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Does Digitalization Supports Project Management Effectiveness? New Insight on the Role of Intellectual Capital

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Abstract: The challenges of the fourth industrial revolution faced by project managers are not only related to continuous adaptation to new technologies and the application of the optimal technical solution within each project but also imply the implementation of systemic changes in project management practice. There is no clear evidence in the literature about project management effectiveness in the digital economy or readiness for digital transformation in project-oriented organizations. The purpose of this paper is to identify the influence of intellectual capital components on project management effectiveness in the context of changes that are stimulated by digitalization, as well as the indirect impact of the company's readiness for digital transformation. Using 147 fully matched pairs of questionnaires collected from project managers and end-users of construction projects, it is proven that digital transformation readiness is relevant as a mediator and moderator between intellectual capital components and project management effectiveness. The contribution of this research is reflected in highlighting the importance of assessing project management effectiveness in order to assure project success. The digital transformation readiness of project-oriented organizations is an important element for increasing project team motivation, building trust, and developing effective communication channels.

Keywords: project management; project management effectiveness; digital transformation; digitalization; intellectual capital

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Citation: Bugarčić, M.; Slavković, M. Does Digitalization Supports Project Management Effectiveness? New Insight on the Role of Intellectual Capital. *Buildings* **2023**, *13*, 1898. https://doi.org/10.3390/buildings13081898

Academic Editors: Jorge Lopes and Patrick S.W. Fong

Received: 14 June 2023
Revised: 11 July 2023
Accepted: 24 July 2023
Published: 26 July 2023

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1. Introduction

With the development of interactive digital technology, artificial intelligence, social and internal networks, cloud technology, the internet of things (IoT), and internet services, the rules are changing in many industries, while the application of advanced and Internet technology contributes to a more efficient and effective value creation process. Digitalization is an umbrella term for a set of social, economic, and cultural changes caused by the use of digital technologies [1,2]. Therefore, every change triggered by digital technologies has been named a digital transformation [3]. Numerous scholars have focused on investigating the nature, key technologies, challenges, and drivers of digital transformation. Current research interests have shifted to a more business-oriented perspective [4], i.e., communication, innovation [5], leadership style, entrepreneurial spirit among employees, and risks and challenges in the implementation of business processes [2].

On the one hand, advanced technologies allow easier execution and monitoring of project activities. Project success is usually evaluated using three important elements described as the "iron triangle": time, cost, and output [6,7]. This has been influenced by digital transformation, which enables saving time and money. On the other hand, the sophistication of client requirements and the necessity of applying new technologies create growing uncertainty for project planning and expected project outcomes. In the context of the construction industry, lack of communication and collaboration [8] and trust building due to the complexity and uncertainty associated with projects and engaged parties [9] have been reported as key issues affecting the successful realization of project activities [10]. The

birth of artificial intelligence and the introduction of advanced modern technologies have been proposed as solutions to the identified problems in project management practices. For instance, solutions based on artificial intelligence may enable the analysis of large datasets in order to get insights into trends and problems as well as conduct corrective actions in future project activities. The issues regarding communication and collaboration between project actors may be overcome through building a project network, which would increase the efficiency of decision-making processes [11].

The reconfiguration of the value creation process, the emergence of digital ecosystems, and, consequently, the increasing complexity and uncertainty of project outcomes encourage companies to have more efficient exploitation of available tangible and intangible resources [12] and to change the existing perspective of perceiving project managers' tasks and assignments [11]. The beginning of the knowledge-based economy was marked by the efficient and effective use of intellectual capital (IC), one of the important assumptions for value creation. Additionally, the importance of investments in IC in the era of digitalization has been proven [12–14]. Previous research was focused on identifying the impact of IC on organizational success [15–17], while there is limited evidence on the impact of IC on project success [18,19]. More recent studies have proved that digital technologies and artificial intelligence have reshaped the set of specific working skills [11], changed the role of humans in the business process, and inevitably announced the beginning of a new era in project management [20]. The changes included redefining demanded skills, job creation, and lack in technical fields [21]. Thus, the digital preparedness of employees is one of the basic conditions for the survival of project-oriented organizations.

The digital transformation has changed how we perceive project success. Therefore, we are focused on evaluating project management (PM) effectiveness through indicators related to team work and communication among the participants in the PM process. Evaluating PM effectiveness enables overcoming the most common problem regarding different perceptions of project success. First, measuring PM effectiveness consists of analyzing the organization's ability to develop a sustainable culture that is maintained through project goals. Second, creating a climate of active participation, trust, harmony, and communication is one of the main indicators of PM effectiveness. Finally, we cannot exclude the traditional "iron triangle", or measuring project scope, schedule, and cost, as well as customer satisfaction [22].

Considering the previous evidence, the purpose of this paper is to identify the influence of IC components on PM effectiveness in the conditions of change that are stimulated by digitalization. In addition to the direct impact, this research examines the indirect impact of the company's readiness for digital transformation in the relationship between the analyzed IC components and PM effectiveness. With regards to the current research interest, this paper highlights assessing digital readiness and employees' digital competence for the implementation of business processes based on modern technologies, communication and collaboration through digital technologies, as well as technical capabilities for remote working and problem solving [23]. Examining the intervening role refers to determining the moderator or mediator effect [24]. In other words, the main aim of the research is to determine whether (1) the readiness for digital transformation changes the relationship between different components of IC and PM effectiveness, and (2) whether that readiness affects the strength and/or direction of this relationship (acting as a moderator) or represents a variable through which IC influences PM effectiveness (mediator). The purpose stated above and the current evidence in the literature led to the following research questions:

- How do IC and its components affect PM effectiveness?
- Does digital transformation readiness have an indirect effect on the relationship between IC components and PM effectiveness?

