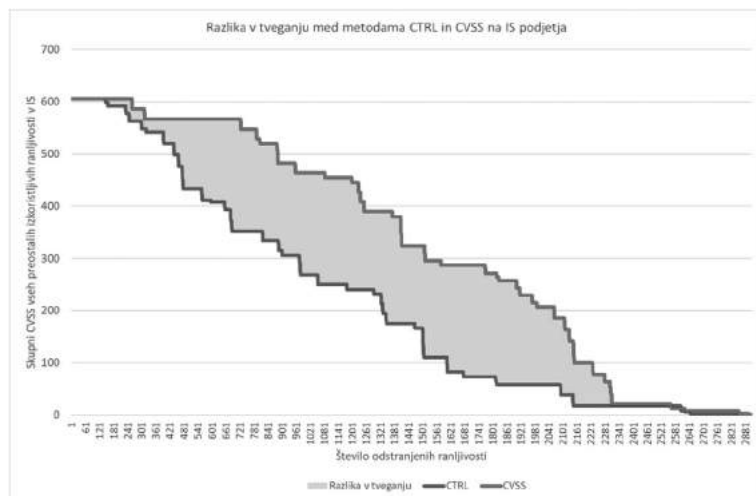
Metoda	ExposureEV	% CVSS	RiskMitigation	% CVSS
CTRL	174.876	75 %	1.014.127	80 %
HTAC	226.679	97 %	1.280.345	101 %
CVSS	232.827	100 %	1.268.065	100 %
VRSS	252.446	108 %	1.416.966	112 %

**Tabela 2. Rezultati meritev učinkovitosti metod za določanje prioritete na IS podjetja.**

Metoda	ExposureEV	% CVSS	RiskMitigation	% CVSS
CTRL	82.268	62 %	626.300	66 %
VRSS	130.343	98 %	932.655	98 %
CVSS	132.913	100 %	950.147	100 %
HTAC	155.025	117 %	1.121.867	118 %



**Slika 1 Graf prikazuje razliko v tveganju pri uporabi metod CTRL in CVSS na IS podjetja. Učinkovitejša metoda hitreje zmanjšuje tveganje (nižja vrednost kazalnika RiskMitigation).**



## RAZPRAVA

Rezultati vrednotenja metod na IS gostitelja spletnih aplikacij so precej podobni tistim, ki smo jih dobili z raziskavo v simulacijskem okolju v predhodni raziskavi. Pri merjenju s kazalnikom ExposureEV je metoda CTRL za kar 25 % boljše od metode CVSS. Po drugi strani je metoda HTAC le za 3 % boljše od metode CVSS, a še vedno učinkovitejša od metode CVSS. Pri merjenju s kazalnikom RiskMitigation je le metoda CTRL (20 %) učinkovitejša od metode CVSS.

V primeru IS podjetja se rezultati precej razlikujejo od tistih v simulaciji v prejšnji raziskavi. Metodi CTRL in VRSS sta učinkovitejši od metode CVSS. Pri merjenju s kazalnikom ExposureEV je metoda CTRL boljše kar za 38 %, pri kazalniku RiskMitigation pa za 34 %. Razlika v učinkovitosti metod VRSS in CVSS je zelo majhna (le 2 %). Metoda HTAC je dosegla slabši rezultat od metode CVSS.

Med opazovanima IS je več očitnih razlik. V primeru IS podjetja je malo produktov in večina izmed njih pripada istemu proizvajalcu (Microsoft). Njegova programska oprema je globalno zelo razširjena, kar glede na ugotovitve drugih raziskovalcev pomeni, da je zanimiva širokemu krogu oseb, ki se ukvarjajo z odkrivanjem ranljivosti (Alhazmi idr., 2007). To se kaže tudi v velikem številu odkritih ranljivosti. Po drugi strani je med njimi relativno malo izkoristljivih. Slednje lahko pripišemo velikemu interesu belih hekerjev za odkrivanje ranljivosti, saj jih večji proizvajalci nagrajujejo za to delo (»Bug Bounty« programi) (Allodi in Massacci, 2014; Miller, 2007; Schneier, 2012). Na osnovi pridobljenih informacij lahko proizvajalec hitro zagotovi zaščito ali ponudi popravek. Napadalci se zato ne trudijo z razvijanjem postopkov izkoriščanja za ranljivosti, ki jih bo težko izkoristiti. Posledično je na teh produktih manj izkoristljivih ranljivosti (Nayak idr., 2014). Funkcija izkoriščanja isExploited (Dobrovoljc idr. 2017, 26065), ki predstavlja osnovo metode HTAC, tega dejavnika ne upošteva, zato beležimo slabše rezultate. Gre namreč za dodatno komponento (de)motivacije, ki je z našim modelom ne moremo preveriti. V okviru vektorja CVSS nimamo podatkov, ki bi omogočali sklepanje o takšnem ravnanju napadalcev.

IS spletnega gostitelja je drugačen. Sestavlja ga veliko število programskih komponent številnih manjših proizvajalcev. Med njimi je tudi nekaj zelo razširjenih produktov (npr. Wordpress, Joomla, MySQL, Linux ipd.). Kljub vsemu je povprečno število odkritih ranljivosti na produkt na tem IS bistveno manjše kot pri produktih IS podjetja. Poleg tega je med odkritimi ranljivostmi bistveno več izkoristljivih, in sicer kar trikrat več. To lahko pojasnimo z dejstvom, da manjši proizvajalci nimajo na voljo sredstev, s katerimi bi lahko nagrajevali bele hekerje, zato so ti manj zainteresirani za odkrivanje. Interes napadalcev, da razvijejo ustrezne postopke izkoriščanja za odkrite ranljivosti, je po drugi strani precej večji, saj je verjetnost uspeha bistveno večja. Boljše rezultate metode HTAC lahko utemeljimo z dejstvom, da predlagana funkcija isExploited predvideva takšno ravnanje napadalcev. Naše izsledke potrjujejo tudi druge podobne raziskave. Tako na primer Nayak s sodelavci (Nayak

idr., 2014) ugotavlja, da večina izkoriščenih ranljivosti na strežnikih za gostovanje pripada spletnim aplikacijam in ne operacijskemu sistemu, kjer so nameščene. Ker je IS za spletno gostovanje že v osnovi namenjen vsem uporabnikom z dostopom do spleta, je izpostavljen zelo širokemu krogu oseb, ki lahko izkoristijo ranljivosti.

Raziskave na produktih največjih proizvajalcev programske opreme kažejo, da z vsako novo različico upade število novoodkritih izkoristljivih ranljivosti in da se hkrati zmanjšuje tudi njihov delež (Nayak idr., 2014). Še pred nekaj leti je bil pri produktih Microsofta delež izkoristljivih ranljivosti 15 %, v naši raziskavi, kjer smo zajeli le podatke iz obdobja 2010 - 2016, je ta delež le še 3 %. Pri spletnih aplikacijah, kjer se neprestano pojavljajo novi ponudniki, je ta delež znatno višji. V primeru IS za spletno gostovanje, ki smo ga ovrednotili v tem poglavju, je povprečen delež izkoristljivih ranljivosti 36 %.

Metoda CTRL se je v vseh opazovanih okoljih izkazala za najučinkovitejšo. Ker pri določanju prioritet uporablja podatke o znanih izkoristljivih ranljivostih, daje prednost tistim vektorjem CVSS, ki so pogosteje izkoristljivi. Ranljivosti v primeru IS podjetja pripadajo manjšemu številu različnih vektorjev CVSS in pri nekaterih ni prav nobene izkoristljive. Možno je, da so te ranljivosti v večini odkrili beli hakerji. Takšne anomalije metoda CTRL dobro nevtralizira, zato je učinkovitejša od drugih. S tem smo potrdili, da je metrika ExploitationRatio, ki jo predlaga Nayak s sodelavci (Nayak idr., 2014), precej uporabnejša pri ocenjevanju tveganj kot metoda CVSS.

Na osnovi zgornjih ugotovitev lahko zaključimo, da je metoda HTAC uporabna v okoljih, kjer IS sestavljajo programski produkti številnih manjših proizvajalcev in s širokim krogom uporabnikov. Ker se področje spletnih tehnologij še vedno močno razvija, lahko tudi v prihodnje pričakujemo ponudbo številnih novih programskih produktov, ki sodijo v to skupino. Po drugi strani moramo izpostaviti tudi omejitve metode HTAC. Uporaba teh metod ni priporočljiva v reguliranih okoljih, kjer je nabor programske opreme standardiziran in ga v večini sestavljajo zreli programski produkti vodilnih proizvajalcev programske opreme na svetu.

## ZAKLJUČEK

V celoti gledano smo z rezultati raziskave potrdili izsledke drugih raziskovalcev, ki ugotavljajo, da lahko z upoštevanjem lastnosti napadalcev bolje ocenimo tveganja (Ben Othmane idr., 2015). Potrdili smo ugotovitve številnih raziskav, da metoda CVSS ni najboljša pri določanju prioritet ranljivostim (Allodi in Massacci, 2014; Bozorgi idr., 2010).

Čeprav se je metoda CTRL v vseh primerih izkazala za najučinkovitejšo, obstaja problem njene realizacije v praksi. Za široko uporabo te metode bi potrebovali prosto dostopne podatke o izkoristljivih ranljivostih. V osnovi naj bi jih zagotavljal že sistem CVSS preko časovnih atributov, a so ti podatki na voljo le proti plačilu pri nekaterih ponudnikih tovrstnih vsebin. Nekaj časa so bili prosto dostopni v podatkovni zbirki OSVDB, a je ta prenehala delovati. Problem pomanjkanja tovrstnih podatkov izpostavljajo številni strokovnjaki s področja varnosti (Holm in Khan, 2015).

Izsledki naše raziskave so koristni predvsem za proizvajalce skenerjev ranljivosti, ki prioritete še vedno določajo na osnovi ocen CVSS. Metodi CTRL in HTAC sta se namreč v določenih primerih izkazali za učinkovitejši od metode CVSS.

