ALFA BK UNIVERSITY
FACULTY OF INFORMATION TECHNOLOGY
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
ALFATECH Journal

ISSN 1XX0-3XX1(Print), ISSN 1XXX-6XXX (Online)

UDK: 004:624.04
DOI: 10.46793/AlfaTech1.1.17M
Original scientific paper

INFORMATION TECHNOLOGIES IN CONSTRUCTION PROJECTS - APPLICATION, ADVANTAGES AND RISKS

Snežana MAKSIMOVIĆ[1],Ksenija BOGOSAVLJEVIĆ[2]

Abstract: The application of information and communication technologies and software solutions, as well as the assessment of their contribution to the success of construction projects, is based on the fact that managing a construction project is a complex task, involving many interdependent activities and a large amount of human and material resources required for the realization of such projects. The development and adoption of automation in construction have evolved more slowly compared to other sectors, but now the time is ripe for automated construction technologies to play a major role in driving construction's digital transformation. Integrating digitization, database management, and modeling creates the potential to overcome numerous limitations in the execution of construction projects . In this paper, we focus on the advantages of process automation in reducing risks, as just one of the components of project success, with the intention of highlighting the importance of applying automated technologies in construction project management. We hope that this paper will contribute to a comprehensive understanding of the issues in this field and open new questions and topics for future research.

Keywords: *digitalization, automation; construction, projects risk*

1. INTRODUCTION

The future growth of the construction industry will heavily depend on the implementation of automation in various forms. This includes automated digital design, analytical processes, and the automated generation of construction documentation, leading up to the automation of the construction process itself. Whether through off-site prefabrication that adopts advanced manufacturing best practices or the use of on-site construction robotics, automation will play a key role in the industry's ability to meet two major 21st-century challenges: the high demand for buildings and infrastructure, and the need for sustainability throughout the entire lifecycle of construction projects. The theoretical and operational definition of the research subject in this paper is based on the need to identify and analyze the critical factors essential for improving management and decision-making processes in the execution of construction projects. Construction automation has the potential to tackle opportunities and challenges similar to those that automated manufacturing processes have addressed in other industries. These include enhancing production times, increasing material efficiency, boosting labor productivity, and improving worker health and safety.

Additionally, automation can help compensate for labor shortages, reduce environmental impacts, and create new design possibilities, among other benefits. The concept of measuring indirect parameters and converting them into desired indicators is based on a process-oriented approach that is iterative and continuous. It focuses on optimizing resources, improving communication, and reducing risks, ultimately leading to greater success in construction projects. The term "construction automation" encompasses the processes, tools, and equipment that utilize automated workflows to construct buildings and infrastructure.

In some cases, automation is used to perform tasks that were previously done manually, while in others, new automated tools enable the development or adaptation of processes specifically for construction. Automation can be applied at different stages of a project, starting with the software-driven design phase, followed by automated aspects of off-site and on-site construction, and concluding with the collection and sharing of data on system performance and energy usage in completed buildings captured in cloud-based dynamic models. To achieve this

integrated feedback loop, various core development strategies are essential, both in software and hardware.

These include collaborative robotics, industrialized construction approaches, innovative robots and automated machines, as well as real-time, in-situ sensing, feedback, and adaptive technologies all of which are converging to make automation a widespread reality in the construction industry.

According to the evaluation of construction contractors, the key success factors of a construction project with the use of automation include: a clearly defined project scope, detailed early planning supported by automated tools, effective management and on-site control through automated systems, positive engagement of stakeholders via digital communication and collaboration platforms, a team-oriented approach supported by collaborative robotics, quick responses to changes thanks to real-time monitoring and process adaptation, and the role of engineers in managing the entire project with the help of automated systems, not just in the technical segment. On the other hand, investors have a similar perception of their role, but behave differently in practice.

From the perspective of process automation, research has shown that investors often do not place enough emphasis on early-stage project planning and do not provide detailed information during the bidding process. Automation could improve this aspect by enabling more precise and faster data collection and analysis in the early stages, facilitating informed decision-making and optimizing processes from the outset.

What is common to both investors and contractors, even in the context of automation, is that both parties still consider human resources to be key to a project's success. Automation can enhance the efficiency and accuracy of processes, but the human factor remains essential for strategic management, creative problem-solving, and making critical decisions. Automated tools serve as support, while the success of projects still largely depends on the skills, experience, and collaboration of the people involved in their execution.

