

GENERAL AND SPECIFIC: THE IMPACT OF DIGITAL TRANSFORMATION ON PROJECT PROCESSES AND MANAGEMENT METHODS

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Abstract: The main aim of the paper is to investigate and discuss the influence of digital transformation (DT) on the processes, tools, and outcomes of project management. It seems to be accepted that not only has the digital economy a great impact on the technologies used, but it affects the transition of strategies, business models, structures, or competences. The objective of the research demonstrated in this paper was to identify the main dimensions and scope of the impact of DT on the area of project management. The conclusions as to the multidimensionality of this impact were drawn on the basis of empirical investigations conducted on a sample of around a hundred of project managers and on the analyses of their perception of the most important aspects of DT. The crucial themes, as well as the advantages and barriers of DT, were discussed briefly.

Keywords: change, disruption, project management, digital transformation, IT tools, agile methods, team management.

JEL Classification: M10.

1 Introduction

When analyzing the development of project management as a particular area of knowledge, it is relatively easy to notice its multithreading and multidimensionality. Moreover, it can be noticed that the research topics are related to the current or fashionable topics of management studies, resulting from the straightforward assumption that projects fit into the conditions of the organization they are performed. It is, therefore, not surprising that the interest in new technologies and digital transformation (DT) is also manifested in project research (e.g., Whyte, Stasis and Lindkvist, 2016; Papadonikolaki van Oel, and Kagioglou, 2019). The broadly understood processes of DT inspire topical research on changes in project management.

My paper is a part of such discussions. I explore here the impact of DT upon the processes, tools, and outcomes of project management. I aim to add to previous research on changes in project management drawing from a modification of existing models of DT, and my objective is to identify the main dimensions and scope of such impact. A qualitative research design is pursued through a cross-sectional study. My findings from the analysis of the respondents' reflections are summarized as a set of peculiar aftermaths and an

elaborated model recapitulating project management transformation.

The paper is constructed as follows: after the delineation of the theoretical framework and the main themes of digitally transformed project management, I demonstrate the result of my empirical research. My investigation has been conducted on a sample of around a hundred of project managers and on the analyses of their perception of the most important aspects of DT.

Coding and analyzing of research materials, supported by the MAXQDA 2020 system, are my foundation for revealing the multidimensionality of the DT impact. I indicate the generic themes as well as the peculiar issues of project management transformation.

2 Digital transformation (DT)

DT is an interesting phenomenon willingly discussed both on scientific forums and in the media, during corporate gatherings, as well as various informal meetings. The recent explosion in the adoption of digital technologies brought this topic to the forefront of debates. DT affects everyone and in almost all spheres

of functioning. Its impact on organizations' management has been analyzed in numerous scientific studies (e.g., Vial, 2019), as a catalyst for change (Yoo, 2013), allowing organizations to exploit new opportunities (Matt, Hess, and Benlian, 2015), integrating digital technologies and business processes, potentially facilitating their reconstruction and improvement (Fitzgerald, et al., 2014). Primarily, DT is related to new digital technologies and strategic changes in organizations, but current discussions concern such spheres as communication, innovation, organizational and individual competences (Berghaus and Back, 2016; Warner and Wäger, 2019). The subjects of scientific research – apart from product or technologies – are, for example, entrepreneurship (Yoo, et al., 2012), digital generation (Prensky, 2012), business models and ecosystems (Berman, 2012; Remane, et al., 2017), or digital shock (Andriole, 2017).

Prior studies and their review indicate a multitude of existing definitions of DT. Some indicate synthetically the essence, for example, the use of digital technologies to radically improve the performance or scope of an enterprise (Westermann, et al., 2011).

The others include more complex terminology: an evolutionary process in which organizations respond to changes in the environment by using digital technologies to improve business models, operational processes, and to create value for customers (Morakanyane, Grace, and O'Reilly, 2017). A detailed review of the existing definitions has been summarized by G. Vial (2019). The author, as a conclusion, proposes an own complex definition (Fig. 1): DT is a process in which digital technologies play a central role both in creating and strengthening disruptive changes taking place in industry (sector) and in society.

Disruptions drive strategic responses – companies to remain competitive, use digital technologies to change the way they create value. To this end, however, to overcome the barriers in transformation processes, they must simultaneously implement structural changes. However, these changes not only lead to positive organizational effects (which are often accompanied by changes at the individual or social level), but may also be associated with undesirable results (Vial 2019, p. 122).