After this Introductory section, there is a literature review, within which the key theoretical assumptions are explained as well as the results of previous studies. Considering the purpose of this paper, we have created a research model. First, the research methodology is presented, followed by an overview of the results of the conducted analyses. Finally, a

discussion of the results is presented, followed by conclusions in which the implications, limitations, and directions for future research are presented.

2. Literature Review and Hypothesis Development

Due to the different approaches in the assessment of project success [25–27], the dynamic nature of the project, and the subjectivity in the evaluation of project outputs and outcomes [26], it is not possible to give a unique, comprehensive definition of project success, and there is no consensus about the categories of project success. According to Turner and Zolin [28], project success may be differently perceived by different groups of stakeholders over different timescales. Regarding different perspectives, the success of the project does not only mean the achievement of the "iron triangle" [29], because it is necessary to measure project effectiveness, which refers to the degree to which the desired outcomes and objectives of the project have been achieved [30].

Projects should be aligned with the company's existing strategy and vision, and it is important that their implementation contributes to organizational success. In other words, the essence of achieving superior business performance is based on successful project implementation [31]. Projects represent a powerful means of value creation [32–34]. By using different mechanisms during project implementation to assure effective monitoring of project implementation, the project is more likely to meet stakeholder expectations. Despite the fact that project managers are often focused on monitoring the effectiveness of project implementation when formulating a strategy, it is important to determine how much a particular project contributes to organizational effectiveness. Hence, project-oriented organizations (POO) should establish business models that will enable satisfying the needs of project stakeholders and achieving organizational effectiveness [35].

Considering the wider perspective of project success and the strategic approach of the assessment, it is relevant to explore different indicators of PM effectiveness. Furthermore, doing business in the current digital age highlights the importance of using the appropriate tools and techniques, managing effective processes, and developing skilled people. PM's effectiveness was highlighted in previous research. For example, Anantatmula and Kanungo [22] identified different drivers of PM effectiveness, such as knowledge management practices and IT systems, while Hyväri [36] argued that organizational design is related to PM effectiveness, suggesting that project team-based organizations are more effective than functional organizations. Ika et al. [26] proved that the use of monitoring and evaluation tools can provide better insights into a project's long-term impact.

Setting up effective communication channels may assure synergy among the team members [37–39]. There is evidence in the construction industry that stresses communication issues [40] and problems in collaboration among project team members [41] as the main causes of project failures. During the COVID-19 crisis, construction projects were affected by problems with project delivery that had negative impacts on project performance and collaboration between interested parties [42]. Employee motivation may be increased, and consequently, it can reduce non-productive effort and avoid mistakes [43]. In this context, problems may be identified sooner, which will help in managing uncertainty [44]. Finally, considering increased motivation, synergy, and harmony among team members and effective communication, a project is more likely to meet its goals and achieve success in the traditional "iron triangle" [37].

The changes in perceiving project managers tasks have begun with the start of the digital era. Advanced technologies have reshaped job descriptions and the set of skills required for superior job performance [11,21]. Consequently, the human role was changed, and the digital preparedness of the employees has become one of the basic conditions for the survival of project-oriented organizations. Apart from technical skills, the employees have to assure more efficient exploitation of available tangible and intangible resources [12]. The importance of investments in IC in the era of digitalization has been proven [12–14], while there are studies that highlight the importance of IC components as factors that influence project success and project performance [19,45,46] (Appendices A and B).

2.1. Human Capital in Project Management

Human capital represents the basic source of innovation and strategic renewal for companies [47], and its effective use leads to the generation of greater value in the digital era. When organizational knowledge is concentrated in the minds of highly qualified individuals, it can become irreplaceable, and their departure from the company can cause gaps that are difficult to overcome [45]. Apart from being considered a key reason that affects the success of companies, project performance is significantly determined by the efficiency of the use of intangible resources, among which are human resources. This supports the fact that none of the phases in the PM process can be carried out without people, i.e., project planning, implementation, and monitoring of project activities. According to Sambamurthy and Zmud [48], all people involved in project development and construction can be divided into three groups: (1) internal actors in the company who are directly involved in the project; (2) internal actors in the company who are not directly incorporated into the project; and (3) actors outside the company who benefit from the implementation of the given project.

According to Handzic, Durmic, Kraljic, and Kraljic [18], the project team is the key carrier of human capital. A project team includes humans who are directly involved in the project's implementation and are responsible for achieving project results, planning, organizing, and controlling the execution of project tasks. Gudienė, Banaitis, Podvezko, and Banaitienė [49] state that human resources in PM, and especially project team members, are important factors in project success. For instance, competent and professional personnel are necessary in order to successfully implement important and complex project tasks. According to Negash and Hassan [46], hiring a competent project manager can lead to cost optimization, quality improvement, and better cooperation between other team members in all stages of the PM process.

