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Technological tools for project management in the digital transformation context

Ferramentas tecnológicas para gestão de projetos no contexto da transformação digital

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ABSTRACT

This article aims to identify the technological tools described in patents that present the relationship between Project Management (PM) and Digital Transformation (DT). The research is characterized as exploratory, with a qualitative approach, and investigates patents in public access bases. The research was carried out in the databases of the office of the World Intellectual Property Organization (WIPO) and the European Patent Office (EPO), bringing a set of 45 patents that addressed technological tools together with the relationship between PM and DT. The results show a great concentration in the patent classification groups G (Physics) and H (electricity), with predominance in the G group. The results also show that, in the context of DT and PM, individuals and teams capable of working with digital technologies and tools are more willing in scenarios of technological automation, process rationalization, agility, cost reduction, and value creation. This research contributes to expanding the knowledge in the use of technological tools in patents in a DT and PM context. In addition, evidence demonstrates that patents require technological capabilities with competent individuals to use technological tools and innovations.

Keywords: Digital Transformation, Project Management, Digital and Technological Tools, Technological Capabilities, Patents.

RESUMO

Este artigo tem como objetivo identificar as ferramentas tecnológicas descritas em patentes que apresentam a relação entre Gerenciamento de Projetos (GP) e Transformação Digital (DT). A pesquisa caracteriza-se como exploratória, com abordagem qualitativa, e investiga patentes em bases de acesso público. A pesquisa foi realizada nas bases de dados do escritório da World Intellectual Property Organization (WIPO) e do European Patent Office (EPO), trazendo um conjunto de 45 patentes que abordavam ferramentas tecnológicas juntamente com a relação entre PM e DT. Os resultados mostram uma grande concentração nos grupos de classificação de patentes G (Física) e H (eletricidade), com predominância no grupo G. Os resultados também mostram que, no contexto de DT e PM, indivíduos e equipes capazes de trabalhar com tecnologias e ferramentas digitais estão mais dispostos a cenários de automação tecnológica, racionalização de processos, agilidade, redução de custos e criação de valor. Esta pesquisa contribui para ampliar o conhecimento no uso de ferramentas tecnológicas em patentes no contexto de DT e PM. Além disso, as evidências demonstram que as patentes exigem capacidades tecnológicas com indivíduos competentes para usar ferramentas e inovações tecnológicas.

Palavras-chave: Transformação Digital, Gestão de Projetos, Ferramentas Digitais e Tecnológicas, Capacidades Tecnológicas, Patentes.

I. Introduction

Technological capabilities to work with new technologies is an issue that has been addressed primarily in companies that are going through the Digital Transformation (DT) process (Assante *et al.*, 2018), and that aim to grow their businesses amidst the needs of innovation and challenges of severe competitiveness (Assante *et al.*, 2020). In the current context of such companies, Leidner (2020) and Richter (2020) address the challenges in carrying out DT and the changes amidst events that change the social and corporate dynamics, such as the lockdown that took place due to COVID-19. However, the incorporation of these changes demand challenges related to DT, such as the need for new technological capabilities to manage and act on projects that use new digital technologies (Guinan *et al.*, 2019; Karimi & Walter, 2015; Vukšić *et al.*, 2018).

From the point of view of digital strategy and technological requirements, Matt *et al.* (2015) argue that the use of technology in a company demonstrates their attitude towards new technologies and how they are exploited to position themselves in the market. From this point of view, the same authors indicate that DT is accompanied by changes that require new technological capabilities to deal with challenges and transformations. In this sense, Kyläheiko *et al.* (2011) state that technological capabilities correspond to the result of the corporation in terms of individual and group technological skills, processes, routines, and other technological assets, which jointly support and technologically enhance the company. The authors also indicate that technological capabilities portray the technological knowledge accumulated and used by the company to improve existing products and develop new products/services. When it comes to the development of differentiated products, Oviatt and McDougall (2005) drive further and indicate that technological capabilities are crucial to promote the performance of companies.

Literature shows that new technological capabilities are needed for people to act with better performance in a DT context that demands the use of new digital tools. Marek et al. (2019)

and Schmitz et al. (2019) highlight that automation projects through the use of RPA (Robotic Process Automation) require competent people to use specific digital tools in order to automate repetitive activities and processes. Another example is demonstrated in the engineering and construction industry with the use of digital tools to adopt the Building Information Model (BIM), characterized as a platform to share information, identify problems and generate collaboration between those involved to develop and deliver products (Belle, 2017).

Regarding the areas comprised by DT, Barsukov et al. (2018) highlight that the theme of technological training is researched from the educational sphere, with the objective of training skilled people to work with digital tools and strategically develop new skills that enable them to deal with the dynamics of DT projects. This research scenario is complemented by Azarenko et al. (2018) when they address the use of technological capabilities to meet projects in the area of Information and Communication Technology (ICT) of companies in a DT environment.