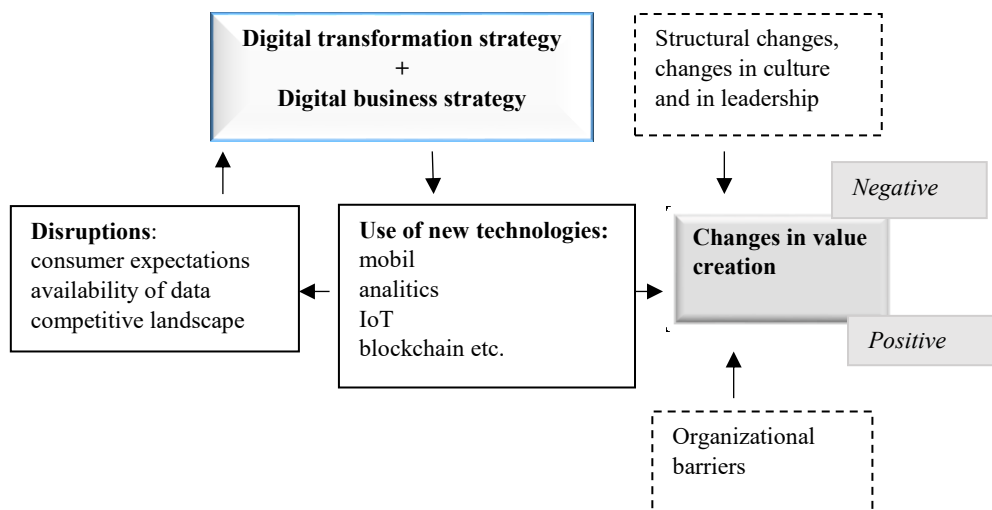


Figure 1. DT – basic components of definition (Source: Vial, 2019, pp.122)

DT involves two important constituents: digital technology and digital innovation. DT can be understood as changes in an organization triggered by the development of digital technologies, covering both the exploitation of existing digital technologies to improve current processes and the exploration of digital innovations that can potentially change the organization's

business model. A. Singh and T. Hess (2017, p.124) emphasize that the use of the term "transformation" (not "change") denotes that the organization must go beyond functional thinking; it must comprehensively consider the coherence of activities aimed at exploiting opportunities and avoiding threats arising from new digital technologies. D. Rogers (2016,

p.308) points out that DT does not only concern the implementation of new technologies, but is a change in the organization's strategy, as managers have to find a way to capitalize on innovative business models and products, as well as on innovative processes, affecting customers' experience and understanding of their expectations.

3 The influence of DT on project management

Prior studies confirm that DT has a significant impact not only on the technologies used, but also affects strategies, processes, customer relations, and the attitudes or expectations of employees (Westermann, et al., 2011; Morakanyane, Grace and O'Reilly, 2017; Vial, 2019). In this context, the impact of DT on project management also seems beyond discussion. However, a very broad spectrum of such impacts can be recognized: from extending the scope of project activities resulting from the implementation of transformational processes (Nambisan, Wright, and Feldman, 2019), through the changes in project management methodologies, notably the increasing role of agile approaches (Whyte, Stasis, and Lindkvist, 2016), to changes in the way particular processes, for example, team communication, are implemented (Guinan, Parise, and Langowitz, 2019). Digital technologies radically transform project roles and project delivery.

The first of the indicated issues concerns projectification of management (Schoper, et al., 2018) resulting from DT. Implementation of changes, and therefore transformation, is both a long-term strategic change and a specific strategy of the company, but it is also a set of projects concerning individual stages or detailed technological solutions. DT could stimulate the growth in the number of projects, but also could influence the perception of numerous activities that are referred to as projects. Moreover, employees of many enterprises are aware of the role of project competences; thus, they use the offered training or certification programs. For example, employees more commonly use the terminology traditionally associated with project management, perceiving projects not as one-off projects, but rather as a permanent element of the company's core business. There are new rules for the allocation of resources (including employees),

as they are assigned to specific projects, rather than to permanent organizational units.

The reflection on the impact of DT could be also focused on the methodological change. Projects related to DT are often called with the very broad term "IT projects." For two decades, these have been managed mainly on the basis of an agile approach (Dingsøyr, et al., 2012). As new technologies are adopted in all project-based industries, their use is breaking old rules, enabling more rapid and more agile forms of organizing (Whyte, Stasis and Lindkvist, 2016). Agility is not only becoming the preferred approach in the field of software development, agile practices appear as increasingly customary, offering an impulse for the hybridization of project management methodologies in various organizations.

Furthermore, DT induces changes in project management processes. Mobile hardware, cloud computing, or integrated software are commonly used for storage of data, automated search of information, as well as prototyping and simulation functions (Whyte, Stasis, and Lindkvist, 2016). In this area, communication in project teams (Guinan, Parise and Langowitz, 2019) and contacts with customers or recipients of the project product are changing, for example, owing to cloud-based technologies. For instance, the use of BIM in construction projects has become increasingly popular, because of project benefits, such as time reduction, coordination improvement, lower costs, and fewer returns for information (Papadonikolaki, van Oel and Kagioglou, 2019). As a result of digitization and access to large data sets, the process of decision-making modifies, just as its speed and quality. The widespread use of project management software and the implementation of dedicated applications facilitating project implementation refine the approach to project planning and monitoring, including, for example, continuous assessment of its effectiveness (Mangla, et al. 2020).