The effectiveness of the project team and the efficiency of human capital investments are observed through team commitment and active participation in the implementation of planned operations, internal and external communication, capabilities, knowledge, and technical skills of the project team, team structure, ambitions of the project team, education and attendance at training programs, productivity and level of motivation of members, team experience, sharing and application of acquired knowledge, teamwork, managerial experience, and experience in production, financial, and legal affairs [18]. One of the most important elements of human capital is the knowledge possessed by employees. Turner, Maylor, and Swart [50] define two types of knowledge that are included in human capital in the context of PM:

(1) Specialist knowledge, which includes knowledge of PM, knowledge of various tools and techniques for project management, skills, and acquired qualifications in the field of project management. Also, this type of knowledge includes knowledge from other areas, such as technical knowledge, which primarily concerns the skill of using various IT solutions;
(2) Generalist knowledge, which implies previous experience and an understanding of the project through the vision of business strategy and operations execution.

In POOs, a significant positive impact of human capital on project performance has been identified, which was observed through the achievement of operational and technical goals, compliance with the defined sequence of activities, acting in accordance with the planned budget, and meeting stakeholders' expectations [19]. Based on the results of empirical research, it is stated that knowledge and experience in the fields of management, design, employee skills, education, and training all have a significant impact on project performance, which was viewed through the prism of the traditional "iron triangle" [46]. The presented results are in line with the fact that the project manager's competence and support during project implementation are important factors that affect the project's success [51–53]. In other words, if there are appropriate competences among the project manager and project team members, high effectiveness of the work of the project team, and efficiency of the knowledge management process, a higher probability of delivering the desired project results is ensured. Summarizing the previous review and evidence, we propose the following hypothesis:

Hypothesis 1 (H1). *Human capital is positively associated with PM effectiveness.*

2.2. Structural Capital in Project Management

The nature of human capital highlights the fact that knowledge, skills, and abilities are inherent in every employee and cannot be owned by the company. Structural capital means "capital" that belongs to the company after the employees leave their workplace. Therefore, structural capital represents the "infrastructure" component of the company's IC, which includes organizational routines, procedures, systems, databases, organizational culture [54], strategies, and programs [55]. The aforementioned elements of structural capital allow employees to be effective in the realization of activities that lead to the achievement of desired performance [56]. Respecting adequate rules, procedures, and business culture, it is possible to achieve the maximum potential of employees, and structural capital is classified as a fundamental basis for the efficient exploitation of human capital, without which it is not possible to create value. Accordingly, regarding the development of organizational culture that supports the new ideas of employees [57], structural capital contributes to not only the increase of human capital elements but also the strengthening of the potential of other components of IC, such as innovation capital and customer capital [58].

According to Milošević et al. [19], it has been proven that structural capital has the greatest impact on project performance compared to the impact of other analyzed components of IC (human and relational capital). In order to achieve a high level of efficiency during project implementation, the category of project processes is managed, which also represents the essence of structural capital in PM. The project process is based on developed PM practices and activities, which enable the reduction of uncertainty during the process of project planning and implementation. Due to the importance of the project for a company's efficiency and effectiveness, the project process is cited as one of the basic business processes in different industries. In the initial stages of the project's management process, a very high degree of uncertainty is noted, which is reduced as a result of the collection, storage, and efficient usage of the necessary information for the project's implementation. Which activities will be carried out within the project's process in order to reduce the degree of uncertainty and enable the success of the project depends on the applied methodology and project life cycle [48].

Although it is considered that investments in planning all activities and possible action scenarios can reduce the creativity of employees engaged on the project [58], project planning is still cited as the most important phase of the project process. In line with previous studies, the importance of the planning phase contributes to risk reduction and increases the probability of project success. Additionally, it has been noted that although planning will not guarantee success, failure is more likely to occur if there is no planning involved. Based on the research conducted by Dvir et al. [59], the positive and significant impact of project planning on project success was confirmed, which was analyzed from the point of view of the end-user, project manager, and contractor.

The positive relationship between the project process and project success is in line with previous research concerning critical success factors, where it has been proven that structural elements of IC have a significant impact on project success and project performance. In addition, it is suggested that the company ensure that the employees who are engaged on the project are familiar with the good practices of project implementation so that the project can be labeled as successful [18]. Thus, it is reasonable to propose the following hypothesis:

Hypothesis 2 (H2). *Structural capital is positively associated with PM effectiveness.*

2.3. Relational Capital in Project Management

If human and structural capital are presented as internal components of IC, then relational capital represents its external part, which includes all relationships that the company establishes with its external stakeholders with the purpose of achieving organizational goals [45]. Therefore, relational capital is the most difficult to manage. The company develops a whole portfolio of relationships, i.e., relations with clients, suppliers, owners,

creditors, and other partners [60]. The key aspect is not only building good relations with the appropriate group of stakeholders. The essence of relational capital is the knowledge that is generated on that basis, so relational capital is presented as the knowledge-based component of a company's assets [56].

Previous empirical studies have had the purpose of determining the impact of relational capital on project performance [19], and this component of IC is classified as a significant factor in project success [51–53,61,62]. Considering the PM perspective, relational capital is viewed through relationships and forms of interaction that are established with project stakeholders [46]. The important elements of relational capital that enable its measurement are relationships with government representatives, clients, consultants and designers, suppliers, and the wider public [46,49,51].

