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The relationship between project management and digital transformation: Systematic literature review

A relação entre gerenciamento de projetos e transformação digital: Revisão sistemática da literatura

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Abstract

Purpose: This article aims to investigate the relationship between project management (PM) and digital transformation (DT) in organizations.

Originality/value: This article contributes to expanding the knowledge of the relationship between PM and DT, indicating that PM and its different approaches are used strategically to enable DT implementation in organizations. In addition, it is evidenced that DT demands individuals with technical and behavioral competencies to work in innovative and rapid organizational, cultural, and technological contexts arising from adopting new digital technologies.

Design/methodology/approach: The research is characterized as exploratory with a qualitative approach. The methodology adopted was the systematic literature review and sought to understand the relationship and convergence between PM and DT. The research was carried out broadly, and the articles were selected on the Web of Science, Scopus, and Google Scholar bases, forming the analysis *corpus* with 104 articles published from 2015 to 2020.

Findings: The results converged in the composition of four factors: competencies; strategy; digital technologies; and portfolio, programs, and projects, demonstrating the evolutionary and adaptive capacity of PM to support major changes such as DT.

Keywords: digital transformation, project management, digital technologies, skills, strategies

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Resumo

Objetivo: Este artigo tem como objetivo investigar a relação entre o gerenciamento de projetos (GP) e a transformação digital (TD) nas organizações.

Originalidade/valor: Este trabalho contribui para ampliar o conhecimento da relação existente entre o GP e a TD, indicando que o GP e suas diferentes abordagens são utilizados de forma estratégica para viabilizar a execução da TD nas organizações. Além disso, é evidenciado que a TD demanda indivíduos com competências técnicas e comportamentais para trabalharem em contextos inovadores e de rápidas mudanças organizacionais, culturais e tecnológicas, advindas com a adoção de novas tecnologias digitais.

Design/metodologia/abordagem: A pesquisa é caracterizada como exploratória com abordagem qualitativa. A metodologia adotada foi a revisão sistemática da literatura, e busca compreender a relação e a convergência entre o GP e a TD. A pesquisa foi realizada de forma ampla e os artigos foram selecionados nas bases Web of Science, Scopus e Google Scholar, formando o *corpus* de análise com 104 artigos publicados no período de 2015 a 2020.

Resultados: Os resultados convergiram para a formação de quatro fatores: competências; estratégia; tecnologias digitais; e portfólio, programas e projetos, demonstrando a capacidade evolutiva e adaptativa do GP para suportar grandes mudanças, como a TD.

Palavras-chave: transformação digital, gerenciamento de projetos, tecnologias digitais, competências e estratégias

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INTRODUCTION

Digital transformation (DT) presents several challenges for organizations and is considered a critical issue (Fitzgerald et al., 2014). However, it is still not widely dominated or known about its characteristics and how they contribute to the practice of performing DT at the organizational level (Berghaus & Back, 2016; Chanias et al., 2019). Besides, DT is a subject that arouses community interest in strategic issues related to business digitalization that require leadership involvement and support to make changes, promote capabilities and leverage its competitiveness and innovation level amid risks (Kane et al., 2015).

Research conducted by Bilgeri et al. (2017) identified six main reasons why DT would affect the overall organizational structure in large manufacturing companies. The highlighted one lies in its executives' uncertainty about where and how to allocate and align digital capabilities within their organizational structures. Ismail Abdelaal et al. (2017) also approached the factors that challenge leaders to perform DT from a strategic and managerial point of view. They underlined factors such as lack of clarity, sense of urgency, vision, direction, organizational aspects related to workers' attitudes, legacy technology, politics, and other factors that challenge leaders to perform DT.

The dynamic in the company is often affected by the changes arising from DT. The convergence and adoption of new digital technologies address performance increase, competitive advantages, and transformation of various organizational aspects such as the business model, the customer experience, the operational model and its processes, social factors related to competencies, talents, culture, and value system (Downes & Nunes, 2013). This context supports a growing research interest that highlights the use of projects to generate organizational changes (Crawford & Nahmias, 2010). Organizations must use projects to deliver change and bring success (Parker et al., 2013), incorporating elements that require effective change management and influential leadership to successfully implement projects and initiatives (Müller & Jugdev, 2012).

The essence of project management (PM) is to support the execution of an organization's strategy to achieve results beyond its competitors (Milosevic & Srivannaboon, 2006). Svejvig and Andersen (2015) show the importance of PM for topics related to strategic changes, innovation to generate competitive advantages, resource optimization, and increased efficiency. These needs suggest the PM's evolution as a discipline supporting organizational, financial, technological, scientific, and social needs (Geraldi & Söderlund, 2018).