In this article, the authors aims to explore the application of ICT (*Information and communication technologies*) solutions, focusing on managing input and output data, the interdependencies and connections between activities, and the responsibility of participants, alongside system control methods. The objective is to assess how automation interacts with key risks and to evaluate the risks related to achieving the objectives in the execution of construction projects, with a particular emphasis on how automation can optimize processes and mitigate potential challenges. In the modeling and analysis of such a system, particularly in the context of examining risks faced by the organizational system, an advanced approach leveraging information technologies can be applied.

This approach involves developing a risk management model using data-driven simulations, analyzing system behavior through real-time monitoring, planning operations using predictive analytics, and controlling output parameters through automated processes. By integrating information technologies, the system can be more effectively managed, and both its individual components and overall performance can be optimized.

Future scientific research will focus on further enhancing these processes through the application of artificial intelligence, machine learning, and big data analytics to improve accuracy, efficiency, and adaptability in risk management and decision-making.

2. A CONCISE OVERVIEW OF CONSTRUCTION AUTOMATION HISTORY

It's easy to imagine robots and automated tools on a construction site as part of a distant, futuristic vision. However, the reality is that key strategies for deploying such tools have existed for millennia, and concepts of mechanized, automated construction have been demonstrated for centuries. Early examples of off-site construction span more than 2,000 years, from the prefabrication techniques used to create the Terracotta Army in 3rd-century in China, to the prefabricated panels assembled on-site for housing in Berlin during the 1920s (Davis, 2022).

Real-time control of construction sites is a rapidly developing field, but it is still in its early stages. The greatest progress so far has been made in the area of earthmoving operations, where tools for quality control and support for equipment operators have been introduced. Additionally, a number of research efforts at the Technion Institute have aimed at fully automating project performance control (Navon, 2005).

For the purposes of project management modeling in construction, the system can be understood as an organized whole, it is a set or combination of parts or elements that form a complex or unique whole, which is significantly more than a simple set of parts. These efforts focus on developing concepts for measuring indirect parameters and converting them into desired indicators. Some of the key indicators include comprehensive control of construction material from tracking orders and procurement to their movement, need for workers, more efficient tools, an d risk in construction project as

monitoring the status of guard rails to prevent falls from heights.

Construction projects have a specific set of goals and constraints, such as the required time frame for project completion. Systems in construction are generally open-type systems, meaning they do not just have one-way reactions but adapt to external influences. Just as the environment affects the system used to model the construction of a building, the building itself changes the environment through its form and functioning. The mutual influence of the system and the environment occurs in real-time and dynamic project management. The main areas in construction where the application of ICT is most needed have been identified as (Ivković&Popović, 2005):

- Knowledge management
- Management of legal and contractual aspects
- Quality and performance management,
- Construction project life cycle management and
- Human resource management

The application of ICT in knowledge management is a common name for continuous professional development, access to relevant information and knowledge during construction project implementation (Tešić et.al., 2013) (in accordance with standards, laws and regulations, models, cost estimates, products, etc.), development of decision support systems, use of positive experiences of dr. (best practice databases).

The significance of ICT in quality and performance management lies in the following areas (Paudyal, 2016) : improving decision-making processes for selecting the most favorable option; enhancing evaluation methods; developing systems and tools to support execution; improving monitoring procedures and measuring project progress and the execution of works; adopting high environmental protection standards, preserving natural resources, employee health and safety; developing procedures for efficient management of productivity and quality, etc.

The project lifecycle management in the field of ICT should enable successful project management through all project phases. This is achieved by improving communication and collaboration, internal integration, and connecting between enterprises, supporting decision-making processes, and creating long-term business relationships among all stakeholders (Karmakar & Delhi, 2021) . It also involves enhancing effectiveness and efficiency, as well as successfully managing the changes that arise from the application of ICT in traditional construction practices.

In human resource management, the attitude of construction workers towards the application of ICT needs to change by removing organizational and personal barriers to its acceptance, supporting global accessibility, flexibility, and strengthening trust and social cohesion in the workplace, while also anticipating the expectations of new generations (Rama &Corkindale, 2013) . ICT is a tool for achieving the satisfaction of key stakeholders.

This paper provides an overview of achievements in digitalization and automation within different phases of a construction project. The project phases are divided into the initiation phase, design and planning, and execution, based on standards prescribed by PMI *(Project Management Institutte)* and the International Project Management Association (IPMA) (PMI, 2021).