In the literature, there is a concept named "project stakeholder management" [63], which includes all activities that are carried out in order to develop and maintain relations with stakeholders who have an interest in project implementation. However, it has been proven that effective management of relations with project stakeholders leads to short-term success, such as efficiency of daily activities, development of attitudes and skills, and high quality of production. To achieve the desired quality, the project team must pay attention to communication channels, and project information must be shared with all stakeholders, especially clients or owners, designers, consultants, subcontractors, and suppliers [46]. According to the previous evidence, we formulated the following hypothesis:

Hypothesis 3 (H3). *Relational capital is positively associated with PM effectiveness.*

2.4. Digital Transformation in Project-Oriented Organization

Digital transformation represents the process of transitioning to digital business, where the focus is on the use of digital technologies in order to implement changes in existing business models or create new ones and thus provide opportunities for value creation [64]. The new era has announced the beginning of changes in both professional and private life, including a wide range of challenges: customized production, automation and adaptation, interaction between people and machines, providing value-added services, as well as automatic data exchange and communication [65]. The changes caused by digitization have also significantly affected PM activities. In POOs, the focus is on applying the opportunities provided by digital technology since project success depends on the organizational ability to create the required value for stakeholders through the implementation of a digital transformation strategy [66,67].

The implications of digitization in PM can also be perceived through the use of various software tools for planning and monitoring project implementation. They enable the identification of risks associated with products, processes, and work tasks [68], while the key features of using these tools are the effective management of huge amounts of complex and interconnected information about projects and individual activities, communication between project team members and all interested parties, creation of activity schedules, division of work, etc. [69]. Determination of accurate information is highlighted, as is insight into the real state of available resources, which are important for project managers in order to be effective in the decision-making process [70].

The characteristics of the enabling technologies affect the way in which IC components are managed [71–73]. Introducing the concept of artificial intelligence conditioned the development of new competencies and changed the role of humans in the process of value creation [74]. Various information gained by processing big data powers the platform, which enables more efficient exploitation of data acquired from customers [75]. Blockchain as a digital ledger allows for cost reduction and increases safety and transparency in relationships [76]. These are only some of the characteristics of the fourth industrial revolution, which certainly changed the role of intellectual capital components in the value creation process.

Although there is evidence that IC influences project outcomes [19,53,77], previous studies have not proven a direct impact [18]. Due to the changes caused by digitization, it is possible to identify the indirect effects of variables related to the company's readiness to respond to

emerging challenges. Information and advanced technology transformed the way in which the company and its stakeholders collaborated and created value. Thus, the concept of digital readiness was developed, which represents the desire and readiness for the application of digital technology and its adoption in order to develop new innovative opportunities and facilitate the company's path to achieving superior results and achieving defined goals [78]. There is evidence that a higher degree of digital readiness positively affects organizational success and contributes to the higher profitability of the company compared to companies with a lower degree of digital readiness [79]. Additionally, it has been proven that social and human capital are important predictors of digital readiness at the national level [80].

In the literature, there is evidence of the significant moderating effect of the use of digital technology in the relationship between intellectual capital and company performance [81], and the importance of adapting the organizational context is highlighted in order to meet the needs of employees and also enable the efficient application of available resources [82]. Apart from a moderating effect, digital transformation has a mediating effect on the relationship between IT capability and firm performance [83]. Respecting its dynamic nature, digital transformation is a complex, multidimensional concept, and there are other related variables that are considered important mediators [84]. For instance, the capability of big data analytics has a partial mediating effect on the relationship between open innovation and financial performance, as well as between open innovation and non-financial performance.

In the context of PM, readiness for digitization is insufficiently researched, despite the fact that in POOs, there are clearly defined principles for the effective implementation of projects in the digital economy [85,86]. Previous evidence points to the importance of intellectual capital for achieving superior project outcomes. However, the direct impact of intellectual capital on project outcomes has not always been proven [18], which raises the question of determining the indirect impact under the conditions set by digitalization. Accordingly, the following hypothesis is defined:

Hypothesis 4 (H4). *Digital transformation readiness plays an intervening role in the relationship between IC components and PM effectiveness.*

Figure 1 presents the research model.