Krasuska et al. (2020) point out that projects in the hospital area demand people with digital excellence to assess technological and non-technological aspects to enable DT and develop digital and management skills in the hospital environment. In the context of management practices, the research presented by Mergel (2016) and Nerurkar and Das (2017), and Penha, da Silva, and Russo (2020) highlight the use of Agile Project Management Practices (APMP) as an adequate approach to dealing with DT projects, in addition to suggesting that organizations adopt the APMP as the most suitable to meet the diverse situations of companies in the DT process.

Regarding the possible impacts of DT on organizations, the research by Parviainen et al. (2017) indicate organizational aspects that permeate various areas of the organization, such as strategy, organizational culture, processes, information technology, business models, products and services, among others. Regarding positive impacts, the research by Westerman et al. (2012) recommends that the success of a DT depends on building a base of essential skills and capabilities of people and the company. This statement is complemented by McAfee and Welch (2013), who assert the theme determining that the success of a DT is achieved when the people involved have adequate knowledge of the business and the digital tools used by companies during the DT process. In such companies, people gain a prominent role.

Kohnke (2017) states that people can use digital technologies and applications for the success of DT. In the same sense, Gimpel and Röglinger (2015) define that the success of a DT lies in the digital workforce employed by people in DT projects and is characterized by people who think in an interdisciplinary way and who seek continuous development of recent digital technologies. In terms of management processes in the context of DT, project management is used as a support tool to enable organizational strategy (Cha, Newman & Winch, 2018; Shenhar & Dvir, 2010; Svejvig & Andersen, 2015). In addition, the DT context requires people with managerial, behavioral and digital technology skills and their tools to conduct DT projects in a differentiated way (Wolff, Verenych & Kevorkova, 2020).

PM professionals are characterized by being adaptable people with diverse abilities to work in contexts that require individual and group skills to carry out innovative work (Bierwolf, 2016; Demirkan & Spohrer, 2018). In this way, the identification and correct use of digital technologies and tools associated with them, contribute to choosing and training individuals capable of improving the results in a DT process, using projects and their techniques as a means to enable all change. Therefore, the objective of this article is to identify the technological tools described in patents that present the relationship between PM and DT.

The research used an exploratory analysis based on information made available in the databases of patents in the public domain. For data collection, the tools PATENTSCOPE and ESPACENET were used in a patent database in the public domain. The results obtained allowed the identification of digital tools present in patents to meet the demands of organizations in the context of PM and DT. The results of the mapping of technologies identified in patents can contribute to the proposition of models centered on helping organizations in the operationalization of DT, as well as helping organizations to identify the most appropriate technological capabilities for a context that involves PM practices and DT. Another perspective can be the proposition of a model aimed at guiding organizations in matters of training, preparation, and selection of people with skills to use adequate digital tools to bring the results required in the strategy developed for DT.

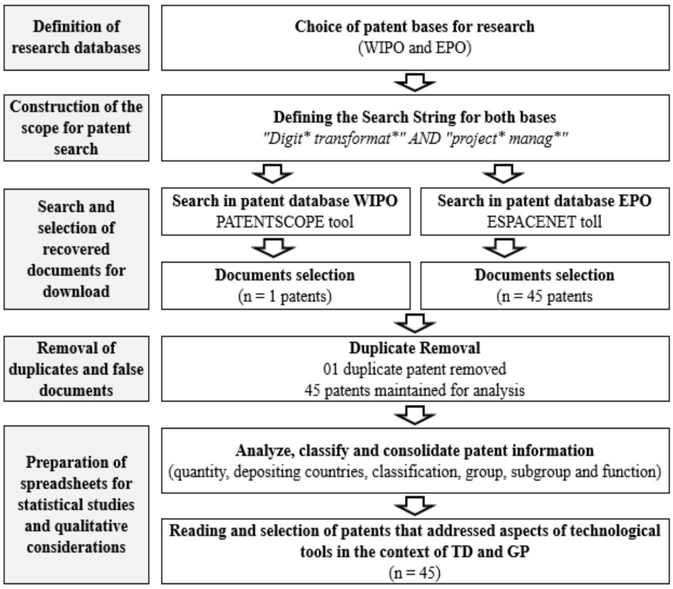
The next section will address the theoretical foundation that guides this work: project management, digital transformation, digital tools, and patents. Next, the adopted methodological procedures will be presented, followed by the presentation of the results and, finally, the conclusion of the article with the presentation of the research limitations and recommendations for future studies.