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Due to DT being broad and demanding the involvement of the entire organization (Gimpel et al., 2018), the use of projects could be necessary to change organizational and technological aspects as well as redefine the value proposition (Wessel et al., 2021). In the context of DT, not all PM practices and approaches are adequate (Shenhar et al., 2001). This makes it necessary to examine PM's existing methods, focusing on DT, to recommend the most important contributions, suiting them to the diversity of projects that require different management practices (Henriette et al., 2015).

Therefore, considering that DT associates aspects beyond the use of technology and includes organizational and strategic changes during DT projects, this study investigates the relationship between PM and DT in organizations. The following research question is proposed:

- What is the relationship between project management and digital transformation in organizations?

To achieve the proposed objective and answer the research question, we performed a systematic literature review (SLR) to explore this relationship and identify the theme's most treated subjects, current issues, and future perspectives.

METHODOLOGICAL PROCEDURES

This article aims to understand the relationship between PM and DT in organizations based on information acquired through literature mapping. According to Kitchenham and Charters (2007), literature mapping uses a broad review of studies already conducted on a given topic to raise evidence and help answer a specific research question. This study uses a qualitative approach of exploratory-descriptive type to elaborate on the research *corpus* and bring up the patterns discovered in the studies surveyed (Tranfield et al., 2003).

This research followed the stages of the protocol prescribed by Pollock and Berge (2018) to perform an SLR, being: 1. clarify research goals and objectives; 2. seek relevant research; 3. collect data; 4. assess the quality of studies; 5. synthesize the evidence; 6. interpret the findings. The first stage, guided by the research question, aims to answer the question: "What is the relationship between project management and digital transformation in organizations?". Pollock and Berge (2018) prescribe a flow to assemble the final *corpus* of analysis, which consists of four phases: 1. identification; 2. screening; 3. eligibility; and 4. included (Figure 1).

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The identification phase, which comprises stage two of the protocol, used the electronic databases Scopus, Web of Science, and Google Scholar to seek relevant research. The definition process of the string used other terms associated with the DT and PM, but the results showed few relevant studies. The final form of the string was then a simple structure extended using an asterisk text mask (*). It was composed of the terms "Digit* transformat*" AND "project* manag*" to perform the search. We considered the operator "AND" and the asterisk text mask (*) to give amplitude to the investigation and bring up the junction of the terms and variability sought by the string.

Scopus, Web of Science, and Google databases were chosen to collect data (stage three); the Publish or Perish software was used to operationalize data collection in the Google Scholar database. The search for articles was conducted in September 2020.

Since it is a topic of recent interest, no time restrictions were used, bringing 1,152 articles without informing the period for the research. The objective was to search as many articles as possible to form the analysis *corpus*. Additionally, articles not written in English were excluded from the *corpus*; thus, 751 articles remained. We adopted conference papers and academic journals as the subject is a topic of recent publications. The objective was to build a *corpus* of analysis with the largest number of research on the topic. It is worth noting that conference articles were in the inclusion and exclusion criteria highlighted in the protocol of this literature review.

Figure 1 presents the steps followed for the final selection of articles that compose the *corpus* of *analysis* for this SLR and that used the orientations and stages shown in the work of Pollock and Berge (2018).

The fourth stage of the protocol comprises the screening and eligibility phases. The screening phase aims to delimit the study to the research purpose. It was performed by reading the titles and abstracts and removing the repeated articles from the *corpus*, remaining 204 articles. In the third phase, eligibility, a complete reading of each piece was done in order to remove those papers whose content did not address the scope of the research, remaining a *corpus* formed by 104 articles.

The last phase, included, was a thorough reading of the 104 articles that form the final *corpus* of analysis, addressing the research objective of verifying PM and DT's relationship in organizations. The article's analysis used a Microsoft Excel spreadsheet to consolidate the findings, categorize them, and gather aspects to give meaning to the reviews, such as methodological procedures, objectives, research approach, results, limitations, and future studies.