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## **COVID-19 IN NJEGOV VPLIV NA UPORABO INFORMACIJSKIH TEHNOLOGIJ V SLOVENSКИH MAJHNIH IN SREDNJIH PODJETIJ**

### **COVID-19 AND ITS INFLUENCE ON THE USE OF INFORMATION TECHNOLOGIES IN SLOVENIAN SMALL AND MEDIUM ENTERPRISES**

#### **POVZETEK**

*Covid-19 je temeljito posegel v poslovanje podjetij in organizacij. Nastala je nova poslovna realnost, ki je digitalna in virtualna in temelji na veščinah in znanjih informacijsko-komunikacijskih tehnologij, kompetenc in rešitev. S tem se pri upravljanju/managementu postavljajo ključne dileme, kako prilagoditi organizacijo in le-to ustrezno opremiti z orodji in postopki, ki jih prinašajo nove razmere. V prispevku opisujemo nekaj rešitev in hipotez, ki smo jih zasnovali na podlagi razgovorov z vodstvi podjetij.*

**Ključne besede:** digitalne tehnologije, Covid-19, digitalna transformacija, odprtokodne rešitve, informatizacija organizacij

#### **ABSTRACT**

*Covid-19 has thoroughly intervened into business and core of the management of companies and organizations. A new business reality has emerged. This reality is digital and virtual and based on the skills and knowledge of information and communication technologies, competencies and solutions. Latter raises key dilemmas for management. How to adapt the organization? How to equip it properly with the appropriate tools and procedures in the new situation? In this paper we are describing some solutions and hypotheses that we have designed based on interviews with management board of small sized and medium companies in Slovenia.*

**Keywords:** digital technologies, Covid-19, digital transformation, open source solutions, informatization of organizations

## UVOD

Svetovna pandemija Covid-19 je temeljito zamajala načine poslovanja podjetij in organizacij. Večino so spremembe presenetile le delno ali slabo pripravljene na poslovanje v novih okoliščinah.

Nova poslovna realnost je digitalna, virtualna, elektronska. Temelji na IT znanjih, kompetencah in rešitvah. Spremembe krize niso začasna, ampak nova normalnost. Managementu se postavljajo ključne dileme, kako prilagoditi organizacijo in le-to oborožiti z ustreznimi orodji ter postopki, ki jih prinašajo nove razmere («European comission» 2020).

Namen pričujoče raziskave je oceniti pripravljenost slovenskih podjetij pri tem. Iz tega sledi cilj oblikovati nekatere splošne smernice za postopke digitalne transformacije v luči zahtev Covid-19 ukrepov ter na podlagi izkušenj iz prakse vodstvom predlagati nekatera odprtokodna orodja in postopke za poslovanje v novem času in razmerah, ki so prišle.

V prispevku smo izhajali iz splošne ocene, da spremembe ob krizi niso začasne, temveč so postale nova realnost ter da so podjetja, kljub že začetim procesom digitalne transformacije, slabo ali le delno pripravljena na nove pogoje poslovanja. Omejitve fizičnih stikov, potovanj, gospodarskih aktivnosti bodo kot kaže ostale, ponovno pa se bodo vračale ob napovedanih nadaljnjih valovih.

## METODE

Ocene pripravljenosti slovenskih podjetij na razmere, težave in dileme, s katerimi se srečujejo pri poslovanju v Covid-19, smo se lotili s pomočjo razgovorov z vodstvi in predstavniki informacijskih oddelkov podjetij. S pomočjo razgovorov in odgovorov na nekatera standardna vprašanja ter njihovo videnje in samoocene, smo oblikovali nekatere splošne zaključke o pripravljenosti podjetij na ta čas.

V nadaljevanju podajamo nekaj splošnih smernic za postopke digitalne transformacije v tej novi luči, ki smo jih oblikovali na podlagi lastnih izkušenj in primerov iz prakse .

## REZULTATI

Po prvem šoku ob poslovni krizi razsajanja Covid-19, po prvih ukrepih za zajezitev in zagotovitev vsaj kolikor toliko normalnega poslovanja ter nekajtedenskem času za premislek je večina podjetij ugotovila naslednje.

***Ugotovitev: Spremembe ob krizi niso začasne, temveč so postale nova realnost. Omejitve fizičnih stikov, potovanj, gospodarskih aktivnosti bodo ostale, ponovno se bodo vračale ob napovedanih nadaljnjih valovih.***

Organizacije in podjetja tako navajajo:

- Enostavni ukrepi za oddaljen dostop do elektronske pošte in dokumente so sicer za silo pokrpali poslovanje, ampak na splošno ne poslujemo enako učinkovito, rešitve so začasne;
- čeprav se zdaj počasi omejitve sproščajo, se bodo pojavili naslednji valovi (kot sedaj v Singapuru) in stroge omejitve bodo spet v veljavi;
- prihaja nova realnost, nič ne bo več tako kot prej, torej ne bodo pomagale začasne rešitve, potrebno se je pripraviti korenito;
- nekako bo treba organizirati notranje delovanje podjetja za oddaljeno delo in komunikacijo s strankami;
- prilagoditi bo potrebno marketinške in trženjske aktivnosti in v večji meri izkoriščati možnosti e-poslovanja, spletnih prodajnih kanalov in marketinškega pristopa;
- naštop na trgu bo treba prilagoditi, saj sedanji način dela ne bo zadostoval (poslovalnice bodo občasno zaprte, stranke se izogibajo fizičnim stikom, vse bolj so navajeni na splet in poslovanje na spletu);
- tudi aktivnosti naši konkurentov (in vzornikov, principalov) se vse bolj selijo na splet;
- potrebno je strateško uvajati e-poslovanje in e-marketing.

Pri tem so organizacije izpostavljale naslednje dileme in vprašanja:

- Katera varna in zanesljiva orodja uporabljati in kako zaščititi podatke pri virtualnem sodelovanju?
- Motivacija in usposabljanje sodelavcev za oddaljeno delo, prodajo in ...;
- kako hitro in učinkovito uvesti spletno prodajo ali atraktivne kataloge;
- s strankami in uporabniki je potrebno biti v vsakodnevnem stiku. kako s pomočjo tehnologije preskočiti omejitve – video konference;
- predstavitve, informiranje ali izobraževanje na daljavo;
- kako s pomočjo digitalnih orodij (sporočila, dokumenti, skupno delo na dokument, video in avdio konference) organizirati delo sodelavcev pri delu od doma in drugih oddaljenih lokacij;
- s katerimi orodji načrtovati in izvajati marketinške in prodajne aktivnosti (CRM, marketing, spletna stran, mailingi, sestanki);
- in projektne sestanke z naročniki in kupci.

Kot ključna skrb vodstev se oblikuje vprašanje, kako preoblikovati organizacijo in jo oborožiti z orodji in procesi na način, da bo bolj odporna, prilagodljiva in sposobna preživeti v novih okoliščinah.

Organizacija in procesi poslovanja, trženjske in prodajne aktivnosti se morajo prilagoditi in postati temu primerne, to je odporne na prihodnje pretrese.

Če odštejemo proizvodne procese in nekatere storitve, večina podjetij in zaposlenih dela v digitaliziranih delovnih okoljih. Ob ustrezni organizaciji in dobri IT podpori lahko opravljajo večino svojega dela enako učinkovito in dobro ne glede na fizično lokacijo. Le skupna malica ali kava odpadeta, ampak to je v času krone tako ali tako omejeno.

V zadnjih letih in desetletju je postalo sodelovanje, komuniciranje in učenje na daljavo nekaj vsakdanjega, sprejemljivega in izvedljivega. Tudi v poslovnem svetu je postal pojem »remote« večinoma domač. Elektronska pošta je postala »storitev« tudi na telefonih in domačih računalnikih, deljenje datotek preko različnih servisov (Drive), storitve video in zvočnih klicev med sodelavci (Skype, Zoom, Signal), pa orodje za posamezne bolj iznajdljive uporabnike. Bolj napredne skupine delijo dokumente v oblaknih rešitvah (Google Docs).

V resnici večina podjetij in posameznikov tovrstne tehnologije še vedno uporablja le delno, izjemoma, za določene potrebe. Ne glede na vse, korenitega premisleka o funkcionalnih zahtevah in znanja o varnostnih vidikih ni dovolj. Izbor je odvisen od uporabnikov, rešitve se podvajajo za enake naloge, varnostno se izpostavljajo ključne komunikacije in informacije v podjetju. Pri sodelovanju v prostorih podjetja, v oddaljenih (remote) skupinah ali s strankami in partnerji, se uporabljajo različne rešitve za enake naloge. Zato so korenite spremembe poslovanja in sodelovanja ob izbruhu bolezni Covid-19 presenetile marsikatero podjetje in po nepotrebem upočasnile (so)delovanje.

Digitalne rešitve in organizacija virtualnega timskega dela so ena izmed pomembnejših organizacijskih tem v organizaciji. Podpirati in vsebinsko razumeti jo mora predvsem vodstvo in vsi sodelujoči. Morebiti je potrebno nekoliko spremeniti procese in načine (so)delovanja, vsi sodelavci se morajo vključiti v učinkovito spoznavanje in uporabo sodelovalnih rešitev. Vsekakor pa je rezultat lahko boljše delovanje tudi v takšnih kriznih razmerah.

***Nasvet: Organizacije naj izkoristijo sedanje razmere za razmislek in organizacijo virtualnega (so)delovanja ter uvajanje sprememb in orodij.***

Digitalizacija in spremembe v poslovanju organizacij so popularna tema, a za korenite spremembe so se, kot smo že ugotovili, velikokrat našle ovire. V izrednih situacijah, ko smo prisiljeni spremeniti način dela in organizacijo, se izkaže, da so to tako le izgovor in (podzavesten) strah pred spremembami. Lep primer v slovenskem prostoru je izobraževanje na daljavo, ki je bilo vedno prisotno, a uporabljali so ga le redki navdušenci. Z zaprtjem šol je doživel večji razcvet in večjo uporabo kot v zadnjih 10 letih skupaj. Zaradi navedenega izobraževanje po tej krizi nikoli več ne bo enako, kot je bilo do sedaj.

Tudi poslovanje podjetij nikoli več ne bo enako, kot je bilo pred krizo. Podjetja so prisiljena v nove spremembe sodelovanja in poslovanja, da preživijo.

***Nasvet: Organizacije so prisiljene v spremembe sodelovanja in poslovanja na virtualni način. Naj le-te ne bodo le krizni ukrep, temveč trajne spremembe organizacije in orodja, ki bodo kratkoročno omogočila preživetje, dolgoročno pa povečano agilnost, konkurenčno prednost in nižje stroške.***

Osnova učinkovite organizacije virtualnega timskega dela so ustrezne IT rešitve. V nadaljevanju bomo opisali nekaj takšnih rešitev za vsakodnevno uporabo, ki so na voljo tudi v ponudbi oblaci storitev ElasticBox.eu (»Connect with future« 2020).

### **Sporočilne in sodelovalne platforme za oddaljeno delo in podporo timom**

Zahteve sodobnega dela digitaliziranih delovnih mest in sodelovanje sodelavcev so že zdavnaj presegle možnosti, ki jih nudi elektronska pošta. Rešitve elektronske pošte, ki vključujejo tudi skupne koledarje in imenike, so le delna izboljšava sicer klasične elektronske pošte.

Sprotno (instant) obveščanje, pogovori (chat), delitve v organizacijske ali projektne time, popolna varnost, zasebnost vsebin ter možnost vključevanja zunanjih storitev omogočajo učinkovito, varno sodelovanje. Ne glede na fizično lokacijo članov tima, sosednja pisarna, domača pisarna ali na poti v tujini, vedno delujejo kot učinkovit in povezan tim.