II. Materials and Method

This study uses a qualitative exploratory approach to constitute the research corpus, group the information, and identify the competencies raised in patents in the public domain. As indicated by Creswell (2014) and da Silva, Russo, and De Oliveira (2018), exploratory research enables a better understanding of a problem that will be investigated, using the survey and analysis of available information related to the problem in question (De Vaus, 2001).

The methodological procedures respected the assumptions for technological mapping through patents proposed by Paranhos and Ribeiro (2018), structured in five phases: (i) Definition of the databases to be searched; (ii) Construction of the scope for patent search; (iii) Search and selection of retrieved documents for download; (iv) Removal of duplicates, repetitions, and false documents; (v) Preparation of spreadsheets for statistical studies and qualitative weightings, which will be discussed below and shown in Figure 1.

Figure 1. Methodological procedures adopted in the survey of patents.



Source: Prepared by the authors based on Paranhos and Ribeiro (2018).

In the first phase, called "Definition of the databases to be searched", the EPO (European Patent Office) and WIPO (World Intellectual Property Organization) bases were chosen, which are among the main patent bases and provide mechanisms that enable import data in formats that facilitate the handling of information (Papadatos et al., 2016). For the second phase, entitled "Construction of the scope for the patent search", the arguments were defined and the search string to be executed in the initially defined bases was structured.

The research arguments are based on the objects of study that guide the research to identify competencies, that is, the terms “digital transformation” and “project management” were used. The construction of the string used the “*” operator to enable breadth in the search and bring to light the diversity of contexts presented in the patents. Therefore, the search string was assembled with the following structure: "digit* transformat*" AND "project* manag*".

In the third phase, called "Search and selection of documents retrieved for download", the search string was executed in both bases through their respective search tools, as follows: PATENTSCOPE for the WIPO base and ESPACENET for the EPO base, held in the first half of June 2021. The execution in the ESPACENET tool brought 45 patents and, in the PATENTSCOPE tool, 1 patent, totaling 46 separate patents for later download. In this way, the fourth phase “Removal of duplicates, repetitions and false documents” was carried out, in which the occurrence of repeated patents between the bases and the removal of duplicates was verified. Among the chosen bases, 1 patent was identified as repeated, being removed and keeping a total of 45 patents for the continuity of the analysis.

In the last phase, “Elaboration of spreadsheets for statistical studies and qualitative weighting”, the information from the 45 patents was imported into a spreadsheet in Microsoft

Excel. In the spreadsheet, the patent information was treated to carry out a more detailed analysis. This enabled the consolidation of quantitative information and the grouping of information through the International Patent Classification (IPC), with its grouping and classification structure. The IPC is used as a classification system that uses letters and numbers in its constitution to index patents, being used by most regional or national patent offices (WIPO, 2019). The IPC is a system that hierarchically classifies patents, facilitating the search for patents based on how their IPC is constituted (WIPO, 2019). According to the National Institute of Industrial Property (INPI, 2021), a patent application can refer to more than one group. The IPC is divided into 09 sections (A to Y), or technical areas, which are made up of approximately 70,000 groups (WIPO, 2019).

A detailed analysis was carried out to identify the digital tools described in a context surrounded by DT and PM. In addition, an attempt was made to identify the established standards and the relationships of these standards concerning the identified patent groups, through the classification of patents, their groups, subgroups, and the respective functions of the patents.

Figure 1 demonstrates from the stage of choosing the bases and research arguments to the final selection of patents that addressed aspects of digital tools in the context of PM and DT. From the consolidated information treated in the Excel spreadsheet, tables and figures were generated to synthesize the results and bring to light the understanding of the selected patents, which will be presented in the next section, which will support the study results.

III. Results

This section presents the results of the survey of patents in the public domain. Initially, the mapping and classification of the patents that constituted the research analysis corpus are presented. Next, the categories highlighted after an in-depth analysis of the contents of the patents are presented.

A. Patent mapping and classification

The 45 patents identified in the research that address aspects of DT and GP cover a period ranging from 2005 to 2021. In analyzing the results, it was possible to identify the countries involved in filing the patents identified in the WIPO and EPO databases. The results show that the United States is the country with the largest number of patents filed that include the themes of DT and PM in its constitution, as indicated in Table 1.

Table 1. Depositary countries of patents selected for analysis.

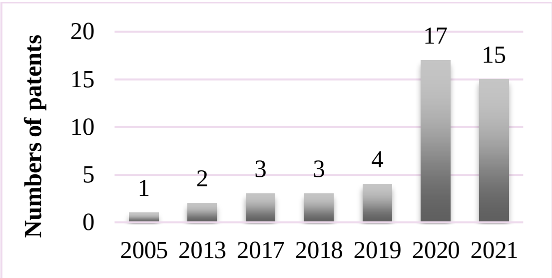
Countries	Numbers
US (United States)	29
CN (China)	24
AU (Australia)	6
EP (Spain)	2
JP (Japan)	1
GB (Great Britain)	1
CA (Canada)	1

Source: Information extracted from the ESPACENET patent database.