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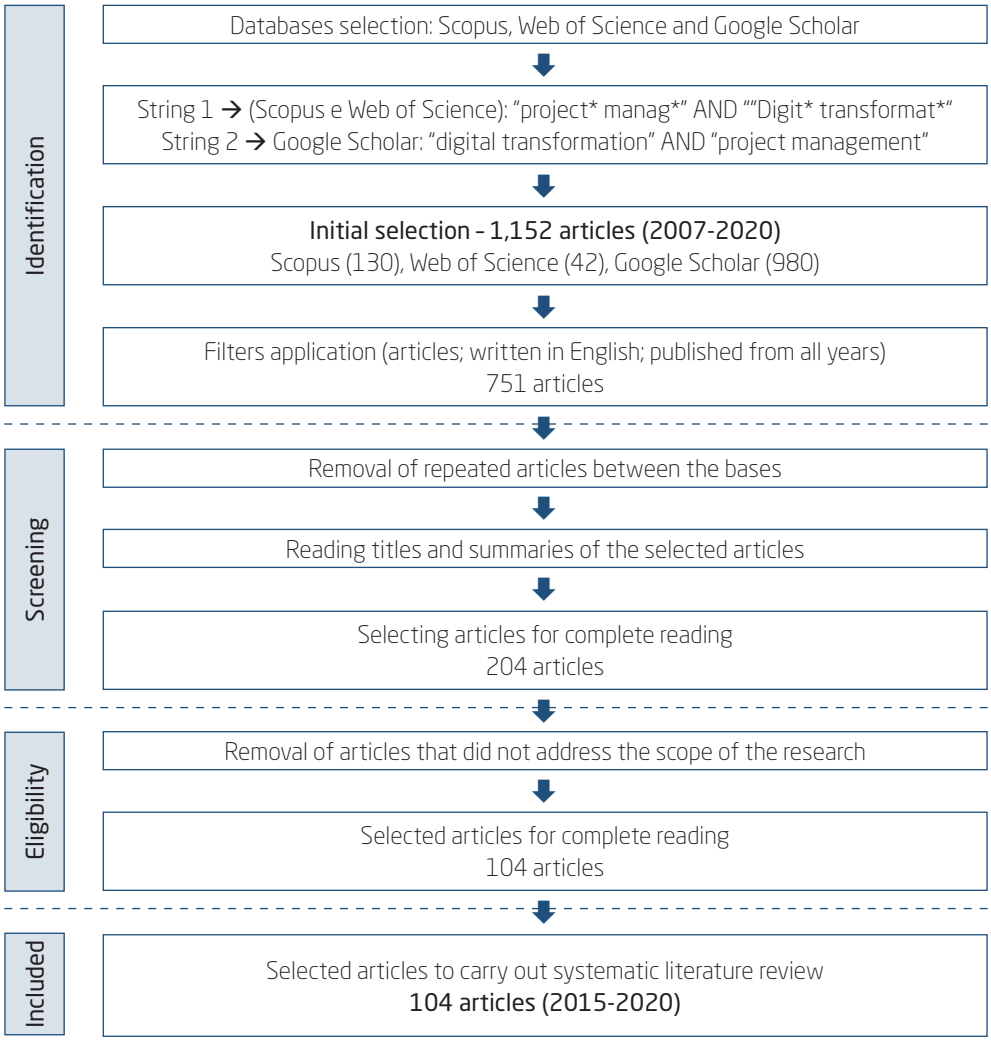
Figure 1

Procedures used in the selection of articles



Source: Adapted from Pollock and Berge (2018).

The activities carried out reflect the stages and the sequence of the protocol prescribed by Pollock and Berge (2018), that is: 5. synthesize the evidence and 6. interpret the findings and prioritize the treatment and qualitative analysis of the articles to consolidate the findings of the studies. The application of the method was audited by two researchers who took part in the study.

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ANALYSIS OF RESULTS

Mapping articles

The *corpus* of analysis was generated for the beginning of the analyses after the filtering process of the articles. It is important to point out that there was no date filter in the search for articles. The first article within the context of this research was published in 2005. The selected articles comprise 104 articles published between 2015 and 2020. Out of this total, 60 appear in 47 journals, and the remaining 44 are posted in 38 various events, congresses, conventions, symposia, and conferences.

After the constitution of the database, the repeated articles were removed to guarantee the homogeneity of the analysis *corpus*. Next, the database was treated with the aid of Excel spreadsheets. This phase of the research also allowed us to present a relevant descriptive analysis of the study carried out.

We emphasize that the applied content analysis is in line with Bardin's prescriptions (2011). The selected articles were read in their entirety. Categories of analysis were sought that could help to understand the phenomenon researched. The categorization criteria were validated by all researchers and included in the Excel spreadsheet. The generated spreadsheet contains the metadata of the selected articles, as well as information about the categorization. After analyzing all the articles, the researchers sought convergences through a clustering process that allowed them to reach the categories presented in the next section.

When analyzing the number of studies published per year, we can see the growing interest in the theme: the most significant number of studies were published in 2019 (Figure 2). We point out that the 2020 period does not cover a full year, so it does not allow direct comparison with other periods.