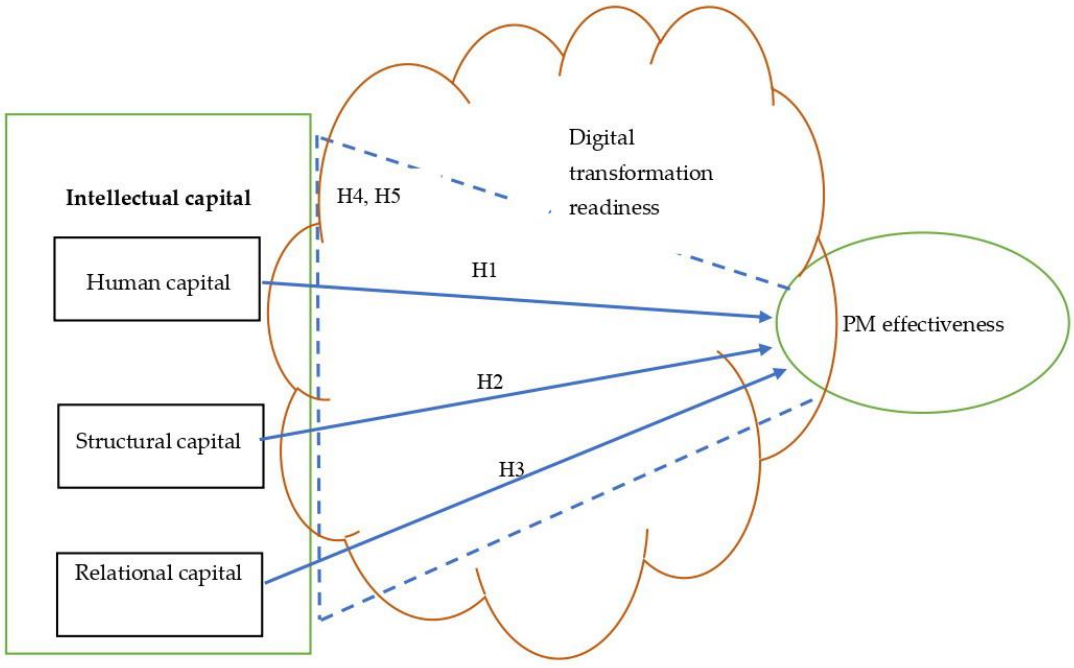

Figure 1. Research model.

3. Methodology

3.1. Sample and Data Collection Procedure

To gain access to research participants, we approached POOs in Serbia using the Serbian Business Register Agency database. We selected POOs that have been responsible for delivering or have supported the realization of construction projects (i.e., residential construction projects, industrial construction projects, commercial construction projects, including energy efficiency projects, fire resistance projects, safety systems projects, and smaller civil projects). These firms had run at least 50 projects in the 5 years period before this research. Through follow-up interviews by phone with key informants who held various titles, such as CEO, founder, and top and senior managers, we explained the objectives, individual returns, and procedures of the study. Then we asked that the research team be permitted to distribute a specially designed questionnaire to project managers. Considering a single project as a research unit, the sample structure is presented in Table 1.

Table 1. Sample structure.

Project Characteristic		Absolute Frequencies	Relative Frequencies
Project budget	Less than 1 million EUR	135	91.8%
	From 1 to 5 million EUR	12	8.2%
Sum		147	100%
Project duration	Less than 6 months	103	70.1%
	From 6 to 12 months	38	25.8%
	More than 12 months	6	4.1%
Sum		147	100%
POO type	IT firms	28	19.1%
	Production firms	87	59.2%
	Construction firms	32	21.7%
Sum		147	100%

After surveying project managers, we collected 206 responses regarding different construction projects. The project managers of each project provided a list of their clients as end-users of the construction projects they conducted. A total of 206 end-users were contacted, and a specially designed questionnaire was distributed to them. Questionnaires (157) were collected from end-users. After excluding non-valid questionnaires, 147 fully matched pairs of questionnaires were created in order to carry out the necessary analyses. The advantages of collecting data on different variables from different groups of respondents can limit the possibility of common-method bias [87]. Including project managers and their subjective perception of the way the PM activities were carried out is considered a valid approach since a high degree of convergence between managerial subjective perception and objective indicators has been identified [30,88]. Project success and achieved project performance can be viewed from different perspectives, including the end-user perspective [89,90]. End-users are considered a good source of information about PM effectiveness because they are directly exposed to the effects of the achieved project results and are cited as the most important critics since their satisfaction is a function of the usefulness of the achieved project outcomes [91].

In order to prevent the common method bias problem, the following procedure was recommended by Podsakoff et al. [92]. The first stage was to assure that all potential respondents were introduced within the bounds of the proper anonymity and confidentiality of their responses and that their responses would be used for conducting statistical analyses and reported solely in academic papers. The next stage proposes to include precise instructions on how to complete the questionnaire. Finally, the questionnaire was designed

with several sections in order to separate items of independent variables (antecedents) and items of dependent variables (outcomes).

3.2. Research Instrument and Measures

According to an extensive review of the literature and sampling procedure, two questionnaires were developed that were used to ask respondents to rate every single item on a scale of 1 (strongly disagree) to 5 (strongly agree). The first questionnaire consisted of items related to intellectual capital and readiness for digital transformation, while the second questionnaire included items that were used to measure project value. Both questionnaires included questions that enabled gathering information about the respondent's demographic characteristics, such as experience, gender, and age, as well as some questions related to general project features, i.e., project budget, project team size, project field, and project durations.

3.2.1. Intellectual Capital

The measurement of IC in this paper is based on the foundations of the Skandia Navigator model, since this model enables monitoring and measurement of individual components of IC. The scale that is adapted to measure "Intellectual Capital" was originally developed by Bontis [56], but it was adjusted in research conducted by Engström et al. [93] and Wu and Tsai [94]. The necessary adjustments to the given statements are implemented according to previous studies in POOs realized by Milošević et al. [19]. Sample items include: "Engaged employees have appropriate experience to work on the project"; "Engaged employees have excellent relationships with other project participants (clients, investors, suppliers, other partners, etc.)"; "The company supports employees to develop new ideas and solutions for better project execution". "By conducting an exploratory factor analysis (KMO = 0.594; Bartlett's test of sphericity = 1004.059; df = 55; $p < 0.001$) and eliminating low factor weights below 0.60 [95], three factors are identified: human capital, structural capital, and relational capital".

3.2.2. Project Management Effectiveness

Statements included for the assessment of PM effectiveness are formulated in order to get insights into project success. Since project success is ensured only when the project team has harmony and effective communication is developed, we considered several statements regarding the project team, coordination, and communication among team members [22,39]. In order to make appropriate adjustments, we considered some previous studies related to the assessment of project success in other national contexts (e.g., Australia, Chile), as well as in companies in different sectors (e.g., mining sector, manufacturing industry, information technology sector, financial institutions, automotive industry, construction, healthcare, education, and consulting) [59,96,97]. Sample items include: "The communication channel between the key participants during project implementation was very useful for the exchange of necessary information.", "There is an active communication between all project participants (project team members, contractors, clients/investors etc.)".