Note: 07 patents appeared with the country with the generic identifier WO, which were reclassified to the depositary countries (US, CN, and AU).

In quantitative terms, the United States is highlighted with 24 patents filed, followed by China with 23 patents. The selected patents indicate a growth over the years when it comes to contextualizing aspects related to GP and TD (Figure 2).

Figure 2. Patents that address the PM and DT themes over the years identified.



Source: ESPACENET, 2021.

Figure 2 demonstrates that PM and DT are themes that are increasingly present in the constitution of the scope of patents. This is demonstrated by the growing interest from the year 2019, with the peak in 2020 with 17 patents filed. It is worth noting that the year 2021 is still ongoing and the amount highlighted does not represent the total number of patents for the year in question. Although other patents can still be filed, the growth of researched topics can be seen.

In this sense, the IPC was used in the analysis process, where information related to the constitution and classification of identified patent records that address the PM and DT topics is presented. Within the scope of the 45 patents identified, they are classified into 99 different groups and 159 subgroups, thus constituting all the subdivisions that detail and define the objectives of each patent. The classifications that most stood out in the study were the G06F, being used 66 times (subgroups) to classify patents, followed by the G06Q classification, being used 52 times.

After identifying the patent depositary countries that address the themes of PM and DT, as well as verifying the evolution of the subject over the years and the demonstration of patents according to their classification, the next step aimed to evaluate, within the proposal of the study, patents that deal with aspects related to digital tools in patent detailing.

B. Relationship between project management and digital transformation

This research aimed to identify patents in public access databases that addressed, in their descriptions, the themes of PM and DT. As a result, 45 patents were identified, which were classified into 99 groups and 159 distinct subgroups. Then, the descriptions of the 45 patents were read to select those that addressed issues related to the themes of PM and DT and that, within this scope of analysis, the digital tools inserted and used to enable the context proposed by the patent were analyzed. The selected patents consisted of 16 groups and 26 distinct subgroups, shown in Table 2.

Table 2. Selected patents dealing with competency aspects.

Id	Title	Publication year	Country	Section	Patent Classification	Publication number	IPC
1	Digital operation analysis platform and method based on enterprise informatization heterogeneous system0	2020	China	G	G06F G06Q	CN110991984A	G06F16/25 G06F16/26 G06F21/31 G06Q10/10
2	Process and method for lifecycle digital maturity assessment	2005	USA	G	G06F G06Q	US2005027550A1	G06F17/60 G06Q10/00
3	System and method to modeling and managing enterprise architecture utilizing artificial intelligence and machine learning	2020	United Kingdom	G	G06Q	GB2580866A	G06Q10/06
4	System, business and technical methods, and article of manufacture for utilizing internet of things technology in energy management systems designed to automate the process of generating and/or monetizing carbon credits	2020	USA	G H	G01N G06Q H04L	US2020027096A1	G01N33/00 G06Q20/38 G06Q30/00 G06Q40/04 H04L29/08
5	Virtual outsourcing agency system and method	2013	USA	G	G06F G06Q	WO2013185063A1	G06F17/30 G06Q10/06
6	System and method for implementing mainframe continuous integration continuous development	2021	USA	G	G06F	US2021133091A1	G06F11/36 G06F8/33 G06F8/60 G06F9/38 G06F9/50
7		2021	USA	G	G06N	WO2021092263A1	G06N3/02

	Control tower and enterprise management platform for value chain networks				G06Q		G06Q10/08
							G06Q50/28
					G16Y		G16Y30/00
8	Control tower and enterprise management platform management platform with a machine learning/artificial intelligence managing sensor and the camera feeds into digital twin	2021	USA	G	G06N	US2021133670A1	G06N20/00
							G06N5/04
					G06Q		G06Q10/08

Source: ESPACENET, 2021.

Table 2 shows that the selected patents are concentrated in two classification sections, namely: G (physical) and H (electricity), with a predominance of patents with classification G. In order to contextualize the patents that make up the final selection, the characteristics of each patent were analyzed regarding the technologies adopted in the relationship between PM and DT. Table 3 highlights the patents in addition to presenting the digital technologies and tools used in each of them.