Certain elements of a system, connected by a common function, can often be grouped into a single unit a subsystem. Relationships between subsystems can be observed at a higher level, similar to the relationships between the elements themselves (Navon &Shpatnitsky, 2005) . This approach allows for a hierarchical modeling of the real situation first, by identifying subsystems and their interactions at the highest level, and then by examining in more detail the structure and relationships between elements within individual subsystems. A typical example is the realization of a project that includes the construction of multiple buildings that are functionally connected. Each building is controlled separately by the investor, so it is necessary to develop a control subsystem for each individual building within the unified project management system.

To achieve this, it is essential to identify the relationships between participants at each building, assign them specific tasks within a given time frame, cost constraints, and quality standards, and continuously monitor whether they are fulfilling these tasks. The relationships between participants are not one-way; feedback on task execution is expected. The existence of two-way communication is a crucial condition for the project management system to function effectively.

Effective control requires two key pieces of real-time information: a list of activities to be completed that day according to performance indicators, and the measurement of the actual performance of those activities. The planned activity information is automatically obtained from the project model, which contains the latest planning and design data. However, the challenge lies in measuring actual results and comparing them to the planned data from the model.

To determine the number of units for a specific activity, it is necessary to identify the construction elements and their quantities, which requires calculating for all relevant elements. Manually performing these processes is not

complicated, but it is very labor-intensive as it involves tracking, collecting data from various sources, and performing calculations.Navon and Goldschmidt (Navon, 2005) investigated how indirect parameters can be used to calculate labor productivity. Their approach involves measuring the time workers spend on a specific activity and linking that time to the amount of work completed. For example, if workers spend 500 hours on an activity that covers 1000 m², productivity is calculated as 2 m² per hour.

The idea of these authors (Navon, 2005) was to develop a model for automatic data collection to manage materials on construction sites. This model automatically initiates the ordering of materials based on project plans and actual stock levels, enabling real-time control and corrective actions. This reduces costs and unnecessary material transport. Additionally, the model provides updated information on material flow and allows for statistical analyses, such as material flow by supplier or material usage by activity or month.

The generated information helps update the database for future project planning. Based on all of this, it can be concluded that the fundamental problem of project management in construction comes down to identifying all relationships and ensuring their efficient functioning, with data and information being the primary resources transmitted through these relationships.

In construction practice, it is common to collect unit prices for materials and machinery and store them in specific databases. This data becomes useful information when applied to calculate the selling price of certain works and to make decisions regarding the offer amount (Hewitt & Gambatese, 2021) . The challenge in project management is how to establish mechanisms that continuously and uniformly collect data and then filter, analyze, and compare it to extract what is truly needed. A particularly important issue is defining the communication channels through which data is gathered, as well as the method for delivering the extracted information to users. In terms of information distribution, it is necessary to define the scope, format, and frequency of reports for each user, establish a system of privileges, and carry out various tasks to ensure security and proper use of the obtained information (Dakhil et.al., 2021).

The timing of information distribution is crucial information must be delivered in a timely manner, as good information received at the wrong time can completely lose its value. In conclusion, the information system in construction serves to collect and process data, and is capable of producing results in the optimal scope, format, and time, and delivering them to users according to their needs and responsibilities.

2.1. The basis point for designing ICT in construction projects

In essence, an information system defines a model for how the real functioning of project management should ideally operate. Its proper functioning results in successful project management, and conversely, poor project management can be a consequence of an inadequate information system. The quality of an information system is tied to its ability to communicate with users in a timely manner and assist them in decision-making.The quality of ICT systems for investment projects depends primarily on understanding the working technology of construction companies. This quality can be observed through several key insights from current practice (Ivković&Popović, 2005):

- **Customized ICT** – Different user needs are addressed by tailoring ready-made solutions, which requires special configuration, maintenance, and support.
- **Information Access** – Access to data about companies and projects is available through local networks and the Internet.
- **Teamwork** – The work of various experts located in companies involved in the project is supported by the web and integrated management systems for document management.
- **Traditional Construction Site** – In terms of information, the construction site is remote, with mobile phones being the only ICT connection.
- **Data Exchange** – Project-related data is processed in different applications and companies, and their exchange is only possible in the file format in which they were created.
- **Basic ICT Skills** – Vary between companies and individuals, depending on the knowledge acquired through diverse learning approaches.
- **Experience from Previous Projects** – Available in the archives of individual companies, sectors, or in personal documentation, but is rarely used in new projects.
- **Contracting Processes** – Contracting and contract monitoring are mostly conducted through paper documentation or its digital version.
- **ICT is Document-Based** – This increases the creation and exchange of information, which still requires human interpretation and repetitive data entry.
- **Business Processes** – Are driven by the principle of lowest costs, while customers are increasingly aware of construction costs throughout the building's entire lifecycle.
- **Best-Equipped Buildings** – Have integrated management systems and quality standards that

use specific platforms and protocols from a particular supplier.

