






Methods and Practices of Integrated Construction Process Management – Minimizing Environmental Impacts and Promoting Efficient Resource Management

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Abstract. Construction is a sector that plays a key role in economies around the world. At the same time, it faces various challenges that affect its efficiency, sustainability and ability to contribute to societal development. Integrated construction management is a key tool for ensuring the successful and sustainable progress of construction projects, not only in terms of finance, but also in terms of environmental and social aspects. This publication explores the application of integrated construction process management (ICPM) as a strategic approach to addressing environmental issues and optimising resource use in the construction industry. The research explores the current state of the art in the levels of integrated project management in construction companies, The study highlights the importance of a holistic and coordinated management framework that integrates different aspects of construction processes. The primary objective of the research was to ascertain the information on methods and practices that contribute to effective resource management. The research analyses the processes and use of integrated project management tools in construction companies, such as integrated communication, integrated management tools and technologies, risk management options and methods, resource optimization, and examines the main challenges, opportunities and observations related to integrated management of the construction project and the company as a whole. The originality of the research lies in defining key innovations that directly contribute to improving competitiveness, solving problems, managing resources, developing society and implementing sustainable project management. In addition to the above, respondents prioritized specific benefits that will help support sustainable project management. At the end of the paper, the goals of future research.

Keywords: construction · management · integrated methods · environmental impacts · resources management

1 Introduction

Construction business management is a complex and dynamic field of risk management, which is focused on the successful implementation of construction projects. The construction industry is known for its diversity and complexity. Against this background, it is important that construction managers have a wide range of skills and knowledge.

Construction management is the act of managing the construction process. The basic resources of a construction project are managed by the construction manager, who may be the contractor, project manager, superintendent, or their representative. The resources of a construction project include workers and subcontractors, equipment and construction plants, materials, money and time. The aim of management is to complete the project on time and within budget [1].

The aim of integrated project management (IPM) is to create a clear picture of the project. This approach is all about streamlining operations, improving communication and improving the overall workflow of a construction project. IPM is a holistic method of planning, managing and executing projects. IPM views the project as a cohesive whole and not as separate components, entities [2].

Monitoring the impact of the implementation of integrated project management in construction companies is important primarily from the point of view of increasing the efficiency and performance of projects, optimizing processes, risk management, improving communication and cooperation, and improving client satisfaction. All these aspects directly support various aspects of the sustainability of construction projects and the construction industry as a whole. Monitoring the impact of implementation of IPM is therefore key to improving efficiency, competitiveness and sustainability, which is increasingly resonating in society and becoming a key aspect of decision-making. Based on the mentioned facts, it is necessary to examine and define the key tools of integrated project management in construction companies.

2 Literature Review

2.1 Sustainability in Construction Industry

The concept of sustainability is maintaining the ability to be sustainable while ensuring diversity and productivity. Sustainability and its very existence depends on natural resources, but the availability of natural resources is not infinite.

Sustainability needs to be seen as a coherent whole and the use of renewable energy sources contributes greatly to its promotion. Activities associated with the destruction of forests, the release of harmful substances into the atmosphere and water, inadequate waste management in relation to nature and many other factors contribute to sustainability becoming a problem for ecosystems [3].

The idea of sustainability is a holistic approach that combines three main pillars: the environmental, social and economic aspects of sustainability. Bringing these three pillars together does not necessarily imply a trade-off between the environment and economic development. The high level of attention paid to sustainability is proof that the three fundamental pillars of sustainability are consistent and closely interlinked. Humanity

recognises that climate change affects the economy and society, impacting different levels of society in different ways [4].

At the United Nations Summit on 25 September 2015, the General Assembly adopted a document entitled *Transforming Our World: the 2030 Agenda for Sustainable Development*. The 2030 Agenda contains 17 Sustainable Development Goals, which are based on three dimensions of sustainability that include elements of economic development, environmental management and social inclusion [5].

Sustainability needs to be applied in different areas of the industry. This concerns the responsible and sustainable use of available resources and processes. It is necessary to achieve actions and practices that minimise the negative impact on the environment. The largest emitters of emissions and greenhouse gases in industry are the manufacturing and textile industries, which strive to reduce emissions and incorporate sustainable aspects and practices into their processes.