Table 3. Description of the competencies identified in the selected patents in the context of PM and TD

			Context		
Id	**Title**	**Aim**	**Digital Transformation**	**Project Management**	**Digital Tools**
1	**Digital operation analysis platform and method based on enterprise informatization heterogeneous system**	Digital business analysis platform based on heterogeneous corporate information system. Use of data to create a software presentation layer.	Use as a support tool for digital transformation based on data analysis.	Use of information from the Project Management organizational tool, serving as a data source for the proposed platform.	Business Systems (ERP, CRM, EPM); Relational and non-relational databases; Data modeling; Big data; Programming languages.
2	**Process and method for lifecycle digital maturity assessment**	The process to assess the digital maturity of the digital transformation process lifecycle.	Offer digital maturity assessment in the context of digitization or digital transformation.	Evolution in management and management controls as a new level of maturity is reached through the presented process.	Management process mapping; Scanning.
3	**System and method to modelling and managing enterprise architecture utilizing artificial intelligence and machine learning**	Method for modeling and managing enterprise architecture using artificial intelligence and machine learning.	Manage status and activities against expectations of digital transformation.	Consider the scrum agile project management methodology to develop the design and manage the organization's implementation. Allows the system to focus on delivering business value in the shortest possible time.	Artificial Intelligence; *Machine Learning*.
4	**System, business and technical methods, and article of manufacture for utilizing internet of things technology in energy management systems designed to automate the process of generating and/or monetizing carbon credits**	An Internet of Things intelligent system for band saw machines, enabling the recognition and monitoring of belt degradation.	Within the context of Digital Transformation, it is presented that the Internet of Things still generates distrust, but the text brings up disruptive issues that were not taken seriously in the past (such as digital cameras), causing businesses and companies to lose their leadership market.	It addresses programmatic development (APD), which requires addressing the need for more complex project management to carry out activities.	Internet of Things; RPA; Business Intelligence; Technical knowledge associated with the use of hardware for digital technologies, such as sensors, routers, Wi-Fi, and Cloud Computing.

5	**Virtual outsourcing agency system and method**	Method for setting up a virtual advertising agency based on client needs and requirements.	In the context of digital transformation, it is highlighted that the marketing and communication sector undertakes digital transformations, creating operational and business models based on various digital platforms with a focus on customers.	It covers features to manage and track the phases of project deliverables, schedule, budget, the scope of work, approval, change management, issues, risks, and other project issues.	Cloud Computing; non-relational database.
6	**System and method for implementing *mainframe* continuous integration continuous development**	The patent is intended as a CI / CD (Continuous Integration/Continuous Development) process design solution for software hosted on Mainframe	Mobility and digital transformation are related to application development, testing, and quality assurance, in addition to establishing shorter development cycles with a higher level of service.	Project management comes into context with the adoption of tools to be used for software development.	Systems architecture; Mainframe programming language; DevOps.
7	**Control tower and enterprise management platform for value chain networks**	Design a logistics system using digital technologies and the use of the value chain.	The digital transformation adopted in the patent solution is linked to the issues of the Internet of Things and Machine Learning as integration tools for the proposed solution.	Automating project management by providing automated recommendations for a set of value chain tasks based on processing previously collected information.	Artificial intelligence; Machine Learning; Cloud Computing; Internet of Things.
8	**Control tower and enterprise management platform management platform with a machine learning/artificial intelligence managing sensor and the camera feeds into digital twin**	The solution is to monitor resources and entities of the value chain network, using Artificial Intelligence and Machine Learning.	Digital transformation is dealt with in the text regarding the adoption of digital technologies adopted in the solution.	Project management appears to be a tool to be automated, providing information based on information from the status of projects.	Artificial intelligence; Machine Learning; Cloud Computing; Internet of Things; Software architecture in microservices; DevOps; non-relational database.

Source: Survey data, 2021.

When looking at Table 4, it is possible to identify the use of new technologies and digital tools in the patents analyzed under the context of PM and DT. The results demonstrate that individuals and teams must have skills aimed at working with digital technologies and tools related to DT, such as the Internet of Things (IoT) to improve productivity with intelligent machines that communicate and exchange information (Darko et al., 2020); Machine Learning (ML) with computer systems that automatically improve performance through experience (Mahdavinejad et al., 2018); Big Data to analyze a large amount of information and provide strategic data for decision-makers (Dremel et al., 2017; Ross, Beath, & Quaadgras, 2013); RPA to automate everyday activities and transactions (Schmitz et al., 2019); Artificial Intelligence (AI) which uses intelligent systems and technologies to create a connection between the physical and digital environment (Darko et al., 2020), or Business Intelligence (BI) which uses data to create knowledge by establishing connections between the information (Liew, 2013).