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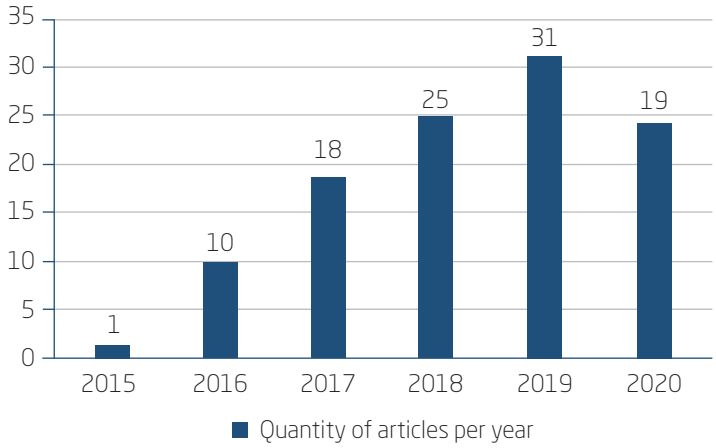
Figure 2

Articles published by year



Source: Elaborated by the authors.

The selected studies were published between 2015 and 2020. They show a growing interest in the subject by scholars. After mapping the articles and performing a careful reading of each of them, it was possible to identify the connections between the contents and the authors, resulting in four categories consisting: 1. competencies, 2. digital technologies, 3. portfolio, programs, and projects, and 4. strategy. We emphasized that the categories presented emerged from the process of reading and categorizing the articles, as presented in Table 1.

We emphasize that the categorization process is understood as an abstraction of the contents observed in the analysis *corpus*. Each category translates a set of meanings representing elements that will be explored in the presentation and discussion phase in the next section.

Four factors were found after performing a complete reading of the articles. The classification of the studies was tabulated in a spreadsheet. It is considered a cross-analysis of several sections of the article title, abstract, covered domains, objectives, approach to research, results, limitations, and future studies. This allowed the identification of the main aspects for categorization into the four factors.

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Table 1

Factors

Category	Description	Authors	Qty
Competencies	Technical (hard skills, new technologies); personal (behavioral); managerial (organizational management and people management).	Assante et al. (2018); Assante et al. (2020); Azarenko et al. (2018); Azzouz and Papadonikolaki (2020); Betz et al. (2016); Bierwolf (2016); Braun and Sydow (2019); Bygstad et al. (2017); Demirkan and Spohrer (2018); Krasuska et al. (2020); Malmelin and Villi (2017); Malmelin and Virta (2016); Ngereja et al. (2020); Papadonikolaki et al. (2019); Rojas and Mejia-Moncayo (2019); Silvaggi and Pesce (2018); Brunet-Thornton et al. (2019); Walker and Lloyd-Walker (2019); Wolff et al. (2019); Wolff et al. (2020).	20
Digital technologies	RPA; BIM; Blockchain; IoT; Big Data; Analytics; CPS. Digital technologies used in conjunction with agile project management.	Aibinu and Papadonikolaki (2020); Bataev (2019); Belle (2017); Boton et al. (2016); Çelik (2019); Chan (2020); Darko et al. (2020); Diaz et al. (2020); Dremel et al. (2017); Durão et al. (2019); Hassani and El Idrissi (2020); Koseoglu and Nurtan-Gunes (2018); Li et al. (2019); Marek et al. (2019); Mishra et al. (2019a); Mishra et al. (2019b); Ochara et al. (2018); Schmitz et al. (2019); Singh (2016); Teizer et al. (2017); Woodhead et al. (2018).	21
Portfolio, programs, and projects	Portfolio management; program management; project management	Barata et al. (2018); Barbosa and Saisse (2019); Crowley et al. (2017); DeLone et al. (2018); Ganis and Waszkiewicz (2018); Gimpel et al. (2018); Gurusamy et al. (2016); Hasibović and Tanović (2019); Hassani and El Idrissi (2020); Hassani et al. (2018); Isikli et al. (2018); Kolasa (2017); Lappi et al. (2019); Mergel (2016); Nataliia and Oleksii (2019); Nerurkar and Das (2017); Pacheco et al. (2018); Perides et al. (2020); Priambodo et al. (2019); Bierwolf et al. (2017); Sánchez (2017); Scott et al. (2019); Shamim et al. (2016); Shaughnessy (2018); Tchana et al. (2019); Teubner (2019); Tsurkan et al. (2019); Wiedemann et al. (2019).	33
Strategy	Strategic alignment; change management; leadership; culture; processes; business model; value creation	Akatkin et al. (2016); Barbosa et al. (2020); Barsukov et al. (2018); Barthel and Hess (2019); Barthel and Hess (2020); Benzerga et al. (2017); Berghaus and Back (2016); Bierwolf (2017); Bierwolf et al. (2017); Borremans et al. (2018); Calvetti et al. (2020); Chowdhury and Lamacchia (2019); Dombrowski et al. (2020); Eikebrokk et al. (2018); Gerster et al. (2019); Guinan et al. (2019); Hartl and Hess (2019); Ignat (2017); Ilin et al. (2019); Jacobi and Brenner (2018); Karimi and Walter (2015); Kouroubali and Katehakis (2019); Krumay et al. (2019); Moreira et al. (2018); Parviainen et al. (2017); Sanchez and Zuntini (2018); Schuh et al. (2017); Vukšić et al. (2018); Wagner et al. (2018); Williams and Schubert (2018).	30
		Total	104

Source: Elaborated by the authors.