Sustainability is a characteristic of development that is mindful of the Earth's development requirements. Sustainable construction includes everything that is connected with construction and the construction object itself, from its implementation to the end of its life. Important factors include energy consumption, CO₂ emissions, the functionality of the building and also the price associated with the cost of operation [6].

Sustainable construction aims to take advantage of energy efficiency and the benefits of green technologies. Sustainable construction also includes the use of renewable energy sources in the construction and use of the building itself. When examining the environmental factors affecting the environment, experts have concluded that the construction industry is responsible for a large proportion of the environmental burden. On a global scale, buildings and structures consume 60% of electricity. Waste is also produced during construction and use, accounting for 40% of the environmental burden, and freshwater consumption is 12% [7].

An important factor to promote sustainable construction is to apply new design principles, the use of innovative materials, and the implementation of new construction and organizational technologies. At the same time, the construction industry influences the environment and society itself to a large extent, therefore it has a great potential for positively influencing the sustainable development of society through the application of optimisation approaches and design and management technologies.

The basic principles of sustainable construction can be divided into three principles [8, 9]:

- environmental sustainability - the ability to conserve and protect the natural environment over time through appropriate practices and policies that meet present needs without compromising the availability of resources in the future. To achieve environmental sustainability, several key objectives need to be achieved, such as reducing greenhouse gas emissions, increasing the production and use of renewable resources, implementing policies to conserve biodiversity, adopting sustainable practices, raising awareness and engaging communities in environmental sustainability issues, and promoting circular construction,
- social sustainability - emphasizes the welfare of individuals and communities. As cities utilize 75% of the world's natural resources, the constructed environment holds substantial potential to minimize its ecological footprint. Prioritizing environmental

justice, employee welfare, and education, social sustainability entails meaningful and measurable actions by companies. These initiatives aim to foster communities with sufficient transportation, secure housing, and safe environments and land.

- economic sustainability - involves conducting co-management activities in a manner that ensures and enhances long-term economic well-being. This approach centers on achieving a harmonious equilibrium among economic growth, resource efficiency, social justice, and financial stability. Key aspects of economic sustainability include responsible resource management, enhanced efficiency, and the implementation of innovations such as economic systems. The framework also underscores the importance of improving financial stability at the macro level, fostering international cooperation and partnerships between public administrations and private enterprises, and supporting policies, programs, and initiatives that address critical social issues like poverty, gender equality, access to education and healthcare, and environmental sustainability. Additionally, economic sustainability seeks to minimize environmental impacts, promote social and economic justice, cultivate a more resilient and dynamic economy, and encourage corporate management based on principles of responsibility and ethics.

2.2 IPM – Integrated Project Management in Construction

Construction is the coordination of different tasks, personnel and resources. The goal of integrated project management is to bring together the various elements to successfully manage a project from start to finish. In project management, many internal and external members are critical to the success of a project. An integrated approach encourages collaboration and identifies critical resources early in the project, allowing more collaborative teams to be built to communicate and share information freely [10].

The main progressive steps of project management implementation are:

- stakeholder identification: a central part of integrated management is the integration of all stakeholders into one team. Each team member has a critical role to play and brings expertise and specific talents that contribute to the project solution. The stronger the alignment, the stronger the team,
- Getting Buy-In: it is important that support is received by the down alignment. Project owners, company owners, and all stakeholders need to have a unified view and alignment of views,
- collaboration: the team constantly shares knowledge and communicates openly, the more successful they are in reaching a joint decision,
- accountability: an essential part of project management. Accountability fosters trust among team members,
- technology: IPM uses technology to ensure full information and supports communication between all stakeholders on the project's interim status. Technology that supports real-time communication and provides transparency is a key cornerstone for integrated project management.

Project integration management involves the coordination of all project elements, including tasks, resources, stakeholders and deliverables. The purpose of pro-project integration management is to ensure that processes run efficiently and meet pre-defined objectives [11].