The new technologies described in the patents offer solutions aligned with DT, proposing inventions that bring rationalization and automation of activities and processes, remodeling the business model, and generating value in its propositions. In this sense, patents bring solutions that eliminate people's routine activities, generating agility and economic benefits through the automation and rationalization of processes. Process automation and rationalization are also presented in the PM questions.

In the context of PM, patents demonstrate the automation of day-to-day project activities, such as extracting reports and generating status reports. From this perspective, the proposed solutions consolidate and generate opinions about the projects, with agility and efficiency brought about by process automation. In addition, the use of the Scrum framework and other adaptive methods (agile methods) of PM is mentioned in the description of patents (Kusters et al., 2017), indicating that individuals and teams must have the capacity to self-manage activities (Wolff et al., 2020), and techniques to develop activities in the proposed solutions using digital technologies such as IoT (Assante et al., 2018; Assante et al., 2020).

Concern digital technologies, a highlight that can be observed is the systems development architecture. Regardless of the development platform, High (Mainframe) or Low (Servers), organizations in a DT process need to be able to make their software available in a Cloud Computing architecture. To minimize possible challenges, Muntés-Mulero et al. (2019) suggest that the people involved in the projects should have a high degree of technical knowledge in the new architecture since after the migration of platforms to the new architecture, the organization will need to guarantee the reliability and security of the data.

Another highlight in the analysis is DevOps, an acronym for Development and Operations, which generates a high level of automation when it brings together the use of digital technologies and predictive methods to quickly deliver environments and solutions with high added value potential. The adoption of DevOps requires people in software development teams that are capable and competent to implement and customize the solutions with the highest quality (Lwakatare et al., 2019). According to Žužek et al. (2020), the implementation of DevOps in organizations is conditioned to the pursuit of delivering value to the customer through the completion of activities related to software development. Modak et al. (2020) highlight that the DevOps team must have the necessary technical skills to adapt the development and delivery process of activities with DevOps practices in a DT process.

The analyzed patents demonstrate that digital tools have a fundamental role when analyzed in a context involving DT and PM. The digital tools described are closely linked to the proposed solutions, constituting an integral part of an invention and its proposition(s). This situation advances in solutions that allow us to visualize the gradual replacement of people for activities that are routine and can be performed by machines. This is reflected even in aspects of the PM, showing that a lot of information can be consolidated and treated and, thus, allow for more robust and strategic analyzes for decision-makers. However, this requires people who are capable of performing analyses, creating models, and operating technological advances. People competent in technology, management, and associated with business knowledge drive results and value creation for companies in the DT process.

IV. Final Remarks

Considering the context of analysis of PM and DT, this research has shown the development of patents arising from the growing use of new technologies and digital tools involved in the management processes of companies undergoing DT. Emphasis on the increase in the filing of patents on the subject from 2017, where the United States and China are the countries with the highest number of published patents. Additionally, it is identified in the patents the proposition of solutions aimed at automating devices, both mobile and in IoT, as well as solutions to improve and automate processes that eliminate routine activities that can be replaced by machines, bringing agility, cost reduction, and generation of value.

When considering the analysis of digital technologies and tools described in patents from the perspective of PM and DT, it is evident that individuals and teams need to have and develop technical skills to work with new digital technologies and digital tools associated with them, such as Machine Learning, IoT, Big Data, RPA, AI, even to deal with hardware such as routers and sensors for IoT devices. Managerial and leadership skills are also evidenced to orchestrate and direct the teams that work within the context of PM and DT.

The PM appears as a support activity in companies in a DT scenario, being, in some cases, proposed the automation of PM processes with information extracted from reports and databases. These PM process automation issues help to streamline the decision-making process. Another aspect highlighted regarding PM is related to PM methods. Adaptive PM methods such as the Scrum framework are characterized as methods that appear from the project design.

Consequently, the more use of technological tools demonstrates the adaptability and adherence to the necessary changes that arise during DT. This situation requires individuals and people with different thinking and skills to act in a DT context.

Finally, another point that stands out concerns the use of DevOps. The use of DevOps throughout the DT process contributes to better use of automation and agility by bringing together new technologies to deliver solutions and products quickly with the expected value. However, companies to adopt DevOps practices need to be aware that they need to have technically competent teams available in handling digital tools. The results offer the opportunity for further studies to explore in-depth the diversity and relationship of aspects that relate to the use of digital technologies and associated digital tools in the context of the relationship between DT and PM. The DT context is dynamic and constantly changing requires companies to master the subject and be structured to face the challenges. We reinforce that this scenario requires a range of people with diverse skills to address all the changes.

As limitations, this work carried out a descriptive analysis of the technological tools found in patent descriptions in a context of DT and PM, thus offering the opportunity to broaden the discussion proposed by this study, which aims to identify the use of digital tools employed in a context of PM and DT covered by patent description. For future studies, there is the possibility of expanding knowledge on the proposed topic, performing a network analysis to identify the relationship between patents that address the issues of digital tools, as well as identifying the relationship of these patents with other patents on a public basis based on the grouping of patents.