3.2.3. Digital Transformation Readiness

The questionnaire contained items related to the readiness for digital transformation, assessing the readiness of employees and managers to implement the necessary changes in order to maximize the positive effects of the implementation of digital technologies. Items are defined based on research conducted by Nwankpa and Roumani [83] and Satoglu et al. [98], the digital competence assessment framework created by Ferrari et al. [23], as well as the framework developed by the European Commission for the Standardization of the European e-Competence Framework 3.0: A shared European framework for ICT professionals in all industry sectors. We adjusted the items so the respondents had to express their attitude on a 5-point Likert scale (from 1, strongly disagree, to 5, strongly agree). A sample item includes: "Business processes in our company are based on modern

technologies (specialized software, social networks, cloud platforms, mobile applications, etc.)"; "Current systems and software in the company can be accessed from a remote location in real time".

4. Findings

4.1. Confirmatory Factor Analysis

We conducted a confirmatory factor analysis (CFA) and tested the hypothesized model with human, structural, and relational capital, digital transformation readiness, and PM effectiveness (Table 2). The model had a good fit with the data (χ^2/df = 2.497; RMSEA = 0.101; CFI = 0.936; TLI = 0.907; IFI = 0.938). Respecting the thresholds given in previous studies [99,100], all of our factor loadings ranged between 0.93 and 0.62 and were balanced within each unidimensional construct. Table 1 shows the factor loadings, including Cronbach's Alpha, the composite reliability (CR), and the Average Variance Extracted (AVE). The value of CR is well above the suggested threshold of 0.600, while the AVE of all measures exceeded the recommended level of 0.5 [101]. Cronbach's α of the formed variables is well above the cut-off point of 0.7 [102]. Putting these elements together, we can conclude that our measures are reliable.

Table 2. Results of confirmatory factor analysis.

Indicator and Items	Factor Loadings	AVE	CR	Cronbach's α
Human capital		0.528	0.690	0.824
IC1	0.90			
IC2	0.76			
Structural capital		0.603	0.817	0.717
IC3	0.79			
IC4	0.71			
Relational capital		0.654	0.849	0.778
IC5	0.62			
IC6	0.92			
IC7	0.70			
IC8	0.62			
DT readiness		0.835	0.938	0.955
DT1	0.93			
DT2	0.88			
DT3	0.98			
PM effectiveness		0.537	0.883	0.885
PM1	0.92			
PM2	0.81			
PM3	0.79			
PM4	0.65			

4.2. Structural Equation Modeling

In order to test the defined hypotheses, several models are created. The first structural model involves testing the direct effect of IC components on PM effectiveness. All indices suggest that the hypothesized model has a good fit with the data (χ^2/df = 2.326; RMSEA = 0.095; IFI = 0.943; CFI = 0.942; TLI = 0.909). The path coefficients in Table 3 are not significant, so H1, H2, and H3 are not supported.

Table 3. Direct effects in structural model 1 (standardized regression weights).

Path	Direct Effect
Human capital → PM effectiveness	0.008 (ns)
Structural capital → PM effectiveness	0.415 (ns)
Relational capital → PM effectiveness	0.112 (ns)

Note: ns—not significant.

In order to test the intervening role of digital transformation readiness in the relationship between the observed independent variables and the dependent variable, three more structural models are created. Structural model 2 is created in order to determine the moderating effect of digital transformation readiness in the relationship between human capital and PM effectiveness. The moderating variable is a third variable that is a controlling condition for the effects of the independent variables on dependent variables [103]. The model has a good fit with the data (χ^2/df = 4.924; RMSEA = 0.164; CFI = 0.930; IFI = 0.930). According to the values given in Table 4, it is proven that there is a complete moderation of the company's readiness for digital transformation in the relationship between human capital and PM effectiveness.

Table 4. Standardized regression weights in structural model 2.

Hypothesized Relationship	Estimate	Comments
Human capital → PM effectiveness	0.189 (ns)	
DT readiness → PM effectiveness	0.383 (ns)	Complete moderation
Human capital × DT readiness → PM effectiveness	0.508 **	

Note: ns—not significant; ** = $p < 0.01$.

The next structural models are created to determine the mediating effect of digital transformation readiness in the relationship between structural capital and PM effectiveness, as well as in the relationship between relational capital and PM effectiveness. Mediation as an indirect effect represents a case in which a third variable is a pathway for the effect of an independent variable on a dependent variable [103]. Both models have a good fit with the data (χ^2/df = 1.944; RMSEA = 0.080; CFI = 0.963; NFI = 0.927; IFI = 0.963; and χ^2/df = 2.111; RMSEA = 0.087; CFI = 0.966; NFI = 0.938; IFI = 0.966). In the case of structural model 3, it is determined that there is a statistically significant direct impact of digital transformation readiness on PM effectiveness ($\beta = 0.313$, $p < 0.05$), as well as a direct statistically significant impact of structural capital on PM effectiveness ($\beta = 0.684$, $p < 0.001$). According to the results obtained in Table 5, the conclusion is that there is a partial mediating effect. In the case of structural model 4, based on the proven direct effect of digital transformation readiness on PM effectiveness ($\beta = 0.298$, $p < 0.01$) and the direct effect of relational capital on PM effectiveness ($\beta = 0.315$, $p < 0.01$), there is also a significant indirect effect; therefore, it is proved that readiness for digital transformation has a partial mediating effect. Hence, H4 is supported.