The advantages resulting from the implementation of IPM are mainly [12, 13]:

- improved client planning: integrated project management solutions create the space to manage client details and plan client-specific activities,
- automation and streamlining: all relevant and correlated data is aggregated. Based on the above, easier and smoother data acquisition and processing is possible,
- improved communication and collaboration: within the integrated project management solution, internal group hubs are created to record and share comments, concerns, advice, records, specifications and files to support collaborative communication. By creating such a platform, there is support for instant decisions, dependencies, emergency workloads and other assignment requirements that can be run collaboratively. Thus, the overview of the phases of a case and its acute status is improved, communication and collaboration is enhanced, which increases transparency in the workplace and leads to faster pace and targeted assistance,
- realistic allocation handling: by implementing IPM, it is possible to monitor funds at any stage throughout the duration of the assignment. This provides the user with realistic details of the actual expenditure metrics, which helps in determining how actual expenditure compares to planned expenditure and allocated funds,
- continuous monitoring: a seamless flow of data across all areas enables integrated project management and promotes collaboration. The system provides up-to-date details on resource use and whether or not the target deadline has been reached,
- resource planning and distribution capabilities: the IPM keeps up-to-date information on what materials are being used and what the future needs are. The data enables superior work productivity because engineers and managers are able to track resource bottlenecks and prevent non-productive impacts.

In addition to the considerable advantages, the implementation of integrated project management faces potential barriers such as [14]:

- lack of data: integrated control is data-dependent and machines can only “learn” from the data available to them. It is therefore important to have a wide range of data that is accurately labelled, organised and unbiased. Acquiring and maintaining such data can be a significant barrier to implementing IPM,
- poor technical infrastructure: for the implementation of IPM, it is necessary to have sufficient infrastructure in place for its implementation. It is important to determine what technology will be used to share the information, whether it is cloud-based or another integrated system, and how many people will have access to it. Without an agreed infrastructure, companies will have a problem with implementation,
- lack of qualified staff: companies need to have teams that are ready to work with the new tools,
- no process set-up: the lack of established design processes may hinder the adoption of IPM. A common cause is the lack of standardised and followed project processes. If processes are not clearly established, they cannot be accurately recorded or repeated - that is, they cannot be implemented and used.

Project management and integrated project management are frequently conflated, particularly when considering the necessary skills, roles, responsibilities, and complexities needed to achieve objectives. However, these represent distinct challenges.

Integrated project management involves combining smaller components into a unified system or entity that operates holistically. Conversely, project management is the utilization of skills, tools, and techniques to oversee project activities, aiming to fulfil project requirements and achieve end goals [15].

Project management is the ability to deliver a project that has these characteristics [15]:

- clearly defined client objectives,
- scope,
- budget,
- stakeholders,
- risk management,
- project team,
- project resources,
- end point, milestones and timelines,
- success criteria.

An integrated management system represents a permanent, unified operational system and harmonisation between [15]:

- functional specialists,
- teams,
- departments,
- systems,
- tools, technologies and
- projects.

The scope of integration can apply to a team, a department, a store, or as a business supply chain ecosystem.

2.3 Integrated Project Management (IPM) and Sustainability

In contemporary times, environmental concerns, social accountability, and economic transformations have become prominent themes across various facets of our lives. Within this context, the concept of sustainability is gaining increasing significance in society, aiming to achieve a harmonious equilibrium between progress and responsible resource management. The incorporation of sustainability into project management is emerging as a crucial catalyst for global impact.

Traditionally, project management has concentrated on achieving timely delivery, staying within budget constraints, and meeting specified requirements. While these parameters are essential for successful project completion, there is a growing recognition that the scope of effective project management should extend to encompass sustainability considerations. In the context of project management, sustainability involves integrating environmental, social, and economic dimensions into the planning, execution, and assessment phases of a project [16, 17].

The role of the project manager is to manage the project in a sustainable way and the possibilities to state that centralized project management allows to influence many aspects of the project [18].