- **Applications** – Are focused on specific engineering functions and traditional project phases.

Data collection and its optimal storage represent the central issue of any ICT system. Therefore, the formation of a database and its efficient use is a key concern in the development of an information system in construction. In this context, we can distinguish between the logical database model, which is a simplified representation of reality and helps users formalize daily tasks in specific applications, and the physical model, which is usually built into the core software and provides the technical prerequisites for forming the logical model.

For the development of an ICT system, knowledge in both areas is necessary: construction work technology and the technical possibilities available.By definition, a database is a mechanized, formally defined set of data within an organization, used collectively and controlled from a central point.

In recent years, the construction industry has actively adopted modern ICT tools and systems to enhance construction project management. Modern information and communication technology, which significantly impacts the construction phase, includes innovative digital tools and systems. These tools are designed to improve communication, data management efficiency, and optimize various on-site construction processes ((Turk &Klinc, 2017) . The construction industry is undergoing a transformation through the adoption of modern ICT technologies during project execution. These innovations align the construction sector with other industries that have already been revolutionized by ICT advancements on a global scale. By enhancing efficiency, safety, and coordination in construction processes, these technologies empower professionals to manage projects more effectively and respond to the increasing demands of the industry (Olaonipekun Toyin, 2024).

Modern tools, such as BIM (*Buildingh Information Modeling*) technology, represent the future of construction design due to their comprehensive capabilities. BIM enables three-dimensional visualization of spaces, detailed planning of work dynamics, and monitoring project progress through all phases. In this way, it provides the possibility for complete control and management of complex construction sites (Ninkov et.al., 2016). BIM is a comprehensive process that integrates all phases of an object's lifecycle, from conceptual design to project documentation, construction management, and maintenance during operation. Based on a precise and detailed 3D model, BIM consolidates all project information into a single coordinated database.

This approach enables the analysis of various solutions, the creation of up-to-date documentation, the prediction of the object's performance in a built environment, as well as efficient planning, management, and maintenance after construction is completed.

The implementation of BIM significantly improves communication and collaboration among participants, minimizes errors, and ensures greater control over all aspects of the project (Ninkov et.al., 2016) . BIM is a concept similar to PLM (*Product Lifecycle Management*) as it goes beyond geometric aspects and encompasses topics such as cost management, project management, and integrated work on various aspects of object usage. This approach enables comprehensive control throughout the entire lifecycle of the object, from planning to operation. BIM enables engineers to predict the performance of a structure before construction, optimize the design, and quickly respond to project changes through analyses, simulations, and visualizations.

This approach results in more precise and higher-quality project documentation. Additionally, BIM enhances collaboration among teams and facilitates the transfer of critical data from the model to the structure before construction, significantly saving time and money that would otherwise be spent on corrections and modifications. BIM (Building Information Modeling) is increasingly being used in the design and construction of highways, offering significant advantages in all phases of the project. By utilizing BIM tools, civil engineers can create three-dimensional models with precise information about the geometry, materials, and infrastructure of the road. These models allow for detailed analysis and simulation of various scenarios, including terrain stability assessment, hydrological conditions, and environmental impact.

During the design phase, BIM enables engineers to quickly identify and resolve potential issues, such as conflicts between underground installations or the need for additional supporting structures. By integrating data, it is possible to achieve more efficient resource planning, reducing construction costs and time.

During construction, BIM tools allow for precise progress tracking, activity coordination, and optimization of equipment and material use. Digital models serve as a foundation for better communication among all project participants, reducing errors and ensuring continuity in execution. The greatest advantage of BIM design for roads and highways lies in improved project quality, as well as increased efficiency and productivity. Thanks to the

dynamic connection between the project and construction documentation, the time required to create alternative solutions, project modifications, and construction documentation is significantly reduced. This is especially important for planning the logistics of material delivery, enabling faster project realization and construction according to a predictable schedule.