Na voljo je precej komercialnih rešitev, najbolj znana in med poslovnimi uporabniki uporabljena je MS Teams (»Microsoft Teams« 2020). Med razvijalci programske opreme in DevOps informatiki pa Slack (»Build stronger relationships« 2020). Obe sta na voljo kot plačljivi spletni storitvi. Značilnost tovrstnih storitev je, da združujejo več komunikacijskih in organizacijskih načinov ter so na voljo tako na namiznih računalnikih kot tudi prenosnih napravah (telefoni, tablice, prenosniki).

**Nasvet:** *Pred izbiro sodelovalne platforme naj organizacije pregledajo razpoložljive možnosti, ocenijo zmogljivosti, varnost podatkov, tveganja izpadov in stroške uporabe. Odločajo naj se z mislijo na varnost in zasebnost, dolgoročne učinke in ne na podlagi informacij da »tudi v sosednjem podjetju uporabljajo take in take rešitve«.*

Na voljo so številne odprtokodne rešitve, ki jih odlikuje zmogljivost, varnostna garancija ter standardiziranost in odprtost. Za povrh jih lahko namestimo v varnem okolju lastnega podjetja (torej zaščitene s požarnimi pregradami), ali jih uporabljamo kot storitev v lokalnem oblaku.

**Nasvet:** *Novo sodelovalno rešitev naj organizacije ponudijo svojim uporabnikom kot priložnost za večjo učinkovitost in povezanost. Vzpodbudijo naj jih k enostavnejšemu in bolj strukturiranemu komuniciranju znotraj podjetja, dobili bodo mnogo bolj kakovostne informacije.*

V podjetju smo že dolgo pred krizo začeli uporabljati odprtokodno rešitev Mattermost (»High trust collaboration for your enterprise« 2020), ki jo uporabljajo tudi številna globalna podjetja. S smiselno organizacijo posameznih organizacijskih timov (prodaja, razvoj, podpora, administracija) in projektnih timov (interni, razvojni in projekti za stranke) smo vanjo vključili vse sodelavce, ki sedijo na različnih lokacijah po Sloveniji, vključno z občasnimi zunanjimi projektnimi sodelavci.

Naše izkušnje: Raven sodelovanja in učinkovitost se je občutno dvignila, pretok in kakovost informacij sta se povečala, predvsem pa smo ustvarili enovito virtualno delovno okolje, ki je varno na voljo ne glede na tip naprave in lokacijo uporabnika. Uporabniki so brez posebnega uvajanja hitro spoznali prednosti MM pred uporabo zgolj elektronske pošte, ki pa ostaja sporočilni sistem za povezovanje z zunanjim svetom.

Mattermost uporabljamo kot storitev v oblaku ElasticBox.eu,

### **Dokumentne in sodelovalne oblaci rešitve za oddaljeno delo in podporo timom**

V okolju sodobnih digitaliziranih delovnih mest in sodelovanja sodelavcev v projektnih timih in organizacijskih oddelkih se večina procesov in kreativnih razmišljanj vrti okoli sodelovanja pri ustvarjanju in usklajevanju elektronskih dokumentov. Projektne dokumentacije in načrti, poročila deležnikom, računovodsko-finančni dokumenti vključujejo najrazličnejše deležnike, z različnimi pravicami, vpogledi in dostopnostjo. Vključujejo zaposlene in sodelavce v podjetju, deležnike pri naročnikih in druge zunanje partnerje, velikokrat ne samo da fizično niso na istem mestu, temveč so tudi v različnih časovnih pasovih.

Rešitve sodelovanja dokumentnega sodelovanja, ki temeljijo na deljenju dokumentov v podjetju in jih uporabljajo v veliko slovenskih podjetjih, niso primerne za podporo tako razpršenim timom. Ne podpirajo varnega vključevanja zunanjih sodelavcev in deležnikov s točno določenimi pravicami in dostopom.

Sodobni virtualni timi, bodisi projektni ali organizacijski, zahtevajo varno in nadzorovano virtualno platformo, ki je dostopna od koderkoli, z običajnimi orodji in spletnimi brskalniki. Vsakemu uporab-

niku lahko dodelimo nadzorovan in ciljno usmerjen dostop do zanj pomembnih vsebin. Sodelovanje vključuje tudi urejanje dokumentov preko brskalnika, kjer za delo uporabniki ne potrebujemo pisarniškega paketa MS Office («Predstavitev okolja Microsoft 365» 2020) ali LibreOffice («Prost, odprt pisarniški paket» 2020). Urejanje pa ni omejeno le na dokumente, temveč tudi na skupno oblikovanje miselnih vzorcev ali projektih nalog.

Pomembno je spremljanje dostopov in sprememb do dokumentov, kdo je kdaj in kaj videl in spremenil. Z uporabo šifriranih komunikacij lahko delimo tudi poslovno zaupne dokumente. Za poslovne uporabnike je pomembna tudi razpoložljivost storitve in varnost ali lokacija dokumentov. Po eni strani ni smiselno naložiti internemu IT oddelku dodatnega dela, po drugi strani pa je hramba dokumentov nekje v »javnih oblakih« sila tvegana. Tem zahtevam ustrezajo poslovne rešitve, ki jih gostijo v svojih oblakih različni ponudniki.

Na voljo je kar nekaj komercialnih rešitev, najbolj znana in med poslovnimi uporabniki uporabljena je MS Teams in MS Office365. Ali med (za osebno uporabo) brezplačnimi Google Suite («Introducing Google Workspace» 2020). Obe sta na voljo kot plačljivi spletni storitvi. Značilnost tovrstnih storitev je da, združujejo več komunikacijskih in organizacijskih načinov ter so na voljo tako na namiznih Pcjih, kot tudi prenosnih napravah (telefoni, tablice, prenosniki).

**Nasvet:** *Pred izbiro dokumentne sodelovalne platforme naj organizacije pregledajo razpoložljive možnosti, ocenijo zmogljivosti, varnost podatkov, tveganja izpadov in stroške uporabe. Odločajo naj se z mislijo na varnost informacij in dokumentov, kje se hranijo, kakšna je zasebnost uporabnikov, zasledujejo dolgoročne učinke in se ne odločajo na podlagi informacij da »tudi v sosednjem podjetju uporabljajo take in take rešitve«.*

Mnogo odprtokodnih rešitev izpolnjuje vse zahteve po varnosti, prilagodljivosti, podpori standardom in funkcionalnosti. Za povrh jih lahko namestimo v varnem okolju lastnega podjetja (torej zaščitene s požarnimi pregradami) ali jih uporabljamo kot storitev v lokalnem oblaku. Med temi je najbolj razširjena rešitev NextCloud («Regain control», 2020), ki jo za varno izmenjavo dokumentov med organi v državni upravi uporablja tudi nemška zvezna vlada. Številne odlike NextClouda pokaže primerjava z dražjimi in drugačnimi rešitvami.

**Nasvet:** *Novo dokumentno sodelovalno rešitev naj organizacije opremijo z dodatnimi orodji za bolj učinkovito delo in jo ponudijo uporabnikom kot priložnost za večjo povezanost. Vzpodbudijo naj jih k učinkovitejšemu sodelovanju z zunanjimi partnerji in bolj strukturiranemu komuniciranju znotraj podjetja.*

V podjetju smo že mnogo pred krizo uporabljali NextCloud za podporo projektne delu in sodelovanju z naročniki ter partnerji. Pomembna orodja, ki so nas prepričala so Nextcloud Files (Enterprise File Sync and Share), Nextcloud Talk (Calls, chat and web meetings), Nextcloud Groupware (Calendar, Contacts & Mail).

Rešitev je navdušila tudi naše partnerje in stranke, ki so tudi pri svojem delu izbrali NextCloud kot osrednjo platformo za skupinsko delo. Bolj zahtevni ga uporabljajo kot namestitev v lastnih podatkovnih centrih, prilagodljivejši pa kot storitev v oblaku ElasticBox.eu.

**Naše izkušnje:** *NextCloud je odlična sodelovalna rešitev, ki podpira različne naloge, vključno z varnim shranjevanjem podatkov v oblaku. Z njeno uporabo hitreje in bolj učinkovito sodelujemo predvsem z zunanjimi člani, dostopnost dokumentov ter pretok in kakovost informacij so se povečali, predvsem pa smo ustvarili enovito virtualno dokumentno okolje, ki je varno na voljo ne glede na tip naprave in lokacijo uporabnika. Uporabniki cenijo prednosti NextClouda pred plačljivimi ali javnimi storitvami kot so Office365 ali Gsuite.*

## RAZPRAVA

Digitalizacija in spremembe v poslovanju organizacij so popularna tema, a za korenite spremembe so se mnogokrat našle ovire. V izrednih situacijah, ko smo prisiljeni spremeniti način dela in organizacijo, pa se izkaže, da so to le izgovor in (podzavesten) strah pred spremembami. Lep primer v slovenskem prostoru je izobraževanje na daljavo, ki je bilo vedno prisotno, a uporabljali so ga le redki navdušenci. Z zaprtjem šol in okoliščinami je to doživelo večji razcvet kot v zadnjih 10 letih. Izobraževanje po tej krizi tako nikoli več ne bo enako, kot je bilo do sedaj.



Ravno tako velja za poslovanje podjetij. Podjetja so prisiljena v spremembe sodelovanja in poslovanja, da preživijo.

Seveda pa se pri tem postavlja vprašanje primernih pristopov, konceptov digitalizacije ter primernosti posameznih rešitev za določeno organizacijo.

V prispevku smo skušali predstaviti nekatere pristope in konkretne odprtokodne rešitve, poudariti njihove prednosti in navesti ugodne izkušnje pri njihovi uporabi.

Ob tem se zavedamo, da ob splošnih smernicah za ukrepanje, obstaja več možnih rešitev oz. orodij, ki jih organizacije lahko uporabijo. V primerih in nasvetih smo tako navedli vire iz prakse, ki so se do sedaj izkazali za učinkovite in uporabne.

## ZAKLJUČEK

Splošne ocene za spremembe ob krizi nisočasne, temveč so postale nova realnost pri čemer so podjetja, kljub že začetim procesom digitalne transformacije, slabo ali le delno pripravljena na nove pogoje poslovanja. Omejitve fizičnih stikov, potovanj, gospodarskih aktivnosti ne bodo izginile, temveč se bodo v nekem daljšem časovnem obdobju ponovno vračale ob napovedanih nadaljnjih valovih. Organizacije in podjetja ugotavljajo, da so pri tem enostavni ukrepi sicer za silo »pokrpali« poslovanje, ampak, da na splošno ne poslujejo enako učinkovito. Menijo, da te rešitve niso lečasne, omejitve se sicer sproščajo, a se bodo pojavili naslednji valovi. Tako ocenjujejo, da nastaja nova realnost – kjer nič ne bo več tako kot doslej, zato se je potrebno pripraviti korenito in organizirati notranje delovanje podjetja za oddaljeno delo in komunikacijo s strankami, prilagoditi marketinške in trženjske aktivnosti ter v večji meri izkoriščati možnosti e-poslovanja, spletnih prodajnih kanalov in marketinškega pristopa. Pri tem podčrtujemo navedene ključne dileme s področja razvoja, upravljanja in motivacije kadrov in razvoja (digitalnih) delovnih mest, spletne prodaje in e-poslovanja, digitalne prodaje ter internega in eksternega projektne delovanja. Pri tem kljub pretresom v poslovanju ugotavljamo, da so na voljo smernice, dobre prakse in mnoga orodja za spopad in prilagoditev novim razmeram, ki smo jih na podlagi izkušenj na kratko opisali.