Every stage in the project life cycle requires the integration of sustainability principles. To ensure the successful completion of a project with sustainability in mind, appropriate measures need to be adopted. One commonly employed method for choosing measures in project management is the iron triangle, which symbolizes the interconnected constraints of time, quality, and cost. The phase gate approach evaluates project success based on time, quality, uncertainty, and cost parameters. When selecting measures for project management, it is imperative to factor in sustainability criteria [19].

Promoting sustainability within project management is a crucial responsibility that yields value and advantages across overall operations. The measurement of sustainability revolves around three key factors: environmental considerations, financial aspects, and social implications. Infrastructure projects, as well as the sustainability and development processes of products, are integral, given their significant influence on environmental and social factors. In the case of infrastructure projects, which vary and involve diverse collaborators with different interests and expectations, the adoption of sustainable project management practices becomes imperative.

Within the realm of project management, the emphasis on sustainability holds particular significance. Through the incorporation of sustainable methodologies, project managers can enhance project resilience, mitigate risks linked to environmental and social factors, and contribute to an organization's image as a responsible and forward-thinking entity within a rapidly evolving global landscape. The primary advantages of implementing integrated project management, which positively impact project sustainability, encompass [20]:

- cost savings in integrated project management involve a comprehensive approach that addresses resource consumption, materials, and energy efficiency. Through the adoption of sustainable practices, there is a significant potential to minimize waste generation, optimize the utilization of materials and energy resources, resulting in an overall reduction in operating costs. The judicious use of resources not only contributes to immediate cost savings but also supports long-term financial stability. Such cost reductions enhance operational efficiency, leading to an improved return on investment. This cost-conscious approach aligns with the evolving business landscape that places a premium on environmentally responsible practices, recognizing them as integral to achieving both economic success and environmental sustainability.
- regarding supply chain resilience, a strategic focus is placed on selecting suppliers committed to sustainable practices. Project managers ensure that the required resources are not only available in the short term but also contribute to the long-term resilience of the supply chain. Sustainable suppliers are often adept at managing environmental and social risks, making them less vulnerable to disruptions caused by factors such as climate change impacts, regulatory changes, or social unrest. In an increasingly volatile global environment, relying on sustainable suppliers emerges as a proactive strategy to navigate uncertainties and maintain a consistent flow of resources both presently and in the future.
- enhancing corporate image and building positive relations with stakeholders involve prioritizing sustainability, showcasing a commitment to responsible business practices, and thereby fostering a favorable brand image. This approach positions the organization positively in the eyes of an increasingly environmentally conscious market,

attracting clients and partners who prioritize sustainability in their business relationships. Sustainable initiatives not only increase community engagement but also garner support for company projects, as local communities are more inclined to embrace and endorse environmentally responsible efforts.

- encouraging innovation and reinforcing project management methodologies are outcomes of a commitment to sustainability. The inherent challenge for project teams lies in minimizing environmental impact, optimizing resource use, and adhering to ethical standards. Sustainable practices stimulate inventive problem-solving, prompting project managers and teams to explore unconventional paths, leverage cutting-edge technologies, and embrace progressive management strategies. Beyond improving the environmental and social footprint of a project, the integration of sustainability propels the field of project management forward, inspiring the development of innovative solutions and methods applicable across various project domains.
- ensuring long-term durability is achieved through the active implementation of sustainable procedures. By anticipating the development of legislation, projects minimize the risk of non-compliance and potential legal consequences. Sustainable infrastructure, designed to withstand environmental challenges, acts as protection against the impacts of climate change and market fluctuations. Efforts to transition to closed-loop systems, where resources are recycled and reused, contribute to a more circular and sustainable approach, reducing dependence on limited resources.
- projects actively contribute to environmental impact reduction through the deliberate integration of renewable energy sources and the adoption of energy-efficient technologies. Sustainable sourcing and responsible use of raw materials not only minimize environmental impact but also support biodiversity and contribute to ecosystem protection. Implementation of recycling and reuse programs further lessens the burden on landfills, curtails waste generation, and promotes a circular economy.