In addition to efficiency, the BIM model allows for project optimization through visualizations, simulations, and various analyses. This approach makes it possible to identify and resolve potential issues before they arise, thus avoiding unnecessary costs and disputes. This predictive capability saves both time and money, contributing to smooth and successful project execution. The construction of the Gdańsk–Toruń highway, spanning 152 km, is one of the most important transportation projects in Poland, holding strategic significance for infrastructure development. Thanks to the use of BIM technology, the project was completed ahead of schedule, achieving significant time and resource savings (Ninkov et.al., 2016).

BIM enabled detailed 3D visualization of the project, providing the client with better understanding during preparation and execution. This model was used for optimizing earthworks, planning temporary technological infrastructure, and simulating work processes on the construction site. The precision of the works was crucial to the project's success, with the use of a GNSS *(Global Navigation Satellite System)* system managing 60 different machines.

This system achieved accuracy of ±2 cm in earthworks and ±5 mm in asphalt works (Ninkov et.al., 2016). Through the application of modern technologies and the BIM approach, the first two sections, totaling 90 km, were completed more than a year ahead of schedule, significantly improving the efficiency, precision, and coordination of all project phases.

3. RESEARCH AND DISCUSSION

This article analyzes the perception of construction companies regarding the benefits of applying automation and information technology throughout the entire project lifecycle. For the purposes of this article, the authors have taken a part of the research from a broader study conducted within the project "Digital Transformation of Enterprises in the Small and Medium-Sized Enterprise Sector in Serbia," implemented by the Serbian Chamber of Commerce in cooperation with the OSCE (*Organization for Security and Co-operation in Europe)* Mission to Serbia. The research, supported by the OSCE Mission to Serbia, also examines which digital competence programs are being developed and launched in Serbia, both within formal and informal education.

The main goal of the research used for this article was to examine the extent to which construction companies use digital tools and IT technologies in various project phases, as well as to determine their perception of how these technologies contribute to improving business processes.

The questionnaire was sent to 79 construction companies and project bureaus, of which 46 provided responses and participated in a 120-minute panel discussion via the Zoom platform. The sample of 46 respondents can provide valid results as it is representative. Approximately 65% of the respondents have more than 10 years of experience,offering valuable insights into the long-term application of automation techniques in the industry. On the other hand, around 35% have 10 or fewer years of experience, bringing perspectives based on knowledge of newer technologies and methodologies in construction. Furthermore, 36 engineers are from construction firms (contractors) and 10 from design offices.

This diversity in participant experience levels enriches the study, as it provides a broader understanding in the context of using ICT technologies in construction. Such an approach enables the identification of key advantages and challenges faced by less experienced companies that are just introducing ICT technologies, as well as those that have already adopted advanced digital tools.

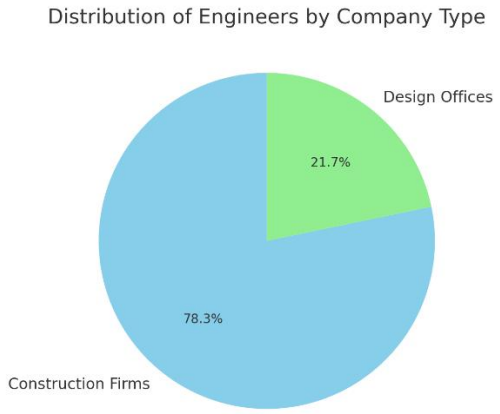

Fig.1. Distribution of Engineers by Company Type

As a research instrument, a specially designed closed-ended questionnaire was used, consisting of three sections. The first section includes general questions: information about the companies and characteristics of the respondents (position, education level, years of experience in the company, years of experience in the current position,

and a description of the tasks currently performed by the respondent), as well as their knowledge about the application of ICT in the management processes of construction projects.The second section examines attitudes toward the established ICT system through the various phases of the project. In the third section, the Delphi method was applied through a Zoom session with participants, during which they elaborated on their previous responses from the questionnaire. The aim was to achieve a consensus among experts on the feasibility of applying ICT in construction projects, the advantages of its use, and potential shortcomings that need to be addressed.