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## **UPORABA DIGITALNIH TEHNOLOGIJ ZA NAMENE IZRAZNOSTI UMETNIKA, PODROČJE PLESA**

### **POVZETEK**

*V tem prispevku bomo pregledali nekatere ugotovitve za uporabo digitalnih tehnologij pri promociji in delu umetniškega poklica na področju plesne umetnosti. Izhajali bomo iz ugotovitev in spoznanj, ki smo jih pridobili pri projektu Izraznost umetnika v sodobnih medijih, študentskem inovativnem projektu iz programa Študentski inovativni projekti za družbeno korist, izvedenega v študijskem letu 2019/2020, ki sta ga sofinancirala Ministrstvo za izobraževanje, znanost in šport in Evropska unija iz Evropskega socialnega sklada.*

*Ključne besede: digitalne tehnologije, splet, umetnost, ples*

### **ABSTRACT**

*In this paper, we will review some findings for the use of digital technologies in the promotion and work of the artistic profession in the field of dance. We will origin from the findings gained from the project Expressiveness of the artist in contemporary media, a student innovative project from the program Student innovative projects for social benefit implemented in the academic year 2019/2020, co-financed by the Ministry of Education, Science and Sport in Slovenia and European Union from the European Social Fund.*

*Key words: digital technologies, web, art, dance*



## PRISPEVEK

Tehnologija je del našega vsakdana, obenem pa tudi globalnega procesa širjenja informacij. Številni avtorji z različnih področijh so se in se ukvarjajo s tehnologijo, njenim pomenom ter vplivi na posameznika in družbo. S tega vidika ima dobre in slabe strani, velja pa, da ves čas napreduje, se spreminja in nadgrajuje. Lahko bi rekli, da je ves čas v gibanju in nekem nenehnem procesu izboljševanja. Na strani uporabnikov pa je, da ta proces prepoznamo, da ga skušamo razumeti ter v povezavi s tem tudi delujemo, da smo, povedano z drugimi besedami, ves čas pozorni na ta nenehno razvijajoči se proces.

S tega pogleda je ključno, da prepoznamo prednosti, ki nam jih uporaba tehnologije nudi. Lahko si jo predstavljamo kot orodje ali bolje kot pomočnika, morda posrednika pri predstavitvi idej in sporočil širši skupnosti, poslušalcem, svetu. Tega pomočnika je potemtakem dobro primerno uporabiti, zato je z vidika ustvarjalca k temu dobro pristopati čim bolj odprto, ustvarjalno, izvirno; pri tem je potrebno iskati nove možnosti za kombinacijo tehnologije in umetnosti ter predvsem za prikaz umetniškega izraza, ki ga lahko zajamemo s pomočjo tehnologije. V ta namen je dobro uporabiti domišljijo in videti možnosti uporabe tehnologije ter umetniškega ustvarjanja, tako lahko izdelamo zelo zanimiv in inovativen umetniški projekt. Motivacija je toliko večja, ker imamo na dlani splet - nesluten vir in možnosti dostopa do občinstva.

V tem prispevku bomo poskušali navesti ugotovitve, ki bodo v pomoč pri delu in učenju plesalcev, študentov, predvsem pri soočanju z uporabo tehnologije; spleta, socialnih omrežij in drugih platform. Delno bomo izhajali iz spoznanj raziskovalcev, navedenih v virih, ter predvsem iz analize dela Berlinske filharmonije in njenega pristopa k uporabi (digitalne) tehnologije (Levin 2020). Pri tem je še posebej zanimivih več Adornovih misli (Álvaro 2018), kot je na primer, da se zvočni zapis glasbe uprizorjeni, živi glasbi oziroma uprizoritvi (zdaj posneti) v resnici na nek način spremeni njen status. Živa glasba namreč ne more biti enostavno »vklapljena« ali ponavljana na neki ukaz, ampak je vezana na specifični čas in kraj; kot pravi, se to odraža kot neka »izguba tretje dimenzije«. Na drugi strani pa misel nadaljuje z močno trditvijo, da posnetek glasbe, tedaj na plošči, omogoča, da glasbo prvič sploh posedujemo kot stvar, česar ni jemal v negativnem smislu, temveč v pozitivnem, saj nam na ta način v bistvu tehnologija omogoča glasbo preleti v svojevrstno besedilo oziroma zapis.

Izhajajoč iz teh misli in drugih izkušenj je zato izrednega pomena, da do uporabe tehnologije pristopamo odprto in da smo pripravljeni odkrivati možnosti uporabe. Zavedati se moramo zahtevnosti celotnega procesa, zato je na mestu tudi prevpraševanje lastnega dela ter nasploh natančnost in doslednost.

S tehnologijo smo tako vsakdanje povezani. Če pa se odločimo, da jo bomo temeljiteje in dosledno uporabili tudi pri svojem poklicnem delu oziroma profesionalnem udejstvovanju, predvsem na primer za samopromocijo kot ustvarjalec / umetnik / plesalec, pa v nadaljevanju prispevka navajamo nekaj pomembnih spoznanj in vsebin, ki lahko posamezniku pri tem pomagajo in smo jih raziskali v okviru projekta Izraznost umetnika v sodobnih medijih (Alma Mater Europaea - ECM 2020)

Začeli bi lahko s temeljitim načrtovanjem, s projektnim načrtovanjem, saj dejansko načrtujemo svojo podobo umetnika na spletu, kjer želimo svoje sporočilo posredovati čim več ljudem, enako velja tudi za druge vsebine, naš namen pa je iz tega tudi nekaj pridobiti. Zanima nas torej, kako se dobro predstaviti na spletu kot umetnik, kako pri tem uporabljati tehnologijo v svoj prid, kako sploh delovati s tehnologijo ter kako vse omenjeno povezati in ustvariti lasten izraz in prepoznavnost.

Pomembno je torej načrtovanje našega dela in organiziranost. V ta namen je v začetku priporočljivo pripraviti jasen načrt predvidenega dela, ki bo omogočal pregled nad delom, urejenost in strukturanost. Začetek vsega je lahko t.i. viharjenje (brainstorming), kjer zbiramo čim večje število idej o našem predvidenem projektu. Po določenem času se ustavimo, pregledamo ideje, izberemo najboljše in jih v nadaljevanju razvijemo. Viharjenje je na splošno izredno uporabna tehnika, ki nam pomaga priti do velikega števila idej in odgovorov. Ti so lahko tudi izredno zanimivi ter pomembni za nadaljnje delo in raziskavo.

Vsak zase lahko premisli o namenu in ciljih uporabe tehnologije. Na tem mestu torej izpostavljamo predvsem pomen tehnologije za plesalce kot promocijsko sredstvo. Tu imamo v mislih različne možnosti, od avdio-vizualnega snemanja do uporabe spleta, ki zares nudi mnogo možnosti sodelovanja. Z uporabo tehnologije - spleta in različnih spletnih strani, socialnih omrežij se informacije širijo

zelo hitro, njihov doseg je ogromen, širijo se globalno; gre na nek način za zelo učinkovito in tudi ugodno (finančno) komunikacijo, oziroma promocijo. Ne glede na to pa je najprej zelo pomembna dobra priprava ter načrt našega dela.

V nadaljevanju si oglejmo dve pomembni lastnosti, ustvarjanje kvalitetne vsebine in širjenje obsega našega občinstva. Ti dve lastnosti sta med seboj jasno povezani. Za ustvarjanje finančnega dohodka in prepoznavnosti na spletu je najprej potreben omenjen projektni načrt, nato pa sledita čas in vztrajnost. Gre namreč za nenehno se spreminjajoč in živ proces. Posebej pomembna pri tem je skrb za kakovost lastnih izdelkov in celotnega dela; k temu spada naša celostna podoba in seveda tehnične podrobnosti, kot na primer kvaliteta zvoka in slike. Kakovost vsebine, naša natančnost in doslednost obenem tudi pomagajo in prispevajo k pridobivanju novega občinstva (a imejmo pri tem realna pričakovanja).

Razmislimo najprej, komu vse bi naše znanje / informacije lahko koristile. Definirajmo naše ciljne skupine in širimo svoje delo. Sodelujmo in povežemo se z različnimi posamezniki, skupinami in organizacijami. Podprimo drug drugega. Pri tem veljajo karakteristike, kot so: izvirnost, iznajdljivost, ustvarjalnost.

Naštete karakteristike imajo enak pomen kot biti prisoten na različnih omrežjih. Pomembno je torej ustvarjati zanimive vsebine ter k ustvarjanju ves čas pristopati na izviren način. Kot ustvarjalec lahko za samopromocijo uporabimo raznolike spletne strani, omrežja, ki nam na različne načine pomagajo širiti naše sporočilo; za deljenje glasbe in videa na primer YouTube, za širjenje fotografij Instagram, ter za raznolike mešane vsebine Facebook.

Za stik z občinstvom, prisotnost na spletu in deljenje informacij o svojem delu je lahko zelo koristno tudi pisanje spletnega dnevnika. Tako smo v dokaj neposrednem stiku s svojim občinstvom, s katerim lahko delimo kar želimo, obenem pa je to tudi sredstvo za pridobivanje novih sledilcev, ki jih bo privabil naš zapis. Seveda pa ima to lahko velik pomen za ustvarjalce same, saj (aktivno in redno) pisanje dnevnika zelo pomaga pri delovnem procesu ustvarjalca – tako pri strukturiranju misli in načrtovanju dela kot tudi pri celostnem pregledu nad delom, njegovo analizo: jasno lahko vidimo potek našega dela ter imamo možnost kadarkoli pogledati nazaj, to ovrednotiti, ali le znova pregledati.

Zelo pomembno je tudi raziskovanje in ustvarjanje. Raziskovanje kombinacij, povezav, novih možnosti. Kako združiti umetnost in tehnologijo? Kakšne pristope ubrati? Ker smo vsi precej v stiku s tehnologijo že v vsakdanjem življenju, lahko začnemo enostavno: uporabimo izkušnje, ki jih imamo z osebnim mobilnim telefonom, ter snemanjem in fotografranjem z njim; te izkušnje naj bodo osnova za snemanje lastne video produkcije. Za zadostno kvaliteto video posnetka bo popolnoma zadostoval pametni telefon; če je ta iz srednjega ali višjega cenovnega razreda, pa imamo kar precej dobro sliko tako že zagotovljeno. Za primer snemanja neke dejanske koreografije predlagamo mobilnik; glasbo se lahko posnetku ločeno doda v programu (morda priporočljivo zaradi boljše kvalitete zvoka, ki je sicer pomembnejši kot slika v medijski produkciji).