3 Research Methodology and Data

3.1 Research Aim

The study aimed to assess the existing status of integrated project management within construction firms. The primary objective was to gather information on methods and procedures that enhance the efficient utilization of resources. The research scrutinized the processes and utilization of integrated project management tools in construction companies, encompassing areas like integrated communication, tools, and technologies for integrated management, potential methods for risk management, resource optimization, and an examination of the key challenges, opportunities, and feedback pertaining to the integrated management of both construction projects and the companies overseeing them.

3.2 Data Collection and Research Sample

The survey took the form of an online questionnaire distributed through Google Forms, targeting various construction companies operating across the entire territory of the Slovak Republic. The main objective was to engage a diverse professional audience, encompassing companies in both the public and private sectors with broad scopes of operation.

In the course of the survey, 68 companies were reached out to via email. Out of the total number of companies and organizations contacted, the questionnaire response rate was approximately 39,71%. The relatively low return was primarily attributed to factors such as respondent reluctance (due to a high number of concurrent online surveys), the substantial workload of companies, and lower awareness.

3.3 Research Step and Methodology

The online questionnaire survey comprised three distinct sections, encompassing a total of 16 questions that included various response formats such as free-form answers, single-choice options, checkboxes, and check grids. The questionnaire sections were categorized into:

- 1st section: Respondent Profile Details - in this section, participants provided fundamental information about their companies, specifying the company size, duration of presence in the market, primary branches of the construction company, and the geographical area of the company's operations.
- 2nd section: Integrated Management of Construction Projects - this segment delved into the key attributes of integrated management for construction projects. It explored the advantages and significance of specific elements, along with defining various tools and methodologies employed in implementing integrated management for construction projects.
- 3rd section: Construction Project Management and Sustainability Aspects - this section focused on examining individual aspects in project management, emphasizing their importance, and considering client requirements, particularly in the context of sustainability.

4 Results – The Current State of Integrated Construction Project Management

4.1 Information About the Respondents

The study was conducted in January 2024, and during this period, individual participants were invited to take part in the survey through various means, including telephone calls, emails, or personal interviews. The initial segment of the questionnaire was designed to gather fundamental information about the respondents. The participants provided responses regarding:

- company size,
- duration of market presence,
- primary branches of activity, with a particular emphasis on construction-related activities,
- geographical areas of operation, specifying the regions involved.

Concerning company size, the majority of respondents belonged to the category of large companies, specifically those with 250 or more employees, accounting for 55,6% of the participants. The second most prevalent group comprised small businesses, with

10 to 49 employees, constituting approximately 33,3% of respondents. Medium-sized enterprises, with employee numbers ranging from 50 to 249, represented the smallest portion, making up around 11,1% of respondents. Regarding the duration of service, the predominant participants were well-established companies with over 15 years of experience, comprising 66,7%. This was followed by newer entrants, i.e., small companies in operation for 1 to 5 years (22,2%), and medium-experienced companies, operating for approximately 6 to 15 years (11,1%).

In terms of geographical reach, the surveyed companies predominantly operated nationally (44,4%) or internationally (33,3%). Only a small percentage worked locally or regionally, each accounting for 11,1% of respondents. The primary branches of construction activity declared by respondents included engineering construction works (bridges, tunnels, water management, and transport structures) at 77,8%, followed by new buildings (55,6%), reconstruction and modernization (44,4%), and specialized construction works (electrical installations, air conditioning), energy-related construction works, and commercial and residential construction, collectively representing 11,1%.

4.2 Integrated Construction Project Management

The second section of the questionnaire focused on integrated management of construction projects as a managerial approach to planning, coordination, and control of all aspects of a construction project. Respondents specified:

- the key characteristics of integrated project management that they implement in their companies,
- prioritized these characteristics,
- and defined how individual aspects are directly implemented within their respective organizations.