Table 5. Direct and indirect effects in structural model 3 and model 4.

Path	Direct Effect	Indirect Effect	Result
Structural capital → DT readiness → PM effectiveness	0.684 ***	0.225 *	Partial mediation
Relational capital → DT readiness → PM effectiveness	0.315 **	0.116 **	Partial mediation

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

5. Discussion

This paper proposes and tests a conceptual model of the impact of IC on PM effectiveness, moderated and mediated by the company's readiness for digital transformation.

Human, structural, and relational capital are considered important components of IC, which is in line with the previous study by Gemünden et al. [85], who noted elements that are highlighted as key factors for the success of POOs in the digital age. Previous studies examined the relation between IC and project success [18,46] and project performance [19], but to our knowledge, there is no evidence regarding PM effectiveness. This research is focused on project team coordination and communication as two of the main determinants of project success [51,52,104,105].

First, permanent changes in today's environment increasingly highlight the need for the development of learning abilities, knowledge acquisition, and the use of acquired knowledge in future endeavors and daily business processes, and there is much evidence proving the importance of project manager competencies [51–53] and the degree of commitment of project team members [106]. Second, in order to achieve positive effects on the improvement of operational efficiency and productivity [65], it is necessary to provide adequate support for the application of digital technology within the company [82]. Finally, the implementation of the project in the conditions of digitization and the consequences of the pandemic caused by the COVID-19 virus additionally emphasize the importance of establishing effective communication between project team members and other relevant stakeholders, who are most often clients and sponsors, which further indicates the importance of human and relational capital as basic pillars on which new approaches in PM are based [31].

The direct effect of the aforementioned components of IC on PM effectiveness was not proven in previous studies [19,48,77], which is why we decided to test the indirect effect of other variables on the relationship between independent and dependent variables [18]. According to Baron and Kenny [24], testing the indirect effect is conducted by identifying the moderating and/or mediating effects of selected variables. The start of the digital era announced the limited application of traditional management approaches and highlighted the importance of adapting to the requirements of digital transformation. A higher degree of digital transformation readiness in companies positively affects organizational success and contributes to higher profitability compared to companies with a lower degree of readiness [107]. The results of the research conducted show that there is a statistically significant moderating effect of digital transformation readiness in the relationship between human capital and project value. The obtained results correlate closely with those reporting that the use of digital technology is an important moderator of the relationship between intangible assets and company performance [81].

Additional analyses have proved that digital transformation readiness is an important mediator in the relationship between the other two components of IC and PM effectiveness. The introduction of digital transformation readiness creates a statistically significant direct, but also indirect, influence of the aforementioned components of IC on PM effectiveness, which indicates partial mediation. These results are in correlation with previous empirical evidence that has proven the mediating role of digital transformation and related constructs [83,84]. Thus, we may argue that digital transformation readiness has a significant role in creating the impact of structural and relational capital on PM effectiveness.

6. Conclusions, Implications, Limitations and Future Research Directions

As a result of the Fourth Industrial Revolution, project managers and other actors in the PM process are faced with permanent pressure to implement the requirements imposed by digitization and to effectively manage projects in order to achieve success and satisfy the interests of stakeholders. Digitization has enabled traditional companies to simplify data management, implement more efficient and personalized solutions, and increase process automation, which additionally highlights the importance of PM activities. However, compared to operations that are carried out every day in the company, projects are more complex; they are characterized by a high degree of uncertainty and the interdependence of planned activities that should be carried out in a precisely determined order. Therefore, digital transformation in POOs implies the change of traditional elements regarding the execution of planning, organizing, management, and control processes.

Our study has revealed that the concept of digital transformation readiness is an important moderator and mediator of the relationship between the components of IC and PM effectiveness, while the direct influence of the single IC component is absent. The results obtained have important theoretical and practical implications. The conducted empirical research ensures filling the identified gap in the existing literature by providing a theoretical basis for measuring PM effectiveness. Apart from the traditional effectiveness measures of project success such as scope, schedule, and cost [108], and exploring the difference between project performance and PM performance [109,110], projects may still not be successful. Therefore, different categories should be included, i.e., impact on the team, impact on the customer, business success, and preparing for the future [111], as well as the perspectives of different stakeholders on different timescales [28]. As an appropriate measure that may overcome limitations, PM effectiveness is considered, measuring the benefits of the project at the team level in terms of team motivation, communication, and collaboration [22,37,39,41].

The theoretical contribution of the work is reflected in the fact that digital transformation readiness is mentioned as a necessary element for improving PM effectiveness. In order to survive in the market, companies are faced with the challenge of establishing new ways of communication and cooperation with partners, redesigning business processes, and developing new business models. The readiness of a company for digital transformation does not only mean the application of digital technologies when planning and executing business processes and activities [88,103], but also includes the awareness and readiness of employees and management to implement the necessary changes [23,107]. Therefore, the readiness for digital transformation is strongly correlated with the human component of the company's intangible assets, since it necessarily implies the development of a new set of competencies that will enable maximizing the benefits of applying digital innovations. In addition, digital transformation readiness implies the creation of a working atmosphere and the development of an organizational culture that supports learning and knowledge sharing among employees, which additionally indicates the importance of structural capital [112]. The contribution of digitization is also reflected in the provision of platforms, which can be used at different levels and, among other uses, would enable the storage of a wide range of information concerning external stakeholders. It has been proven that the effective management of the mentioned information, as well as the maintenance of stable relations with this group of stakeholders, leads to the improvement of innovation in the digital age [113].