Zavedanje pomembnosti, da nam tehnologija omogoča ta zapis (kakor črke ta prispevek na primer, ali bolj natančno avdio-vizualen zapis, snemanje) pomembno prispeva k nastanku prvega zvočnega in video zapisa ter predstavlja nove in raznolike možnosti za ples. Šele s tem pride do novih možnosti nekega celovitega zapisa koreografije.

Umetniški video nudi mnogo možnosti za izvirno umetniško ustvarjanje (kombinacija videa oz. filma ter plesa – koreografije in običajno tudi glasbe, zvoka). Predlagamo »sestop iz okvirjev« in čim bolj široko ter odprto mišljenje – to področje namreč vsebuje še precej »neodkritega« – iščimo torej, raziskujmo, ustvarjajmo nove ideje. Z raziskovanjem bomo prišli do ugotovitev, spoznanj, morda novih rešitev, ki nam bodo, vsaka na svoj način prišla prav pri delu v prihodnje. Pri tem si oglejmo tudi delo podobnih ustvarjalcev, oziroma se seznanimo z načinom, kako oni pristopajo k uporabi tehnologije, spletnih/socialnih omrežij. Analizirajmo in vrednotimo svoje delo, nadgrajujmo svoje znanje, raziskujmo, povežemo se z drugimi, sodelujmo. Sodelujmo z ustvarjalci, umetniki (s katerimi soustvarjamo projekte), sodelujmo z različnimi organizacijami (možnosti za dogovore o donatorskih / sponzorskih sredstvih) in seveda tudi z občinstvom.

Za zaključek povzemimo nekaj bistvenih stvari, za katere menimo, da je dobro, da jih umetnik, ustvarjalec, plesalec, študent, ki se sooča z uporabo tehnologije in predvsem z izzivom spletne samopromocije na spletu ter na raznolikih pripadajočih platformah, upošteva. Poudarimo izredno pomembnost in dobro pripravo, načrt dela; nadaljujmo z učenjem in nadgradnjo svojega znanja

(tehnologija se namreč hitro razvija in spreminja in moramo živeti z njo). Bodimo torej prisotni, dobro je tudi, da so naše objave oziroma pojavljanja redni, pogosti. Priporočamo tudi doslednost pri objavljanju vsebin na spletu ter iskrenost, predvsem v našem umetniškem izrazu. Pomembno je ustvarjati kvalitetne vsebine (predvsem vsebinsko, in tudi tehnično), pomembno je, da smo pri tem ustvarjalni in izvirni, ter da iščemo nove pristope ter rešitve. Posameznik naj torej premisli o svojem (spletnem) občinstvu; naj poskusi pridobiti novo občinstvo, naj širi poznanstva, obiskuje podobne stvari in ohranja stike; pri tem velja razmisliti o tem, kdo je ciljna publika za posameznika in »kje« jo iskati, prav tako razmisliti o pristopu do mladih. Nadalje je pomembno sodelovanje in povezovanje ter na drugi strani vrednotenje, predvsem lastnega dela, kar nam omogoča nenehno rast in razvoj, in nazadnje tudi vrednotenje. Le s tem pregledom lastnega dela ter preučevanjem novih spoznanj bomo ustvarili najboljše, kar znamo.

## ZAHVALA:

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## **DAVČNA UTAJA KOT PREKRŠEK IN KOT KAZNIVO DEJANJE TAX EVASION AS A MISDEMEANOR AND AS A CRIMINAL OFFENCE**

### **POVZETEK**

*Vsaka davčna utaja, po Kazenskem zakoniku opredeljena kot davčna zatajitev, še ni kaznivo dejanje. Kot dopuščajo različni zakoni, povezani z davki in financami, med njimi naj postavimo Zakon o davčnem postopku in Zakon o davku na dodano vrednost, je oškodovanje državne blagajne v določenih primerih zgolj prekršek, za katerega pristojni organ odmeri globo in plačilo davka, s tem pa se davčni utajevalec tudi izogne kazenskemu pregonu. Objektivna pogoja, ki določata, kdaj je davčna zatajitev kaznivo dejanje, sta opredeljena v 249. členu KZ-1, tj. izognitev obveznosti v obdobju največ 12 zaporednih mesecev ter višina zneska, ki pomeni veliko premoženjsko vrednost. Po 3. točki devetega odstavka 99. člena KZ-1 je to znesek, ki presega 50.000 evrov.*

*A vse le ni tako prepuščeno iznajdljivosti davčnih utajevalcev, saj varovalo proti tovrstnim zlorabam vsebuje 11.a člen Zakona o prekrških, v katerem je določeno, da se mora prekrškovni postopek, v kolikor gre za kaznivo dejanje, umakniti kazenskemu. Razmerje med prekrškom in kaznivim dejanjem je v 11.a členu ZP-1 urejeno na dveh nivojih – prvo pojasnjuje vprašanje steka med prekrškom in kaznivim dejanjem, drugo pa smiselno uveljavitev načela ne bis in idem v primerih tovrstnega steka.*

*Ne bis in idem oz. prepoved ponovnega sojenja o isti stvari je eno od temeljnih načel kazenskega postopka, ki ga zagovarjajo ne le državni pravni akti, temveč tudi mednarodni pravni instrumenti, kot sta Protokol št. 7 k Evropski konvenciji o človekovih pravicah in Listina EU o temeljnih pravicah. Svojo dotedanjo sodno prakso v zvezi z razlago omenjenega načela je ESČP poenotilo z odločbo Zolotukhin proti Rusiji leta 2009, na katero se je večkrat sklicevalo tudi slovensko Vrhovno sodišče, in presodilo, da ponovni pregon, sojenje ali kaznovanje posameznika za drugo kaznivo dejanje, ki izhaja iz dejstev, ki so identična ali v bistvu enaka kot tista, ki so bila podlaga za prvo kaznivo dejanje, ni dopustno. Na nedopustnost široke uporabe načela ne bis in idem sicer opozarja tudi pravna teorija.*

**Ključne besede:** davčna utaja, prekršek, kaznivo dejanje, ne bis in idem, samoprijava

## ABSTRACT

*Each tax evasion, defined by the Criminal Code as a tax offence, does not constitute a criminal offence. Several laws, connected with taxes and financing, especially the Law on Tax procedure Act and Law on Value Added Act, namely allow that defrauding of the State Treasury in certain cases is nothing more but a misdemeanour which is fined by a competent authority, imposing at the same time a payment of the tax as well, thereby making it possible for the tax evader to avoid the prosecution. Two objective conditions that determine when the tax evasion constitutes a criminal offence, are stipulated in the article 249 of the Criminal Code-1, namely the evasion of the obligation in the time period not exceeding the 12 consecutive months at the most and the extent of the amount, which establishes a considerable profit. According to the third point of the 9 subparagraph of the article 99 of the Criminal Code-1, this sum amounts above the 50.000 euros.*

*However, everything is not left to the inventiveness of the tax evaders, as there is a safeguard against the abuses in the article 11.a of the Offences Act-1, established at two levels-the first level explains the question of convergence between the misdemeanour and the criminal offence, while the second level clarifies the reasonable enforcement of the principle ne bis in idem in the cases of any such sort of convergence.*

*Ne bis in idem or the prohibition of double jeopardy, is one the basic principles of the Criminal Law Proceedings, defended not only by the Slovenian legal acts, but also by the international legal instruments, such as the Protocol No. 7 to the European Convention on Human Rights and the Charter of Fundamental Rights of the European Union. The European Court of Human Rights has standardised its previous case-law with the case of Zolotukhin versus Russia in 2009, which was referenced to several times by the Slovenian Supreme Court, and has adjudicated that a renewed prosecution, retrial and penalising of an individual for another criminal offence, arising out of the identical or, in effect, the same facts as those which had served as the basis of the first criminal offence, were not admissible. Furthermore, the legal theory warns that using the principle ne bis in idem broadly is not acceptable.*

**Key words:** tax evasion, misdemeanour, criminal offence, ne bis in idem, self-correction

## UVOD

KZ-1 z zadnjo spremembo 249. člena iz leta 2015 določa, da so tako fizične kot pravne osebe varne pred kazenskim pregonom, če državo oškodujejo za manj kot 50.000 evrov v obdobju največ 12 zaporednih mesecev. V tem primeru jim davčni inšpektorji lahko odmerijo zgolj globo in plačilo davka, zato je še toliko bolj presenetljivo, da se razen redkih posameznikov le peščica raziskovalcev ukvarja z davčnimi utajami kot prekrški in kot kaznivimi dejanji. Med literaturo o davčnih utajah kot prekrških in kot kaznivih dejanjih tako zasledimo Primoža Baucona, ki opozarja, da se v praksi pogosto pojavlja vprašanje, ali gre v neki situaciji neizpolnitve oziroma izogibanja izpolnjevanja davčnih obveznosti za dejstvo, ki pomeni prekršek ali kaznivo dejanje, do tega pa prihaja, ker so v izvršitvenem ravnanju davčnih kaznivih dejanj (zlasti davčne zatajitve) vsebovani tudi znaki davčnih prekrškov. (Baucon 2018) Prepoved ponovnega sojenja o isti stvari, tj. *ne bis in idem*, pa je eno od temeljnih načel kazenskega postopka. Za presojo, ali je možno prvotni pravnomočno zaključeni prekrškovni postopek obravnavati kot kazensko zadevo, so se pred ESČP razvila t.i. merila Engel, izhajajoč iz primera Engel proti Nizozemski, in kjer se prvo merilo nanaša na uvrstitev določbe v kazensko pravo skladno z nacionalnim pravom, drugo merilo je presoja, ali se pravilo, ki za svojo kršitev določa sankcijo, razteza na vsakogar in ne le na omejeno skupino s posebnim statusom, ter kakšen je namen sankcije (če gre za represivni ali preventivni namen, govorimo o kazenski sankciji), tretje merilo pa se nanaša na vrsto in težo zagrožene kazni. (Case of Engel and others v. The Netherlands, 8. junij 1976) Kot je razvidno iz omenjenega primera, je ESČP določilo, da zadošča že denarna kazen, za katero je v primeru neplačila zagrožen zapor, ali ki se vpiše v kazensko evidenco, da gre za kazensko zadevo. Potemtakem gre kot kazensko zadevo obravnavati tudi davčno zatajitev kot prekršek: gre za inkriminacijo, ki spada na področje kazenskega prava, določba je usmerjena zoper vse prebivalce, namen kaznovanja je odvrčanje konkretnega storilca ter tudi vseh ostalih potencialnih storilcev, kar predstavlja lastnosti kazenskih sankcij. Poleg tega se davčna zatajitev kot prekršek vpiše v evidenco prekrškov, s čimer je izpolnjeno tretje merilo. Iz ustavne odločbe U-I-24/10-12 z dne 19. april 2012 izhaja, da mora biti načelo *ne bis in idem* zagotovljeno tudi, ko je zoper posameznika še pred uvedbo kazenskega postopka tekel prekrškovni postopek in je bil tudi pravnomočno končan, če narava dejanja in teža predpisane sankcije za prekršek kažeta na to, da je šlo v resnici za kaznivo ravnanje, ki ima naravo »kaznivega dejanja«, iz opisa prekrška pa je razvidno, da je temeljil na istem historičnem dogodku. (VSL Sklep VII Kp 52361/2016, 25. april 2019) Vendar, da ne bi prišlo do abuzusa inštituta *ne bis in idem*, varovalo proti tovrstnim zlorabam ponuja 11.a člen ZP-1.