In terms of specific tools for integrated construction project management, companies predominantly utilize the following key characteristics:

- 77,8% of respondents incorporate various tools to support planning and monitoring. These tools aid in regular project planning and progress monitoring, ensuring adherence to schedules and deadlines. Simultaneously, there is an emphasis on increasing flexibility and adaptability, facilitating swift adjustments to changes and unexpected events during the project.
- 66,7% of respondents employ tools that enhance coordination and communication (ensuring effective communication among all stakeholders, including developers, architects, engineers, contractors, and others), process integration tools (bringing together the diverse phases of the project into a cohesive whole for better control and monitoring), optimization of resource usage (efficient utilization of human, financial, and material resources to minimize anticipated and cost-related risks), and risk management tools (effectively utilizing human, financial, and material resources to minimize anticipated and cost-related risks)

The surveyed participants were required to establish the prioritization within the study, specifically by defining the significance of integrated project management advantages that are relevant to them or constitute relevant aspects in their decision-making

process. Based on this, respondents indicated that the pivotal factor influencing their decision-making is:

- better communication - IRSP ensures effective communication between all project stakeholders, reducing the risk of misunderstandings and errors – 17,7%,
- centralised information management - sharing information through a centralised system ensures that all team members have access to up-to-date data and documents – 22,1% and,
- improved coordination - integration of the different phases of the project allows better coordination between the different teams and processes – 22,1%.

Detailed outcomes are presented in Table 1. Simultaneously, participants were required to provide comments on the inquiries.

- How do you integrate communication between different stakeholders within the project?
- What technologies or tools do you use to support the integrated management of construction projects?
- How does your company manage risks in construction projects?
- How do you optimize the use of resources (human, financial, material) through the integrated management of construction projects?

Regarding integrated communication among diverse project stakeholders, respondents primarily employ internal tools such as coordination meetings, minutes, information sharing through external storage, phone calls, emails, and Building Information Modelling (BIM) tools. In support of integrated construction project management, individual participants mainly utilize tools such as Microsoft Project, Microsoft SharePoint, BIM, SAP, Documentus, external repositories for data sharing, and conventional methods like meetings, internal directives, and similar approaches. In terms of risk management, commonly used tools include regular coordination meetings, minutes, independent inquiry controls, quality plans, and control and test plans. In the context of optimizing resource utilization (human, financial, material), respondents predominantly utilize regular analyses, with outcomes presented during meetings (either in person or online), and simultaneously available on platforms facilitating communication among various stakeholders.

4.3 Construction Project Management and Sustainability Aspects

Sustainability holds significant importance across various industries, including construction. Within the construction sector, sustainability encompasses aspects that impact the environment, society, and the economy. Managing construction projects with a sustainability focus entails integrating principles of environmental, social, and economic sustainability throughout all phases of the project cycle. This approach aims to minimize negative environmental impacts, contribute to social well-being, and simultaneously achieve economic efficiency.

Table 1. Priority benefits of implementing integrated construction project management (ranking).

Advantages of use	Ranking/share										
	1. Place	2. Place	3. Place	4. Place	5. Place	6. Place	7. Place	8. Place	9. Place	10. Place	11. Place
better communication - IRSP ensures effective communication between all project stakeholders, reducing the risk of misunderstandings and errors	17,7	0	4,41	0	4,41	0	0	0	0	8,82	4,41
centralised information management - sharing information through a centralised system ensures that all team members have access to up-to-date data and documents	0	22,1	0	4,41	0	0	4,41	4,41	4,41	0	0
improved coordination - integration of the different phases of the project allows better coordination between the different teams and processes	0	0	22,1	0	0	4,41	0	0	8,82	0	4,41
resource optimisation - IRSP enables efficient use of human, financial and material resources, leading to minimisation of planning and cost risks	0	4,41	4,41	17,7	0	4,41	4,41	35,3	0	0	0

(continued)

Table 1. (continued)

Advantages of use	Ranking/share										
	1. Place	2. Place	3. Place	4. Place	5. Place	6. Place	7. Place	8. Place	9. Place	10. Place	11. Place
improved risk management - identification and management of potential risks is an integrated part of the IRSP, helping to minimise unexpected problems	4,41	4,41	0	4,41	13,2	4,41	0	4,41	0	0	4,41
quality project documentation - centralised access to documentation ensures accurate and up-to-date information is available to all stakeholders	8,82	0	0	4,41	4,41	17,7	0	4,41	0	0	0
speeding up planning and implementation - integration of processes greatly simplifies project planning and implementation, which can lead to earlier completion	0	4,41	0	0	8,82	4,41	22,1	0	0	0	0
flexibility and adaptability - IRSP allows flexibility to adapt to changes during the project, which is important in the dynamic environment of the construction industry	0	0	4,41	4,41	4,41	0	8,82	11,8	0	0	0