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The following section presents the identified factors' discussion, explaining this research's findings and their relationships.

DISCUSSION OF RESULTS

Competencies

Making a company fit for DT demands that competencies be incorporated at a strategic level (Azzouz & Papadonikolaki, 2020) as a prerequisite in managers' training (Azarenko et al., 2018; Bygstad et al., 2017; Malmelin & Virta, 2016) preparing these managers to be responsible for DT and guide the company in methods, tools, and expert processes (Wolff et al., 2020).

Individuals trained in managerial, personal, and behavioral topics are perceived as someone with a differential to conduct DT projects (Rojas & Mejıa-Moncayo, 2019), even with the participation of internal and external agents (Braun & Sydow, 2019). Technical skills and training in new technologies, such as the internet of things (IoT), are complementary skills to DT and pressing for companies to expand in the business of high competitiveness and innovation (Assante et al., 2020).

The organizational culture achieves digital excellence through the new technological capacities and changes undertaken to enable innovation, a new way of thinking, and the possibility of people venturing into new challenges with leadership support (Ngereja et al., 2020). Professionals who work with multiple PM frameworks to meet technological change projects are perceived as adaptable individuals with specific skills to work in high-performance teams, combining their talents to create innovative jobs (Demirkan & Spohrer, 2018).

New digital skills demanded by the market may also impact DT processes (Betz et al., 2016; Papadonikolaki et al., 2019). These skills are demonstrated in the adoption of building information modeling (BIM) by sharing information in engineering projects that adopt agile project management (APM) and the need to inspire an agile culture in teams to gain acceptance and synergy (Silvaggi & Pesce, 2018). The different PM approaches, such as the APM, show that the lack of individuals with an adequate profile to act in the positions demanded by DT's process may impact some sectors (Brunet-Thornton et al., 2019). However, the impact of changes in the work environment and future trends in the PM field in terms of knowledge, skills, attributes, and experiences tend to be more appreciated (Walker & Lloyd-Walker, 2019).

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The proposition of frameworks appears with various purposes. In the questions of maturity assessment in DT, a framework is proposed for companies that need educational programs and certifications to manage DT, evaluating the competencies required based on a competencies model elaborated for DT (Wolff et al., 2020). Another proposition assesses digital excellence in hospitals, evaluating technological capabilities and non-technological aspects as enablers for digital change in each specific health system, aiming to develop PM skills and digital skills to support hospital teams (Krasuska et al., 2020). We emphasize that these skills are associated with the competencies necessary for the DT process. Such competencies must be present in the people and, in some way, in the company´s culture.

Strategy

In strategic matters, the process of organizational change aligned with technological needs passes through new PM perspectives. These perspectives bring simplicity (Chowdhury & Lamacchia, 2019; Gerster et al., 2019; Ignat, 2017) to attend the central strategy of DT (Kouroubali & Katehakis, 2019), new business perspectives and innovations to the organizations of many industries (Benzerga et al., 2017; Krumay et al., 2019). However, many companies misunderstood the objective of DT. DT means combining the use of technologies, leadership, culture, and skills to integrate and explore the fundamental aspects of DT and meet the business's digital needs (Guinan et al., 2019; Karimi & Walter, 2015; Vukšić et al., 2018).

The disruptive and innovative conjuncture of DT (Barthel & Hess, 2019) is pressing digital leadership to act as an agent of change to disseminate and cultivate the cultural aspects of DT (Jacobi & Brenner, 2018). The managers evaluate and measure the maturity of DT to manage change, develop PM capabilities, outlining the future of organizational relationships, technological changes, culture, people, and processes (Akatkin et al., 2016; Bierwolf et al., 2017; Ilin et al., 2019; Berghaus & Back, 2016; Schuh et al., 2017).

Digital technologies provide spaces for co-creation in the context of innovation with adequate resources and partners influenced by DT (Eikebrokk et al., 2018; Williams & Schubert, 2018). Another example is the virtual environment required for people to interact with digital technologies, generating intelligence and collective agility to innovate (Moreira et al., 2018). The educational area approaches digital technologies to develop, strategically, new skills in the individual and address the dynamics of DT projects and social needs (Barsukov et al., 2018). Artificial intelligence (AI) is also applied

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to monitor construction employees' performance electronically, aiming to create intelligent contracts in the DT context (Calvetti et al., 2020).