Posebne vrste varovalo pred posledicami davčne zatajitve kot prekrška je institut samoprijave, katere cilj je privabiti zavezanca za davek, da prijavijo svojo davčno obveznost, ki je iz kateregakoli razloga niso ali pa so jo prijavili le delno. Vendar, s samoprijavo se davčni zavezanec lahko izogne kazni za prekršek, ne izključuje pa kaznivega dejanja davčne zatajitve po 249. členu KZ-1.

Da bi dobili jasno sliko o davčnih zatajitvah kot prekrških in kot kaznivih dejanjih v Sloveniji, smo preučili statistiko, ki jo vodijo FURS, Vrhovno državno tožilstvo RS in slovenska Policija.

### Namen in cilj

Namen raziskovalnega dela o davčnih utajah kot prekrških in kot kaznivih dejanjih je bil proučitev meril, ki določajo, kdaj je davčna utaja kaznivo dejanje in kdaj prekršek. Cilj pa je bil raziskati davčne utaje in njihovo opredelitev prekrška/kaznivega dejanja v nacionalnih pravnih virih in kakšna je na tem področju sodna praksa.

V tem okviru smo raziskovali dejavnike:

- opredelitev davčne utaje kot prekrška in kot kaznivega dejanja v slovenski zakonodaji,
- davčne utaje in njihove sankcije v sodni praksi,
- samoprijavo,
- načelo *ne bis in idem* – prepoved ponovnega sojenja o isti stvari.

Temeljno raziskovalno vprašanje je bilo: Pod kakšnimi pogoji je davčna utaja prekršek in pod kakšnimi pogoji kaznivo dejanje?



## METODE

Uporabili smo metode deskripcije, kompilacije, analize, sinteze, ekspertize, dokazovanja, opisne statistike in linearni trend, pa tudi komparativno metodo in induktivno-deduktivno metodo.

V raziskovalnem delu smo zbrali podatke za zadnjih deset let o zabeleženih davčnih utajah tako med pravnimi kot tudi med fizičnimi osebami, ki jih vodijo slovenska državna tožilstva, medtem ko Policija s področja davčnih utaj beleži statistiko za kazniva dejanja, pri katerih se je potrdil sum storitve kaznivega dejanja ter je bila na pristojno tožilstvo podana kazenska ovadba, in kazniva dejanja, pri katerih se sum kaznivega dejanja ni potrdil, zaradi česar je bilo s strani policije na pristojno tožilstvo podano Poročilo. Za obdobje 2015-2019 smo pridobili podatke iz FURS-a, ki pri davčnih zatajitvah vodi število kazenskih ovadb in naznanil kaznivih dejanj. Podatke na tak način FURS vodi od leta 2014 naprej, saj je tega leta nastala Finančna uprava z združitvijo tedanjih davčnih in carinskih uprav.

## REZULTATI IN RAZPRAVA

Število prejetih ovadb na državnih tožilstvih zoper polnoletne osebe, ki jih bremeni zatajitev davčnih in drugih finančnih obveznosti, od leta 2015 vztrajno raste. Podatki iz Skupnega poročila o delu državnih tožilstev za obdobje od leta 2015 kažejo, da so državna tožilstva leta 2015 prejela 134 ovadb, leta 2016 215, leta 2017 257, leta 2018 299 in leta 2019 367. Vendar, še leta 2014 je bilo na državno tožilstvo vloženih skoraj še enkrat več ovadb zoper polnoletne storilce (258) kot leto kasneje, kar državna tožilstva pripisujejo dejstvu, da se je prag kaznivosti s spremembo KZ-1 za to kaznivo dejanje pomembno dvignil, učinki najnovejše spremembe zakona pa naj bi se po njihovih pričakovanjih, kot je vidno iz Skupnega poročila o delu državnih tožilstev za leto 2015, pokazali šele čez nekaj let, kar se je z rastjo prejetih ovadb izkazalo tudi za točno predvidevanje.

**Tabela 1 Pregled postopkov zatajitve davčnih in drugih finančnih obveznosti - polnoletni storilci**

	2019	2018	2017	2016	2015	2014
PRENESENE NEREŠENE OVADBE	469	347	292	263	371	258
PREJETE OVADBE	367	299	257	215	134	258
SKUPAJ V DELU	836	646	549	478	505	516
ZAVRŽENJE	168	145	143	117	154	138
OBTOŽNI PREDLOGI	17	17	21	6	9	10
NEPOSREDNA OBTOŽBA	5	9	0	0	7	2
ZAHTEVA ZA PREISKAVO	97	75	69	97	111	79
USTAVITEV	13	20	29	41	25	52
VLOŽEN OBTOŽNI AKT PO PREISKAVI	78	80	77	79	83	85
OBSODILNA SODBA	58	66	36	28	50	37
OPROSTILNA SODBA	14	10	11	5	4	20
ZAVRNILNA SODBA	10	5	6	3	4	4
VLOŽENO - PRITOŽBE DRŽAVNEGA TOŽILCA	27	14	13	13	16	17
UGODENO - PRITOŽBE DRŽAVNEGA TOŽILCA	6	11	6	7	3	6
NEUGODENO - PRITOŽBE DRŽAVNEGA TOŽILCA	21	3	7	6	13	11
ŠE NI IZREČENA 1.ST. SODBA	171	145	134	92	55	47
PRIPOR	0	0	0	0	3	

Do spremembe 249. člena KZ-1 je nazadnje prišlo 21. oktobra 2015 (KZ-1C), pred tem (KZ-1B) pa je le-ta kot element kaznivega dejanja določil veliko premoženjsko korist, to je korist, ki presega 50.000 evrov periodičnih davčnih obveznosti, kar torej pomeni mesečnih oz. enkratnih. Tako danes velja, da po 249. členu KZ-1 kaznivo dejanje davčne zatajitve stori tisti, kdor z enim ali več ravnanji, zato da bi se sam ali kdo drug popolnoma ali deloma izognil plačilu davkov, prispevkov ali drugih predpisanih obveznosti fizičnih ali pravnih oseb ali neupravičeno dobil v celoti ali deloma vrnjen davek v Republiki Sloveniji ali drugih državah članicah Evropske unije, da lažne podatke o pridobljenih dohodkih, stroških, predmetih, blagu ali drugih okoliščinah, ki vplivajo na ugotovitev davkov in drugih predpisanih obveznosti, ali kako drugače preslepi organ, pristojen za odmero ali nadzor nad obračunavanjem in plačevanjem teh obveznosti, pa skupna višina neporavnanih obveznosti ali obveznosti, ki se jim je izogibal, ali davka, ki mu je bil neupravičeno vrnjen, ne glede na vrsto obveznosti ali davka v obdobju največ dvanajstih zaporednih mesecev, doseže veliko premoženjsko vrednost (Zakon o spremembah in dopolnitvah Kazenskega zakonika (KZ-1C) 2015), le-ta pa je po 3. točki devetega odstavka 99. člena KZ-1 znesek, ki presega 50.000 evrov. KZ-1 ne opredeljuje davčne zatajitve zgolj kot storitev, temveč tudi kot opustitev dolžnega ravnanja, torej da osebe, tako fizične kot pravne, ne prijavijo pridobljenega dohodka ali drugih okoliščin, ki vplivajo na ugotovitev davkov, prispevkov ali drugih predpisanih obveznosti fizičnih ali pravnih oseb oziroma se izogibajo plačilu, objektivna pogoja pa sta tudi po tem odstavku največ 12 zaporednih mesecev in da storilec doseže veliko premoženjsko korist. Za oboje je zagrožena enaka kazen, tj. zapor od enega do osmih let, medtem ko tretji odstavek omenjenega člena predvideva do dve leti zaporne kazni za tistega, ki z namenom, da bi preprečil ugotovitev dejanske davčne obveznosti, na zahtevo pristojnega davčnega organa ne daje podatkov, ne vodi ali ne predloži poslovnih knjig in evidenc, ki jih je dolžan voditi, ali so knjige in evidence vsebinsko napačne, ali ne da pojasnil v zvezi s predmetom davčnega nadzora ali ovira davčni nadzor. (Zakon o spremembah in dopolnitvah Kazenskega zakonika (KZ-1C) 2015) Kaznivo dejanje davčne zatajitve je obravnavano strožje, če je storjeno v hudodelski združbi, saj KZ-1 določa, da se v tem primeru storilec kaznuje z zaporom od treh do dvanajstih let. Po eni strani je bilo torej s to novelo zakona zajetih več dejanj davčnih zatajitev, ki so storjene v obdobju 12 mesecev, po drugi strani pa manj, tj. samo tista, ki so skupno presegle znesek 50.000 evrov.

Kot vidimo, 249. člen KZ-1 jasno opredeli, da je storilec tega kaznivega dejanja lahko vsakdo, torej tako fizična oseba kot davčni zavezanec, odgovorna oseba pri pravni osebi, ki je zanj zavezana dati podatke v zvezi z odmero davkov ali drugih obveznosti, ter vsaka oseba, ki omenjenima vrstama davčnih zavezancev (fizični ali pravni osebi) pomaga v obliki storitve po prvem odstavku tega člena. Za to kaznivo dejanje je lahko odgovorna tudi pravna oseba. (Deisinger 2017)

Tudi v interesu Evropske unije je zaščititi finančna sredstva Evropskih skupnosti, a očitno ne za vsako ceno in na vsak način. Sodišče Evropske unije je namreč v zadevi kriminalne združbe Dzivev in drugi, ki je nameravala obogateti z izoginitvijo plačilu davka in je zato posegla po davčnih kaznivih dejanj prek gospodarske družbe, odločilo, da je treba člen 325(1) PDEU ter člen 1(1)(b) in člen 2(1) Konvencije, pripravljene na podlagi člena K.3 Pogodbe o Evropski uniji, o zaščiti finančnih interesov Evropskih skupnosti razlagati tako, da glede na načelo učinkovitosti kazenskega pregona glede kaznivih dejanj, povezanih z davkom na dodano vrednost (DDV), ne nasprotujejo temu, da nacionalno sodišče uporabi nacionalno določbo, ki določa, da morajo biti iz kazenskega postopka izključeni dokazi, kot so prisluškovanja telefonskim pogovorom, za katera je potrebno predhodno sodno dovoljenje, če je to dovoljenje izdalo nepristojno sodišče, čeprav bi se zgolj s temi dokazi lahko dokazala storitev zadevnih kaznivih dejanj. (Sodba Sodišča EU v zadevi C-310/16, 17. januar 2019)

Skupna poročila državnih tožilstev razkrivajo, da tudi pri zatajitvah davčnih in drugih finančnih obveznosti pri pravnih osebah število ovadb od leta 2014 raste – če so državna tožilstva leta 2014 prejela 64 ovadb pravnih oseb, se je to leta 2019 že potrojilo na 196 prejetih ovadb.