REFERENCES

Assante, D., Fornaro, C., Castro, M., Martin, S., Leisenberg, M., & Kronsbein, P. (2020). Internet of Things: Three years of experience on education in the business sector. 2020 IEEE Global Engineering Education Conference (EDUCON), 1800–1806. IEEE.

Assante, D., Romano, E., Flamini, M., Castro, M., Martin, S., Lavirotte, S., … Bagdoniene, I. (2018). Internet of Things education: Labor market training needs and national policies. 2018 IEEE Global Engineering Education Conference (EDUCON), 1846–1853. IEEE.

Azarenko, N. Y., Mikheenko, O. V., Chepikova, E. M., & Kazakov, O. D. (2018). Formation of innovative mechanism of staff training in the conditions of digital transformation of economy. 2018 IEEE International Conference" Quality Management, Transport and Information Security, Information Technologies"(IT&QM&IS), 764–768. IEEE.

Barsukov, D., Kuzmina, S., Morozova, N., & Pimenova, A. (2018). Professional education for digital economy: Trends and prospects. MATEC Web of Conferences, 170, 01063. EDP Sciences.

Belle, I. (2017). The architecture, engineering and construction industry and blockchain technology. Digital Culture, 2017, 279-284.

Bierwolf, R. (2016). Project excellence or failure? Doing is the best kind of learning. IEEE Engineering Management Review, 44(2), 26-32.

Cha, J., Newman, M., & Winch, G. (2018). Revisiting the project management knowledge framework: Rebalancing the framework to include transformation projects. International Journal of Managing Projects in Business, 11(4), 1026–1043.

Creswell, J. W. (2014). Qualitative, quantitative and mixed methods approaches. Sage.
da Silva, L. F., Russo, R. D. F. S. M., & De Oliveira, P. S. G. (2018). Quantitativa ou qualitativa? um alinhamento entre pesquisa, pesquisador e achados em pesquisas sociais. Revista Pretexto, 30-45.

Darko, A., Chan, A. P., Adabre, M. A., Edwards, D. J., Hosseini, M. R., & Ameyaw, E. E. (2020). Artificial intelligence in the AEC industry: Scientometric analysis and visualization of research activities. Automation in Construction, 112, 103081.

De Vaus, D. (2001). Research design in social research. Sage.

Demirkan, H., & Spohrer, J. C. (2018). Commentary—Cultivating T-shaped professionals in the era of digital transformation. Service Science, 10(1), 98–109.

Dremel, C., Wulf, J., Herterich, M. M., Waizmann, J.-C., & Brenner, W. (2017). How AUDI AG Established Big Data Analytics in Its Digital Transformation. MIS Quarterly Executive, 16(2).

Gimpel, H., & Röglinger, M. (2015). Digital transformation: Changes and chances–insights based on an empirical study.

Guinan, P. J., Parise, S., & Langowitz, N. (2019). Creating an innovative digital project team: Levers to enable digital transformation. Business Horizons, 62(6), 717–727.

INPI. (2021). Recuperado 17 de maio de 2021, de Instituto Nacional da Propriedade Industrial website: https://www.gov.br/inpi/pt-br/inpi

Karimi, J., & Walter, Z. (2015). The Role of Dynamic Capabilities in Responding to Digital Disruption: A Factor-Based Study of the Newspaper Industry. Journal of Management Information Systems, 32(1), 39–81.

Kohnke, O. (2017). It’s not just about technology: The people side of digitization. In Shaping the digital enterprise (pp. 69-91). Springer, Cham.

Krasuska, M., Williams, R., Sheikh, A., Franklin, B. D., Heeney, C., Lane, W., … Hinder, S. (2020). Technological Capabilities to Assess Digital Excellence in Hospitals in High Performing Health Care Systems: International eDelphi Exercise. Journal of medical Internet research, 22(8), e17022.

Kusters, R. J., Leur, Y., Rutten, W., & Trienekens, J. J. (2017). When Agile Meets Waterfall. Faculty MST, Open University, Valkenburgerweg 177, Heerlen, The Netherlands.

Kyläheiko, K., Jantunen, A., Puumalainen, K., Saarenketo, S., & Tuppura, A. (2011). Innovation and internationalization as growth strategies: The role of technological capabilities and appropriability. International business review, 20(5), 508-520.

Leidner, D. E. (2020). Editorial reflections: Lockdowns, slow downs, and some introductions. Journal of the Association for Information Systems, 21(2), 10.