During the discussion with respondents, a consensus was reached that 96% of participants highlighted that the highest automation index (AI) is achieved in the initial phase and project definition. This percentage reflects the use of software tools for planning, design, progress tracking, and resource management, such as BIM (Building Information Modeling), CAD (Computer-Aided Design), and project management software.Additionally, 83% of respondents believe that ICT plays a crucial role in networking within project organizations, where digital platforms enable all teams (architects, engineers, contractors, and clients) to exchange information in real-time. Furthermore, integrated information systems, such as ERP*(Enterprise Resource Planning),*CRM *(Customer Relationship Management),* and BIM (Building Information Modeling) tools, utilized by 44% of participants throughout all project phases, allow for automated tracking of inventory, costs, time, and resources, contributing to better decision-making and quicker adaptation to changes. On the other hand, maintaining the construction logbook has the lowest level of ICT technology application.

Nevertheless, 83% of respondents agree that the level of ICT technology implementation significantly affects whether a project is successful or unsuccessful. While 50% of participants associate automation in construction with advanced project management tools, 36% link it to the automation of construction equipment, and a smaller percentage considers other technological aspects. We will present the results of the research graphically on Fig.3.

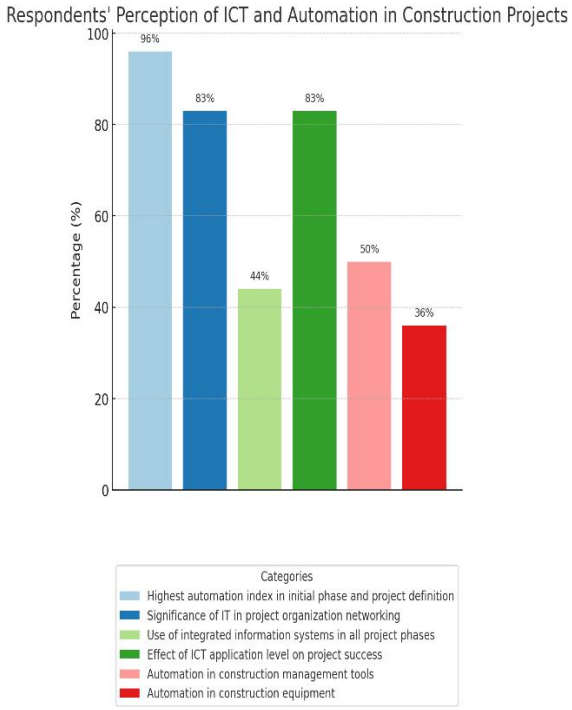

Fig.2. Respondents' Perception of ICT and Automation in Construction Projects

These findings indicate that construction companies recognize the importance of ICT technologies for increasing efficiency and competitiveness. However, challenges remain in implementation, including initial costs and employee adaptation to new technologies.

4. CONCLUSION

Information and communication technologies (ICT) today play a crucial role in the construction industry, significantly changing the way construction projects are planned, managed, and executed. ICT tools, such as software applications for design, planning, and progress tracking, have become essential for successfully managing projects in this industry. ICT in construction is no longer just a tool for internal organization but has become key to optimizing collaboration among various stakeholders, including architects, engineers, contractors, suppliers, and clients. Digital platforms allow for real-time information sharing, improving coordination and speeding up decision-making. In this article, we investigate the perception of automation technology in the construction sector in Serbia.

Although the research shows that participants consider various technological aspects of automation in construction, the majority of engineers clearly recognize the importance of ICT technologies throughout all phases of a project. The results suggest that technology integration is a key factor

for the success of construction projects. Companies that adopt and implement high standards of ICT technologies have a significantly greater chance of successfully executing projects and remaining competitive in the market.However, many construction companies still face challenges when it comes to fully integrating ICT systems. Fragmented systems, the lack of strategic plans for technology implementation, and limited knowledge of ICT application in project management are slowing down the digitalization in construction. Companies that successfully implement ICT technologies in construction gain a significant advantage in terms of efficiency, cost reduction, and better risk management. Those lagging behind this trend risk becoming less competitive and facing difficulties in executing projects according to modern standards and market demands.

The authors of this article aim to provide insights into the importance of ICT application in construction projects , as well as how the digitalization of construction projects in Serbia can be assessed. In their concluding remarks, the authors emphasize that, alongside focusing on assessing digitalization trends at the broader industry level, it is equally important to evaluate digitalization trends at the individual project level. We believe that future research should be conducted not only to apply the digitalization index at the level of the entire construction industry, but also to validate and pretest it on selected projects. This phase is crucial for assessing the index as a tool that can improve efficiency and track digitalization within the construction industry. Additionally, evaluating its applicability to future projects would enable the industry to more accurately identify areas requiring technological advancement, thereby accelerating the integration of digital solutions and enhancing the sector's competitiveness.