**Tabela 2 Pregled postopkov zatajitve davčnih in drugih finančnih obveznosti - pravne osebe**

	2019	2018	2017	2016	2015	2014
PRENESENE NEREŠENE OVADBE	210	172	132	119	102	71
PREJETE OVADBE	196	117	86	58	56	64
SKUPAJ V DELU	406	289	218	177	158	135
ZAVRŽENJE	89	52	56	46	31	40
OBDOŽILNI PREDLOGI	6	2	4	1	3	2
NEPOSREDNA OBTOŽBA	1	5	0	0	1	2
ZAHTEVA ZA PREISKAVO	15	18	6	14	19	7
USTAVITEV	5	6	6	4	3	5
VLOŽEN OBTOŽNI AKT PO PREISKAVI	4	8	3	10	5	4
OBSODILNA SODBA	12	2	4	3	5	1
OPROSTILNA SODBA	1	0	0	1	0	2
ZAVRNILNA SODBA	2	1	0	1	2	0
VLOŽENO - PRITOŽBE DRŽAVNEGA TOŽILCA	1	0	2	0	2	1
UGODENO - PRITOŽBE DRŽAVNEGA TOŽILCA	1	0	1	0	0	1
NEUGODENO - PRITOŽBE DRŽAVNEGA TOŽILCA	0	0	1	0	2	0
ŠE NI IZREČENA 1. ST. SODBA	19	20	11	13	7	8

Bistven napredek je viden pri odkrivanju organiziranega kriminala, tako pravnih oseb kot tudi polnoletnih storilcev. Kot je razvidno, vse od leta 2015 do vključno 2018 državna tožilstva niso prejela ovadb zoper pravne osebe, ki bi davčne zatajitve izvajala kot organiziran kriminal, medtem ko so leta 2019 prejela 10 ovadb.

**Tabela 3 Pregled postopkov davčne zatajitve - pravne osebe, organiziran kriminal**

	2019	2018	2017	2016	2015
PRENESENE NEREŠENE OVADBE	0	0	0	0	0
PREJETE OVADBE	10	0	0	0	0
SKUPAJ V DELU	10	0	0	0	0
ZAVRŽENJE	0	0	0	0	0
OBDOŽILNI PREDLOGI	0	0	0	0	0
NEPOSREDNA OBTOŽBA	0	0	0	0	0
ZAHTEVA ZA PREISKAVO	0	0	0	0	0
USTAVITEV	0	0	0	0	0
VLOŽEN OBTOŽNI AKT PO PREISKAVI	0	0	0	0	0
OBSODILNA SODBA	0	0	0	0	0
OPROSTILNA SODBA	0	0	0	0	0
ZAVRNILNA SODBA	0	0	0	0	0
VLOŽENO - PRITOŽBE DRŽAVNEGA TOŽILCA	0	0	0	0	0
UGODENO - PRITOŽBE DRŽAVNEGA TOŽILCA	0	0	0	0	0
NEUGODENO - PRITOŽBE DRŽAVNEGA TOŽILCA	0	0	0	0	0
ŠE NI IZREČENA 1. ST. SODBA	0	0	0	0	0

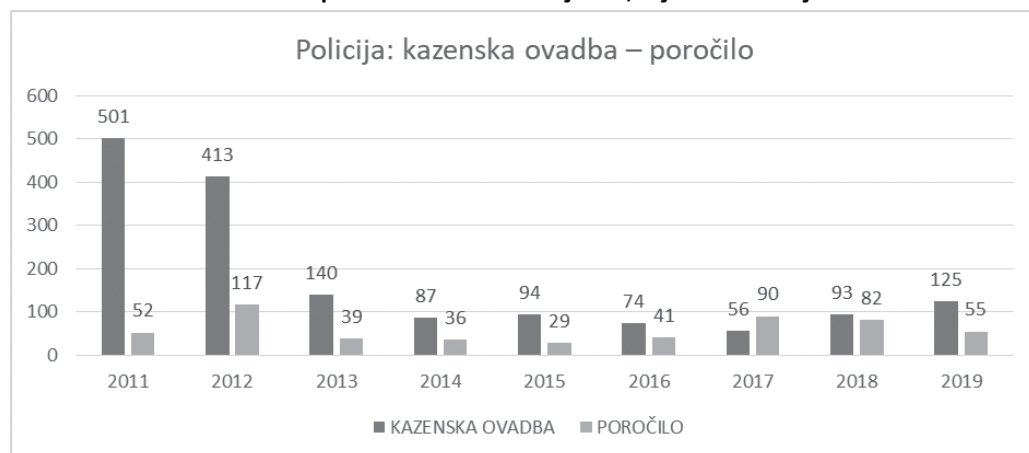
Podobno stanje je bilo tudi pri polnoletnih storilcih, ki davčne zatajitve izvajajo kot organiziran kriminal. Res je sicer, da so državna tožilstva iz preteklih let prenesla v leto 2015 5 nerešenih ovadb, za 4 je bila nato uvedena preiskava, leta 2016 pa je bil prav tako za 4 ovadbe vložen obtožni akt po preiskavi, sledila je obsodilna sodba, vendar skupna poročila razkrivajo, da državna tožilstva v obdobju 2016-2018 niso prejela novih ovadb. Nato pa sledi leto 2019, ko so prejela kar 42 ovadb za organiziran kriminal polnoletnih storilcev po 249. členu KZ-1, kar je bistveno več kot leta poprej.

**Tabela 4 Pregled postopkov davčne zatajitve - polnoletni storilci, organiziran kriminal**

	2019	2018	2017	2016	2015
PRENESENE NEREŠENE OVADBE	0	0	0	1	5
PREJETE OVADBE	42	0	0	0	0
SKUPAJ V DELU	42	0	0	1	5
ZAVRŽENJE	0	0	0	0	0
OBDOŽILNI PREDLOGI	0	0	0	0	0
NEPOSREDNA OBTOŽBA	0	0	0	0	0
ZAHTEVA ZA PREISKAVO	0	0	0	0	4
USTAVITEV	0	0	0	0	0
VLOŽEN OBTOŽNI AKT PO PREISKAVI	0	0	0	4	0
OBSODILNA SODBA	0	0	0	4	0
OPROSTILNA SODBA	0	0	0	0	0
ZAVRNILNA SODBA	0	0	0	0	0
VLOŽENO - PRITOŽBE DRŽAVNEGA TOŽILCA	0	0	0	0	0
UGODENO - PRITOŽBE DRŽAVNEGA TOŽILCA	0	0	0	0	0
NEUGODENO - PRITOŽBE DRŽAVNEGA TOŽILCA	0	0	0	0	0
ŠE NI IZREČENA 1.ST. SODBA	0	0	0	0	0
PRIPOR	0	0	0	0	0

Ena od temeljnih nalog slovenske Policije je prav varovanje finančnih interesov Republike Slovenije in Evropske unije, zato ne preseneča, da posebno pozornost posveča davčni problematiki. Pri tem Policija vodi evidenco tako kaznivih dejanj, pri katerih se je potrdil sum storitve kaznivega dejanja ter je bila na pristojno tožilstvo podana kazenska ovadba, kot tudi kaznivih dejanj, pri katerih se sum kaznivega dejanja ni potrdil, zaradi česar je bilo na pristojno tožilstvo podano Poročilo.

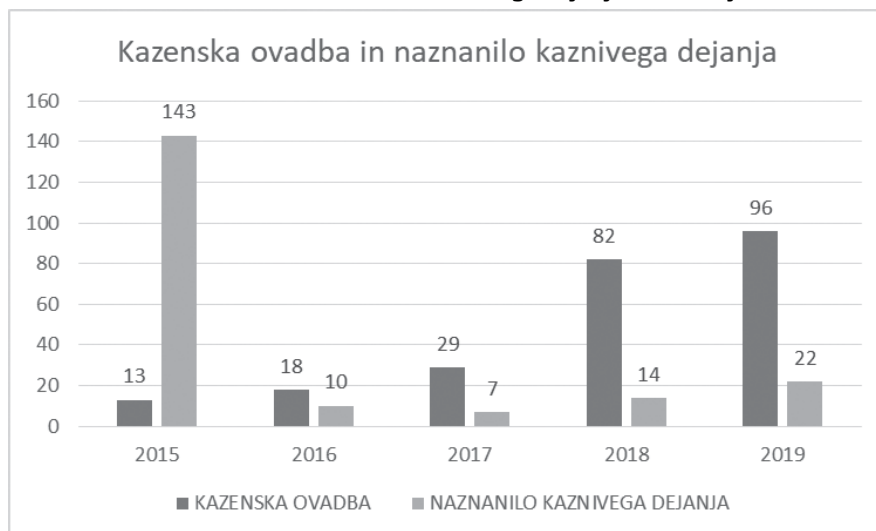
**Tabela 5 Kazenske ovadbe in poročila o davčnih zatajtvah, ki jih vodi Policija**



Že hiter pregled razkrije opazna nihanja, ki pa jih gre pripisati zakonodajni spremembi kaznivega dejanja davčne zatajitve po 249. členu KZ-1 v letih 2012 in 2015. Pred letom 2015 je namreč Kazenski zakonik (KZ-1B) kot element kaznivega dejanja določil veliko premoženjsko korist, to je korist, ki presega 50.000 evrov periodičnih davčnih obveznosti. V primeru periodičnih davčnih obveznosti, tj. mesečnih, je nepravilno ali nepopolno prikazovanje dejstev pri izpolnjevanju take obveznosti predstavljalo eno prepovedano ravnanje, ki je bilo dokončano vsakokrat, ko storilec z aktivnim ravnanjem ali opustitvijo o svoji davčni obveznosti preslepil davčni organ, obenem pa je moral biti znesek vsake posamezne utajitve večji od 50.000 evrov. (www.fpir.si 2015) A kot rečeno je bila takšna ureditev člena le med leti 2012 in 2015.