Liew, A. (2013). DIKIW: Data, information, knowledge, intelligence, wisdom and their interrelationships. Business Management Dynamics, 2(10), 49.

Lwakatare, L. E., Kilamo, T., Karvonen, T., Sauvola, T., Heikkilä, V., Itkonen, J., ... & Lassenius, C. (2019). DevOps in practice: A multiple case study of five companies. Information and Software Technology, 114, 217-230.

Mahdavinejad, M. S., Rezvan, M., Barekatain, M., Adibi, P., Barnaghi, P., & Sheth, A. P. (2018). Machine learning for Internet of Things data analysis: A survey. Digital Communications and Networks, 4(3), 161–175.

Marek, J., Blümlein, K., Neubauer, J., Wehking, C., vom Brocke, J., Mendling, J., & Rosemann, M. (2019). Ditching labor-intensive paper-based processes: Process automation in a Czech insurance company. BPM (Industry Forum), 16–24.

Matt, C., Hess, T., & Benlian, A. (2015). Digital Transformation Strategies. Business & Information Systems Engineering, 57(5), 339–343.

McAfee, A., & Welch, M. (2013). Being digital: Engaging the organization to accelerate digital transformation. Digit Transform Rev (4), 37–47.

Mergel, I. (2016). Agile innovation management in government: A research agenda. Government Information Quarterly, 33(3), 516–523.

Muntés-Mulero, V., Dominiak, J., González, E., & Sanchez-Charles, D. (2019). Model-driven Evidence-based Privacy Risk Control in Trustworthy Smart IoT Systems.

Nerurkar, A., & Das, I. (2017, March). Agile project management in large scale digital transformation projects in government and public sector: A case study of DILRMP project. In Proceedings of the 10th International Conference on Theory and Practice of Electronic Governance (pp. 580-581).

Oviatt, B. M., & McDougall, P. P. (2018). Toward a theory of international new ventures. In International Entrepreneurship (pp. 31-57). Palgrave Macmillan, Cham.

Papadatos, G., Davies, M., Dedman, N., Chambers, J., Gaulton, A., Siddle, J., … Overington, J. P. (2016). SureChEMBL: A large-scale, chemically annotated patent document database. Nucleic Acids Research, 44(D1), D1220–D1228.

Paranhos, R. D. C. S., & Ribeiro, N. M. (2018). Importância da prospecção tecnológica em base em patentes E seus objetivos da busca. Cadernos de Prospecção, 11(5), 1274.

Parviainen, P., Tihinen, M., Kääriäinen, J., & Teppola, S. (2017). Tackling the digitalization challenge: How to benefit from digitalization in practice. International journal of information systems and project management, 5(1), 63–77.

Penha, R., da Silva, L. F., & Russo, R. D. F. S. M. (2020). Escalando as práticas ágeis. Revista de Gestão e Projetos, 11(2), 1-11.

Quoniam, L., Kniess, C. T., & MAZIERI, M. R. (2014). A patente como objeto de pesquisa em Ciências da Informação e Comunicação. Encontros Bibli: revista eletrônica de biblioteconomia e ciência da informação, 19(39), 243–268.

Richter, A. (2020). Locked-down digital work. International Journal of Information Management, 55, 102157.

Ross, J. W., Beath, C. M., & Quaadgras, A. (2013). You may not need big data after all. Harvard business review, 91(12), 90-+.

Schmitz, M., Dietze, C., & Czarnecki, C. (2019). Enabling digital transformation through robotic process automation at Deutsche Telekom. In Digitalization cases (p. 15–33). Springer.

Shenhar, A. J., & Dvir, D. (2010). Reinventando Gerenciamento de Projetos: A Abordagem Diamante ao Crescimento e Inovação Bem-Sucedidos. M.Books Editora.

Svejvig, P., & Andersen, P. (2015). Rethinking project management: A structured literature review with a critical look at the brave new world. International Journal of Project Management, 33(2), 278–290.

Vukšić, V. B., Ivančić, L., & Vugec, D. S. (2018). A preliminary literature review of digital transformation case studies. International Journal of Computer and Information Engineering, 12(9), 737–742.

Westerman, G., Tannou, M., Bonnet, D., Ferraris, P., & McAfee, A. (2012). The Digital Advantage: How digital leaders outperform their peers in every industry. MITSloan Management and Capgemini Consulting, MA, 2, 2–23.

Wolff, C., Verenych, O., & Kevorkova, S. (2020). Digital Transformation Time: Research Results for Ukrainian Community.

Žužek, T., Kušar, J., Rihar, L., & Berlec, T. (2020). Agile-Concurrent hybrid: A framework for concurrent product development using Scrum. Concurrent Engineering, 28(4), 255-264.