Other aspects show the strategic design to drive DT changes, such as using Lean to map the value stream and support decisions about the potential use of technologies and solutions (Wagner et al., 2018). Similarly, portfolio management broadly outlines the value chain's strategy and organizes PM resources and areas to optimize projects' conduct (Bierwolf, 2017). Technological change, on the other hand, proves beneficial in the process of transitioning projects that incorporate new technologies to obtain transformative organizational results in the DT context (Hartl & Hess, 2019).

Another well-explored point concerns the proposition of frameworks with the prescription of scripts to assess maturity and help companies face the challenges of DT (Parviainen et al., 2017). Some examples of frameworks are those designed to manage and characterize projects, aiming at effectiveness in the results of the project (Dombrowski et al., 2020); to formulate DT's strategy for the company's business processes (Borremans et al., 2018); to explain the resources needed for small and medium-sized enterprises (SMEs) to face the DT process (Sanchez & Zuntini, 2018).

These strategies should allow the DT process to occur clearly, and objectively and follow the companies' business rules. In order to achieve these results, the competencies must be disseminated among people, as presented in the previous subsection.

Portfolio, programs, and projects

The portfolio, programs, and projects factor shows their importance in organizing and addressing DT initiatives. Portfolio management connects different organization levels with project governance practices allied to management and leadership skills (Lappi et al., 2019) and treating projects in a strategic context to maximize results (Barata et al., 2018; Isikli et al., 2018). At another level of abstraction, program management is used to organize inter-relationship projects and addresses the various aspects of organizational transformation to enable DT (Perides et al., 2020; Tchana et al., 2019; Teubner, 2019).

The APM is predominant in DT, but the hybrid approach stands out in companies in the transition phase. The hybrid system benefits projects' conduction in a context of volatility and uncertainties, which requires agility, collaboration, and risk management (Barbosa & Saisse, 2019; Hassani et al., 2018). Besides the APM being the most used PM framework in DT projects,

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it is not unanimous (DeLone et al., 2018; Gimpel et al., 2018; Hasibović & Tanović, 2019; Nataliia & Oleksii, 2019; Shaughnessy, 2018).

Companies that need a quick response to business and community will take advantage of APM (Nerurkar & Das, 2017). This advantage is because APM integrates the stakeholders to address PM matters (Nerurkar & Das, 2017) and value aspects of leadership, teams, and ability to innovate (Gurusamy et al., 2016; Mergel, 2016; Shamim et al., 2016). APM brings benefits to being used with DevOps (development and operations), adjusting projects to the ongoing model, continuous deliveries of value, no end date of the project, and management based on products (Wiedemann et al., 2019).

The leadership exercise is a subject present in the DT researchers, especially the project manager's leadership. Outstanding leadership is collaborative and capable of bringing together internal and external actors to generate innovations through multifunctional teams, collective learning, and agile processes for decision-making and problem-solving (Crowley et al., 2017; Scott et al., 2019). The specificities of projects challenge project managers and leadership with complexity, constraints, and critical success factors to achieve high performance and ensure success in DT projects (Kolasa, 2017; Priambodo et al., 2019).

The PM is a strategic priority for organizations and their leaders to address the opportunities and challenges regarding new surgent digital technologies (Hassani et al., 2018). Exploring diverse digital technologies needs deep analysis under optics that integrates technology, process, and people (Hassani & El Idrissi, 2020). It should start with a technological transformation that supports DT (Tsurkan et al., 2019) and brings clear benefits to the organization and interdisciplinary projects (Ganis & Waszkiewicz, 2018).

In the DT process, the projects start focused on strategy and need to be aligned with the customer value proposition. This scenario is supported by the APM and the development team, always in line with the business strategy.

Digital technologies

Areas that develop projects using technologies such as Robotic Process Automation (RPA), BIM, Blockchain, IoT, Big Data, Analytics, and Cyber-Physical Systems (CPS), among others, will benefit when the technology is used in conjunction with APM. For example, the projects that use APM management implementing RPA to automate routine tasks and scan processes,

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bring technical innovations, and connect the business areas to the organization's IT (Marek et al., 2019; Schmitz et al., 2019). The importance of creating a reliable environment in integrating RPA project teams (Mishra et al., 2019b) and the technical management's support to build the skills in the workers (Mishra et al., 2019a).

Within the field of AI, BIM is increasingly used to address complex problems in the Architecture, Engineering, and Construction (AEC) industry and address optimization, simulation, PM, and uncertainty treatment (Darko et al., 2020). Among the issues addressed by digital technologies, we highlight the use of APM in projects that needs the ability to design new features, scale resources (Diaz et al., 2020), improve production processes, and add new technical resources. APM can add value by integrating and managing those involved during the construction and delivery of the assets (Aibinu & Papadonikolaki, 2020; Chan, 2020; Dremel et al., 2017; Ochara et al., 2018; Woodhead et al., 2018).