(continued)

Table 1. (continued)

Advantages of use	Ranking/share										
	1. Place	2. Place	3. Place	4. Place	5. Place	6. Place	7. Place	8. Place	9. Place	10. Place	11. Place
improved safety and quality of work - with clear management and monitoring of processes, IRSP can contribute to safer working conditions and the achievement of higher quality standards	4,41	0	0	0	0	0	0	4,41	16,7	8,82	4,41
client-oriented approach - better project organisation enables clients' expectations to be met more efficiently and satisfaction with the results to be improved	4,41	4,41	0	4,41	0	0	0	0	4,41	17,7	4,41
Increased efficiency and competitiveness - the overall benefits of IRSP lead to increased efficiency and competitiveness of the company in the marketplace	4,41	0	0	0	4,41	4,41	0	0	4,41	4,41	17,7

In terms of sustainability aspects, respondents closely monitor parameters like energy and water consumption and the investment payback period. Other monitored parameters include the amount of construction waste generated, financial efficiency, participant involvement and satisfaction, and the utilization of renewable resources. Less attention is given to monitoring greenhouse gas emissions (CO_2 , CH_4 , N_2O) and the sustainability index/certification of buildings.

Respondents were asked about aspects that clients specifically demanded. Clients primarily sought financial efficiency in their projects, followed by inquiries related to controls for construction waste, sustainability index, building certification, payback period, and the use of renewable resources. The least demand was observed in the area of greenhouse gas production (CO_2 , CH_4 , N_2O).

Regarding specific sustainability aspects, clients expressed the highest demand for tools such as Building Information Modelling (BIM), green technologies, and tools supporting energy optimization. There was relatively less demand for Life Cycle Assessment, virtual prototyping, and waste management. Based on this, respondents identified Life Cycle Assessment (LCA) and Building Information Modelling (BIM) as the most crucial tools for implementing energy optimization, with many companies having either already incorporated these tools or planning to do so in their processes soon.

5 Conclusion

Effectively overseeing a construction company is a pivotal factor for successful project management, efficient resource utilization, and the overall advancement of the company. The management of a construction company necessitates robust skills in overseeing projects from inception to completion, adeptly managing all resources (labor, materials, technologies), optimizing individual processes, ensuring effective and economical cost management, adherence to regulations, adept communication, fostering innovation and continuous development, and, importantly, incorporating practices that uphold sustainability across all processes.

Integrated project management in construction entails a systematic approach to managing construction projects by integrating diverse aspects, processes, and cohesive frameworks. This systematic approach allows for the enhancement of planning, monitoring, and management efficiency in construction projects. The findings from the online survey conducted as part of the research provide insights that align with societal concerns. The most significant challenges identified in integrated project management within the construction industry are perceived as enhancing the efficiency of planning, monitoring, and increasing flexibility and adaptability. Addressing these challenges requires the implementation of comprehensive strategies, utilization of modern project management tools, effective communication, and the capability to adapt to evolving conditions and uncertainties within construction projects.

As part of future research, it is necessary to analyse in more detail the strategies of individual construction companies in the field of project management and to define the impacts on selected indicators defining the success of the project and overall project management, such as the fulfilment of goals, compliance with the budget and schedule, quality of outputs, customer satisfaction, the ability to identify, manage and minimize project risks and other key aspects.

Acknowledgements. The paper presents partial research results of projects APVV-22-0576 “Research of digital technologies and building information modeling tools for designing and evaluating the sustainability parameters of building structures in the context of decarbonization and circular construction” and APVV-17-0549 “Research of knowledge-based and virtual technologies for intelligent designing and realization of building projects with emphasis on economic efficiency and sustainability”.

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