Literature:

[1] Dakhil,A., Naji, Z., & Alsalih (2021) „ The Applicability of
Using Automation in Construction in Iraq“, *Journal for Engineering Science, 21(2), 39–44,* Basrah

[2] Davis,M. (2022,) „*What Is Construction Automation, and How Will It Drive the Future of Building“* https://www.cmaanet.org/sites/default/files/resource/Construction%20Automation.pdf,

[3] Hewitt,M. & Gambatese, J.(2021) „Automation Consideration During Project Design,*Proceedings* of the 19th International Symposium on Automation and Robotics in Construction (ISARC) University of Edinburgh, UK

[4] Ivković, B, &Popović,Ž. (2005)“ *Project Management in Construction“, Third Revised Edition.* Construction book,Belgrade

[5] Izetbegović, J., Orešković,M.&Bandić,M. (2004) “Primena i razvoj informatičke tehnologije u hrvatskom graditeljstvu“,Građevinar,56(8), pp.481-488.

[6] Karmakar,A. & & Delhi, V.S.K (2021) „ Construction 4.0: What we know and where we are Headed“ ? *Journal of Information Technology in Construction, Vol. 26, 526-545.*

[7] Navon,R. &Shpatnitsky, Y.(2005)“Fielg Experiments in Automated Monitoring of Road Construction“,Journal of Construction Engineering and Management, Vol. 131.N$_0$4

[8]Navon,R.(2005)" Automated project performance control of construction projects". *ELSEVIER, Automation in Construction No.4.*, pp.467-476.

[9] Ninkov, T., *Sabadoš, I., Sušić, Z., Batilović, M., Bulatović, V.* (2016),*BIM technilogy an its application in design and road construction* Novi Sad: Research project of
the Department of Civil Engineering and Geodesy (DGG)Faculty of Technical Sciences in Novi Sad "Improvement of the teaching process and research of the new technologies in civil engineering."

[10]Olaonipekun Toyin,J. (2024) "Investigating the influence of ICT application in construction jobsities: a systematic review and bibliometric analysis", J*ournal of Information Technology in Construction - ISSN 1874-4753 DOI: 10.36680/j.itcon.2024.021*.

[11] Official Gazette of the RS", Nos 95/18, 144/20, and 118/. (2021). *The Customs Law ("Official Gazette of the RS",*
No95/18, 144/20, and 118/21) - consolidated text by the Ministry of Finance. Available on: https://mfin.gov.rs/en/decrees-2/the-customs-law-2.

[12] Paudyal,G. (2016) "ROLE OF ICT IN CONSTRUCTION"*Conference: National students Conference on Information Technology(NaSCoIT)At: Hotel Yak and Yeti,* NCIT, Balkumari.

[13] Pilcher,R. (1995)" *Project Cost Control in Construction, Second ed."* BleckwellScientific Oxvord.

[14] PMI. (2021), *International Project Management Association* Available on: https://www.pmi.org/ [Accessed 18.10.2024).

[15] Ram,J., Corkindale,D.R.,Ming,L.W. (2013)" Implementation critical successfactors (CSFs) for ERP: Do they contribute to implementation success and post implementation performance"? . *International Journal Production Economics,*, pp.157-174.

[16] Sacks, R., Navon, R., Goldschmidt,E. (2003)"Building Project Model Support for Automated Labor Monitoring." *JOURNAL OF COMPUTING IN CIVIL ENGINEERING /*, 17(1): 19-27.

[17] Tešić, B.,Marković,M.,Plećić, K.&pantelić,I. (2013)" Knowledge management aninformation technologies." *V Scientific meeting USPON* (str. pp. 198-204). Belgrade: Singidunum University.

Contact information:

Snežana MAKSIMOVIĆ, PhD
Associate Professor, MB University
Faculty of Business and Law, Belgrade, Serbia
E-mail:galena.mcl@gmail.com
https://orcid.org/0000-0001-9928-1292

Ksenija BOGOSAVLJEVIĆ, PhD
Assistent Professor,Department of Finance, Florida Atlantic University, Boca Raton 33431, FL, USA,
E-mail: kbogosavljev2015@fau.edu
https://orcid.org/0000-0003-1152-1680