An example of BIM projects is using the Lean method as a support tool to help with the difficulties faced for adaptation to DT and to improve processes, productivity, efficiency, and quality in construction (Çelik, 2019; Koseoglu & Nurtan-Gunes, 2018). Another approach proposes product lifecycle management best practices to indicate improvements in BIM results using an information-centric management approach in construction projects (Boton et al., 2016).

BIM shows the prominence of digital technologies such as IoT, which brings real-time project situations, using intelligent systems to assist decision-making processes and avoid risks in AEC projects. It will also benefit the work's performance by providing accurate data integrated with a cloud-based BIM data platform (Teizer et al., 2017). The significant increase in the use of agile tools in conjunction with digital tools demonstrates the degree of importance and relevance they acquire to address organizations' future priorities in implementing DT (Durão et al., 2019).

The delay in adopting blockchain in the industry has several origins: lack of collaboration and exchange of information, mistrust between the parties, operational and management problems, and intellectual property rights (Li et al., 2019). Projects that jointly use BIM and blockchain prove complexity by bringing together products, processes, people, technologies, and policies (Singh, 2016). The use of blockchain can bring together parts of different sectors to support the design and construction phases, increasing performance and improving quality and transparency in projects (Bataev, 2019; Li et al., 2019).

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Digital technologies have an important role in the DT process, ensuring that projects are aligned with the companies' business rules strategy, driven by people's technical skills, and disseminated throughout the organization.

Model proposition

Figure 3 summarizes the study's findings, demonstrating the main aspects and the relationship between the four factors. The elements of competencies appear in all factors, demonstrating their scope and importance in carrying out the DT.

The strategy factor relates to the definition and planning to remodel and create new business models, digitize services, maintain competitiveness amid major changes, generate value, outline, and drive the organizational and cultural changes involved. Management and business competencies are highlighted in this factor.

The factor portfolio, programs, and projects appears to structure the enabling factors of DT. The portfolio aspect connects different levels of the organization, governance, and leadership aspects. The programs aspect is used to organize and interrelate projects with common purposes. The projects aspect performs deliveries through agile, hybrid, and traditional approaches. In this factor, competencies are fundamental to leading the delivery of products and services within the new context of DT.

The digital technologies factor demonstrates the use of these new technologies in the challenges involved in automating and optimizing processes, simulating scenarios and models, generating operational efficiency, assisting in the decision-making process, and generating collaboration between individuals and teams. This factor requires individuals and teams proficient in technical skills to use new digital technologies. The competencies factor participates in the other factors and is considered at the individual and collective level. In this sense, the competencies factor covers the entire DT adoption process, being necessary to plan the strategy and conduct the process, operationalize digitization through digital technologies, and support change and operationalization through PM frameworks.

Considering the four factors involved in the relationship between DT and PM, all factors are interrelated to the objective of performing DT. Therefore, DT is a process that needs to be in line with the company's strategy regarding its digitalization planning. Thus, to make DT operational, individuals with competencies in digital technologies are required to operationalize the digitization, as well as PM competencies to support the process of change.