The results presented in this paper can be used to innovate and improve the existing educational process. Since people are an important part of the project's value creation process, it is extremely important to develop the appropriate competencies that will contribute to maximizing the project's outcomes. The emphasis should be on encouraging digital innovations, that is, the acquisition of knowledge and skills in the field of application of modern, digital technological solutions, as well as how they affect the operations of existing companies and the creation of new ventures. The implementation of the given guidelines, which concern the redefinition of the existing educational process, is not only a task for formal educational institutions but also for human resource managers within companies, who are expected to organize appropriate training programs.

In relation to previous research, the breakthrough of the research conducted for the purposes of this paper is reflected in the way in which PM effectiveness is assessed. Previous studies included the assessment of project success from the point of view of the project manager or key informants, while in the present research the emphasis is on the perception of project clients, who are the direct users of the project results. Consequently, the obtained results represent important guidelines for project evaluators and organizations in charge of project financing, whose interest is the efficient allocation of available resources.

Even though the possibility of common method bias is reduced, there is a limitation in measuring the components of IC in the approach based on the questionnaire. The approach of measuring IC, which is based on the indicators available in financial reports, is rated as more exact [114], but the application of the method opens the problem of choosing the reference year from which financial reports should be used. The application of this

approach would simultaneously eliminate the use of structural equation modeling in the analysis of effects due to the use of different types of variables and favor the application of multiple regression analyses. The next limitation comes from the very structure of the sample, in which POOs from different industries are present. Variations in the impact of IC on PM effectiveness in different industries are possible, and therefore the focus of future research will be on one industry in order to conduct the research on a homogeneous sample of companies. The results of the research are partly burdened by the context of the national economy. However, the heterogeneity of the sample, which was previously identified as a possible limitation, represents a good basis for overcoming the potential influence of the national context due to the participation of knowledge-intensive POOs (i.e., IT companies), in which intangible assets are designated as a key resource for value creation.

The findings of this study provide guidelines for future project management research. First, the lack of a direct relationship between intellectual capital and PM effectiveness indicates the need for additional research into the effects of intellectual capital on project activities and, more importantly, the effects of intellectual capital on project value creation and project success. Second, the national context can be identified as one of the factors that contributed to intellectual capital's ineffective deployment. Therefore, it is necessary to conduct a comparative analysis that measures the national context objectively. Third, the process of digitizing project activities can be further specified for the construction industry by customizing observational statements. By adopting this approach, scholars and PM professionals can gain a more comprehensive understanding of the extent to which digital transformation has been accomplished as well as its importance in project value creation.

Author Contributions: Conceptualization, M.B. and M.S.; methodology, M.B.; software, M.B.; validation, M.S.; formal analysis, M.B.; investigation, M.B.; resources, M.B. and M.S.; data curation, M.S.; writing—original draft preparation, M.B. and M.S.; writing—review and editing, M.B.; visualization, M.S.; supervision, M.S.; project administration, M.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Project-Oriented Organization Perspective Items

Section I		
Construct	**Item**	**Question**
Human capital	IC1	The employees who are engaged in the project are experienced in project management.
	IC2	Employees engaged in projects have the opportunity to express their opinions.
Structural capital	IC3	The company supports employees engaged in projects to develop new ideas and solutions for better project execution.
	IC4	The cooperation between different departments of the company is at a high level.
Relational capital	IC5	Employees engaged in projects have excellent relationships with other project stakeholders (clients, investors, suppliers, contractors, etc.)
	IC6	The company have excellent relationships with clients / investors for whom the projects are delivered.
	IC7	We have excellent relationships with suppliers and subcontractors engaged in our projects.
	IC8	The number of clients / investors who are ready to collaborate is increasing.

Digital transformation	DT1	Business processes in our company are based on advanced technologies (specialized software, social networks, cloud platforms, mobile applications, etc.).
	DT2	Business processes in our company are largely automated and/or digitized.
	DT3	Existing systems and software in the company can be accessed from a remote location in real time.
Section II		
Number of delivered projects		1. Less than 10 projects 2. 10–50 projects 3. More than 50 projects
Project field		1. Organizational/Business Change 2. Construction 3. Information Systems and Technologies 4. Services 5. System Maintenance/Installation 6. Research and Development 7. Other
The average project value		1. Less than 1 million eur 2. 1–5 million eur 3. 5–10 million eur 4. More than 10 million eur
The most of project budget is used for		1. Procurement 2. Compensation for team members 3. Hiring experts/consultants 4. Travel and meetings 5. Other
Project duration		1. Less than 6 months 2. 6–12 months 3. More than 12 months
Number of employees engaged in project		1. Less than 10 2. 10–50 3. Od 51–100 4. 101–500 5. More than 500

Appendix B. End-User Perspective Items

Construct	Item	Question
PM effectiveness	PM1	The project realization is done by competent project team members.
	PM2	There is active communication between all project participants (project team members, contractors, clients/investors, etc.).
	PM3	Key participants in the project's realization actively communicate in order to provide all necessary information.
	PM4	The project was completed before the due date.

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