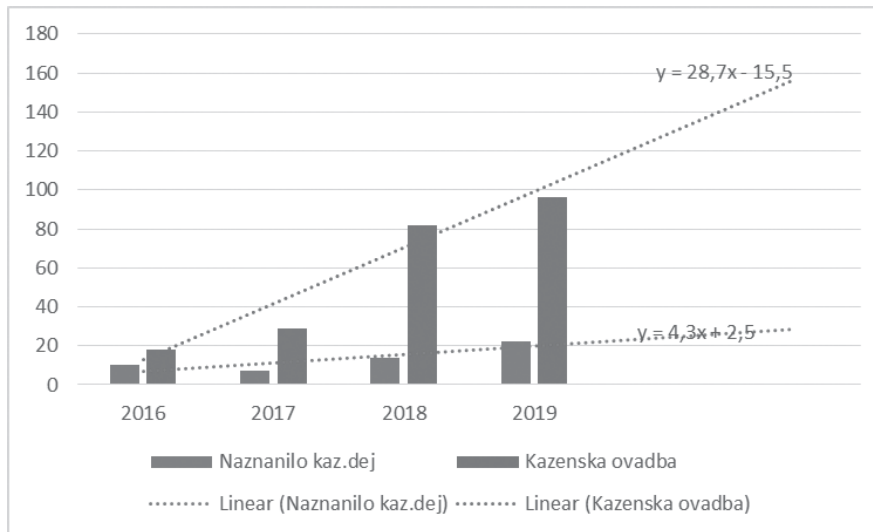
Davčna zatajitev po določbah 249. člena KZ-1 je najpogostejše kaznivo dejanje, ki ga beleži FURS. V kolikor so izpolnjeni vsi zakonski znaki kaznivega dejanja davčne zatajitve po določbah 249. člena KZ-1, FURS na pristojni organ poda kazensko ovadbo ali naznanilo. Kot je razvidno iz statistike, število kazenskih ovadb od leta 2015 do 2019 narašča, medtem ko pri naznanilu kaznivega dejanja še posebej izstopa leto 2015 s kar 143 primeri.

**Tabela 6 Kazenske ovadbe in naznanila kaznivega dejanja za obdobje 2015–2019**



O številu prekrškov davčne utaje FURS sicer ne more poročati, saj, kot pojasnjujejo, davčna utaja ni poseben prekršek, ampak v okviru splošnega termina davčne utaje beležijo različne prekrške, kot so npr. nepredložitve napovedi, nepredložitve obračunov, navedeni napačni podatki v teh napovedih ipd.; ni pa nujno, da je npr. vsaka nepredložitve obračuna že davčna utaja.

Projekcija razvoja obsega kazenskih ovadb in naznanil kaznivega dejanja na osnovi podatkov brez leta 2015 (ker so podatki za to leto atipični) razkriva, da je trend porasta »Kazenskih ovadb« izredno velik (28,7 letno), kar kaže, da se lahko število iz leta 2019 podvoji že v letu 2022. Trend porasta »Naznanilo kazenskih dejanj« pa je nizek in iz uporabljenih podatkov kaže, da te vrste dejanja naraščajo v obsegu 4 do 5 dejanj letno:

**Tabela 7 Trend razvoja obsega kazenskih ovadb in naznanil kaznivega dejanja**

Davčni zavezanec se lahko izogne kazni za prekršek s samoprijavo, vendar pa le-ta ne izključuje kaznivega dejanja davčne zatajitve po 249. členu KZ-1. Institut samoprijave krepi davčno moralo, ker predstavlja vez do nekaznovanosti. (Jerovšek idr. 2008) Vendar le na prekrškovni ravni, medtem ko vez do nekaznovanosti na kazenski ravni lahko predstavlja prepoved ponovnega sojenja o isti stvari oz. načelo *ne bis in idem*. Za presojo, ali je mogoče prvotni pravnomočno zaključeni prekrškovni postopek obravnavati kot kazensko zadevo, so se pred ESČP razvila tako imenovana merila Engel (izhajajoč iz primera Engel proti Nizozemski), medtem ko iz ustavne odločbe U-I-24/10-12 z dne 19. april 2012 izhaja, da mora biti načelo *ne bis in idem* zagotovljeno tudi, ko je zoper posameznika še pred uvedbo kazenskega postopka tekel prekrškovni postopek in je bil tudi pravnomočno končan, če narava dejanja in teža predpisane sankcije za prekršek kažeta na to, da je šlo v resnici za kaznivo ravnanje, ki ima naravo »kaznivega dejanja«, iz opisa prekrška pa je razvidno, da je temeljil na istem historičnem dogodku. (VSL Sklep VII Kp 52361/2016, 25. april 2019) Tudi ESČP je z odločbo Sergey Zolotukhin proti Rusiji z dne 10. februar 2009, na katero se je večkrat sklicevalo slovensko Vrhovno sodišče, poenotilo svojo dotedanjo sodno prakso v zvezi z razlago načela *ne bis in idem* in presodilo, da ponovni pregon, sojenje ali kaznovanje posameznika za drugo kaznivo dejanje, ki izhaja iz dejstev, ki so identična ali v bistvu enaka kot tista, ki so bila podlaga za prvo kaznivo dejanje, ni dopustno. (Case of Sergey Zolotukhin v. Russia, 10. februar 2009)

Obstaja torej možnost, da je storilec v Sloveniji obsojen za prekršek davčne zatajitve, nadalje pa zanj velja načelo *ne bis in idem*. Lahko se torej zgodi, da se storilcu splača biti obsojen za prekršek, vendar je takšna razlaga zloraba in ji ne smemo dati potrditve. Poleg tega je zakonski dejanski stan prekrška zelo redko v celoti enak kot za kaznivo dejanje, zato pri prekrških to pride res izjemoma v poštev – le ko se v popolnosti prekrivata.

Načelo *ne bis in idem* prepoveduje kumulacijo postopkov in sankcij kazenske narave za ista dejanja in proti isti osebi tudi v 50. členu Listine EU o temeljnih pravicah, vendar pa je Sodišče EU v zadevi Menci razsodilo, da je treba ta člen razlagati tako, da ne nasprotuje nacionalni ureditvi, na podlagi katere je mogoče zoper osebo zaradi opustitve plačila dolgovanega davka na dodano vrednost v zakonskih rokih začeti kazenski postopek, čeprav je bila tej osebi za ista dejanja že naložena pravnomočna upravna sankcija kazenske narave. (Sodba Sodišča EU v zadevi C-524/15, 20. marec 2018) Sodišče je še prepričano, da so kazenske sankcije lahko nujne za odvratilno in učinkovito preprečevanje nekaterih primerov velikih zatajitev na področju DDV in pri tem opozarja, da imajo države članice za zagotavljanje pobiranja prihodkov iz naslova DDV svobodo pri izbiri sankcij, ki lahko zajemajo upravne sankcije, kazenske sankcije ali kombinacijo obojih, saj pravo Unije na tem področju ni harmonizirano.

Varovalo proti zlorabam načela *ne bis in idem* v slovenski zakonodaji določa 11.a člen Zakona o prekrških, v katerem je določeno, da se mora prekrškovni postopek, v kolikor gre za kaznivo dejanje, umakniti kazenskemu. Omenjeni člen ureja razmerje med prekrškom in kaznivim dejanjem na dveh nivojih: prvi se nanaša na vprašanje steka med prekrškom in kaznivim dejanjem, drugi pa na smiselno uveljavitev načela *ne bis in idem* v primerih steka med prekrškom in kaznivim dejanjem. (Čas idr. 2018)

Široko možnost uporabe načela *ne bis in idem* odklanja tudi pravna teorija. Dr. Boštjan M. Zupančič je prepričan, da »isti historičen dogodek«, ki je ključen pri načelu *ne bis in idem*, ne obstaja, obstaja namreč drug vidik istega sklopa konkretnih dejstev. Bistvene so okoliščine, elementi, ki ločijo med kaznivim dejanjem in prekrškom, pri tem pa sta namena obeh norm v mnogočem različna. *Ne bis in idem* je tako označil za doktrino, ki je šibka točka ne samo v slovenski, temveč tudi v praksi Sodišča EU ter praksi Evropskega sodišča za človekove pravice.

## ZAKLJUČEK

Vez do nekaznovalnosti na prekrškovni ravni za davčnega zavezanca predstavlja institut samoprijave, medtem ko vez do nekaznovalnosti na kazenski ravni lahko predstavlja prepoved ponovnega sojenja o isti stvari oz. načelo *ne bis in idem*. Kot je razvidno iz podatkov o davčnih zatajitvah, ki jih vodijo državna tožilstva, število prejetih ovadb tako zoper polnoletne osebe kot tudi zoper pravne osebe raste od leta 2015, ko je bila tudi zadnja sprememba 249. člena KZ-1. Projekcija razvoja obsega kazenskih ovadb, ki jih beleži FURS, razkriva, da je trend porasta izredno velik, kar kaže, da se lahko število iz leta 2019 podvoji že v letu 2022. Možnost nadaljnega raziskovanja obravnavanega problema je torej lahko zelo široka, tako od raziskovanja kako pogosto se davčni utajevalci odločijo za samoprijavo do tega, v katerih primerih lahko govorimo o isem historičnem dogodku pri davčnih zatajitvah pri sklicevanju na *ne bis in idem*.

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# ŠTUDIJSKI PROGRAMI AKREDITIRANI NA AMEU

DODIPLOMSKI ŠTUDIJ	MAGISTRSKI ŠTUDIJ	DOKTORSKI ŠTUDIJ
SOCIALNA GERONTOLOGIJA	SOCIALNA GERONTOLOGIJA	SOCIALNA GERONTOLOGIJA
HUMANISTIČNI ŠTUDIJI	HUMANISTIČNE ZNANOSTI	HUMANISTIČNE ZNANOSTI
DIGITALNA HUMANISTIKA <sup>‡</sup>	DIGITALNA HUMANISTIKA <sup>‡</sup>	
MANAGEMENT POSLOVNIH SISTEMOV	MANAGEMENT POSLOVNIH SISTEMOV	STRATEŠKI KOMUNIKACIJSKI MANAGEMENT
	EVROPSKE POSLOVNE ŠTUDIJE PROJEKTI MAN.	PROJEKTI MANAGEMENT
	INOVATIVNI MANAGEMENT V TURIZMU <sup>‡</sup>	
FIZIOTERAPIJA	ZDRAVSTVENE VEDE Zdravstvena nega, Javno zdravje, Fizioterapija, Integrativne zdravstvene vede, Avtizem, Logopedija	FIZIOTERAPIJA
ZDRAVSTVENA NEGA		
ARHIVISTIKA	ARHIVISTIKA IN DOKUMENTOLOGIJA	ARHIVSKE ZNANOSTI
	EKOREMEDIACIJE	
PLES, KOREOGRAFIJA	ŠTUDIJE PLESNIH UMETNOSTI	
SPLETNE IN INFORMACIJSKE TEHNOLOGIJE	SPLETNE ZNANOSTI <sup>‡</sup> Kibernetska varnost, Umetna inteligenca	SPLETNE ZNANOSTI <sup>‡</sup> Kibernetska varnost, Umetna inteligenca

<sup>‡</sup> v procesu akreditacije