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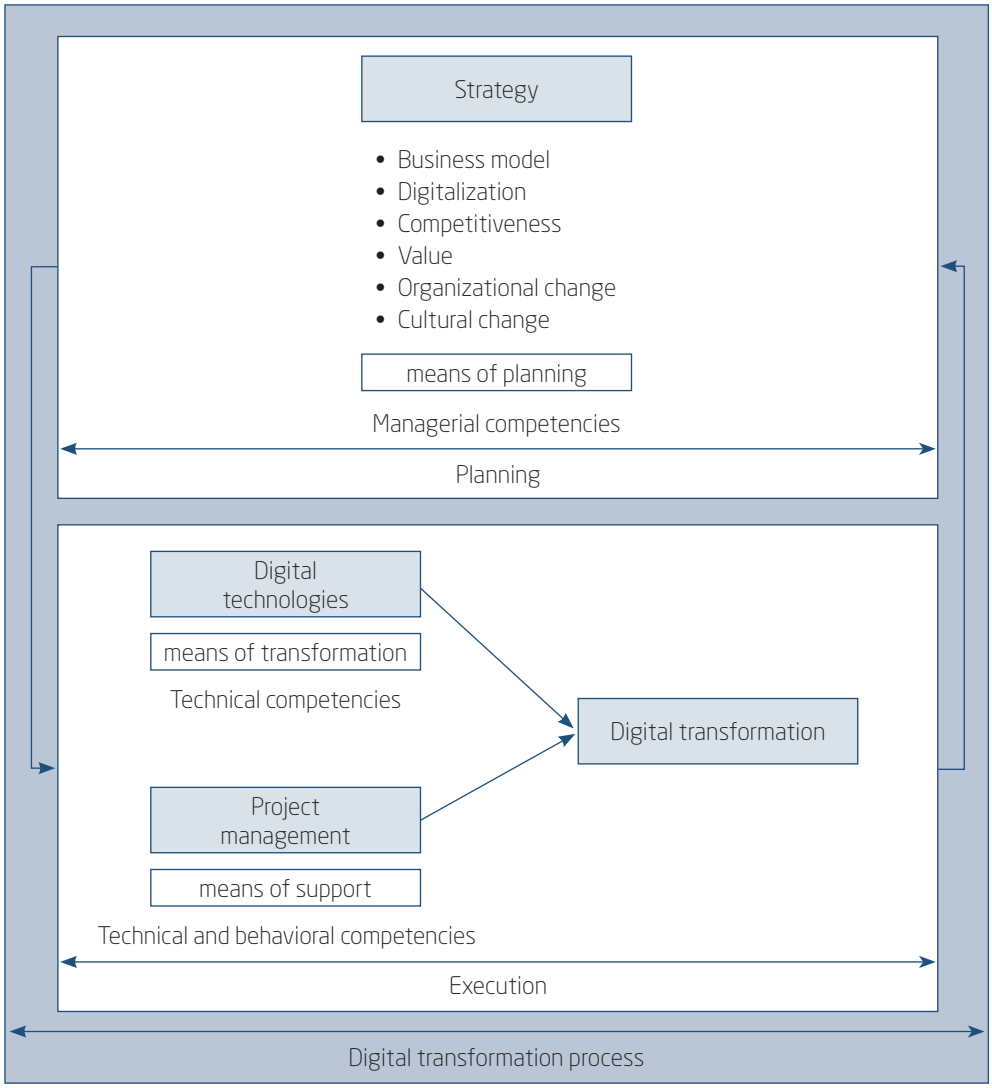
Figure 3

The four factors to perform DT



Source: Elaborated by the authors.

FINAL CONSIDERATIONS

This research analyzed the relationship between PM and DT to identify convergence points. The analysis *corpus* comprised 104 articles published in

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journals, congresses, symposiums, and conferences between 2015 and 2020. For the most part, the articles came from engineering, telecommunications, health, management, media, technology, and strategy areas.

The *corpus* of analysis categorizes four factors: 1. competencies, 2. strategy, 3. portfolio, programs, and projects, and 4. digital technologies. The factors identified present aspects relate to the challenge of performing a DT. Using new digital technologies is the basis for performing DT, and it brings the company to a new competitive level. In this sense, the articles explore DT applicability in various situations. However, some articles show that digital technologies need alignment with the strategy that adapts and shapes the organization into a digital market context.

Considering the research question proposed in this study, which verified the relationship between DT and PM, we can infer that the DT process has a strong relationship with PM, being necessary to understand the introduction of digital technologies aligned with business strategies supported by the PM. In addition, an important aspect of the relationship is the relevance of people management as identifying and using competencies that facilitate the realization of DT.

New digital technologies and strategies, allied to DT initiatives, demand competencies in technical and behavioral aspects suitable for operating in environments of rapid change, volatility, and high risks. In this context, PM presents adaptability, supporting DT transitions with adaptive PM approaches (agile and hybrid methods). It is hoped that this study will contribute to deepening the discussion on the themes of PM and DT and the existing relationship. The research question of this study was answered with the indication that the relationship between TD and PM starts from a strategic direction to plan and execute TD, using the PM to support the strategy, digital technologies as a means for implementation, development, and maintenance of skills for the entire change process. Additionally, this article proposes in Figure 3 an interaction flow between the factors that make DT viable.

The model is composed of factors identified in the study and considers strategic premises to develop the DT strategy. The model is composed in such a way that the DT is reviewed and analyzed throughout the life cycle of the DT project. In addition, it considers that the organization must address aspects of competitiveness, innovation, and rapid changes in the market.

The model proposes that the DT strategy rethink its business models and services for the digital context and undertake organizational and cultural changes to execute the transformation. The model considers the digital

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technologies factor as a fundamental means to execute the DT, providing the strategy execution to reach a new level of competitiveness for the organization. In this scenario, PM frameworks are a supporting factor to help operationalize the DT strategy and maintain alignment with organizational strategy.

Thus, competencies appear to be essential for the model's factor to enable the organization to face the challenges arising from DT by developing and maintaining technical, relational, and managerial competencies for the entire DT process. It is expected that this study will contribute to the deepening of the discussion on the themes of PM and DT in organizations, and the relevance of providing a database that informs the work carried out, periodicals, authors, and sub-theme categories is a facilitating tool for researchers.

Therefore, for future research, we recommend that studies be carried out to understand the influence of competencies for DT, which play a strategic role in operationalizing and improving the DT process. Furthermore, DT is an evolving topic with great potential for further studies.

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