4 Research process

Empirical research sought answers to research questions concerning the recognition of practitioners involved in the delivery of projects as to the impact of DT upon project management. The issues under re-

search related to perceiving (or not) DT only as a technological area (IT tools) or rather as including a bundle of adaptations, for example, new rules of team cooperation or communication with other stakeholders. The analyses carried out as part of this research, apart from identifying those areas of project management that are modified most significantly, contained also explorations of attitudes toward such changes, that is, the perceived positive and negative sides in the context of project management.

As the own research concerned perception, that is, recognition, judgment, or understandings of the respondents, the use of qualitative methods seemed to be required. The research was conducted in the spring of 2019 with the computer-assisted personal interviewing (CAPI; online) method. A simple research tool containing one open question was used to collect the research material for further analysis.

A short textual presentation of the issues was based on the text: "A special type of change that affects modern organizations is digital transformation, i.e., organizational changes that effect the penetration of digital technologies through all aspects of the organization's operation, and results in the integration of digital technologies and business processes, leading to the emergence of a new model of organization functioning." Next, the following question was formulated: What is the relationship between DT and project management? Identify the three most important aspects, and justify your choice. The respondents were asked to write a short answer presenting their own conclusions, observations, or reflections.

The research sample was a judgmental (quota) sample, as the investigation was addressed to a specific group of respondents, and thus, the method of respondents' selection was derived from the snowball approach. It was decided to collect research material until 100 answers were obtained. After analyzing the answers and selecting the texts, it was settled to take into account the statements of 88 respondents, 12 responses were rejected because they contained too general discussion or negated the possibility of answering the question.

The survey metric was relatively limited; what is more, the identification questions were not treated as obligatory; hence, unfortunately, not all answers had

assigned data. The data provided by the respondents indicated that 42% of the respondents were women, and that 59% of the respondents had experience as project managers, the remaining respondents participated in the work of project teams, and 22% of the respondents indicated that they represent the IT sector.

The qualitative analyses were conducted with the support of dedicated software, that is, MAXQDA, version 2020. The research material was the subject of exploratory investigations in the form of lexical analyses, as well as analyses based on open coding and close coding under the concept-driven coding approach. Five groups of codes were exploited: factual codes related to phenomena described on the basis of respondents' experiences, thematic codes related to the specificity of projects (definitions), models of DT existing in the literature, codes in the form of evaluation categories related to the positive and negative sides of the transformation, and codes of the assessment of significance (ranks) of the indicated aspects of the explored relationship.

5 Research results

The concise review of the texts and topics manifested in the respondents' opinions revealed that six of them spoke rather about the transformation of enterprises implementing projects, ten works dealt with both subjects: DT of projects and projects of DT, and in 72 cases, the respondents focused solely on projects, project teams, tools, and project management processes.

In the first stage of the exploration, the lexical research, that is, the analysis of the vocabulary (terminology) used by the respondents in their statements, was conducted (Table 1). The assumption underlying this type of research was the belief that the language used by the respondents can be considered as a reflection of their beliefs and experiences and therefore the terms and their frequency construct an image of the assigned meanings. As discovered by the quantitative analysis, the total of the analyzed text contained 22,842 various words, and after eliminating the identified irrelevant words (e.g., is, was, pronouns, etc.). 6,353 words were taken into account in further research.

Table 1. The results of the primary lexical analysis (*Source*: Own research)

Word in the text			Without inflection and basic terms		
No	Word	Number of words	Word	Number of words	Varieties
1	project	234	data	231	339
2	data	231	process	88	238
3	management	201	change	87	221
4	transformation	178	customer	59	195
5	digital	177	time	50	150
6	organization	172	tools	59	132
7	transformation	137	communication	59	122
8	digital	130	information	92	121
9	work	118	employee	81	120
10	management	103	resources	39	71

However, they were also different inflectional forms (declination and conjugation), but without taking into account the upper- and lower-case letters. As for clear reasons, the words: project, transformation, digital, organization, and management were dominant; the indicated words were removed from the set.

It seems that on the basis of Table 1, an interesting conclusion regarding the broad perception of the meaning of DT can be formulated: in the group of words, there are both those related to technology, for example, data or IT tools, and those related to the social issues, for example, customer or employee.

The next stage of the research was the analysis of respondents' perceptions of the most important aspects of the relationship between DT and project management. The respondents' narratives were coded first using open coding (about 40 codes) and then closed (19 codes). Table 2 presents the results of such an analysis by comparing the main aspects indicated in the texts when regarding them as entire and full-length, that is, with the abandonment of hierarchy, and the aspects indicated by the respondents in the first place, that is, as the most important.

Table 2. Key aspects of the relationship between digital transformation and project management (*Source*: Own research)

No.	Excluding the hierarchy of aspects	Number of indications	Indicated first (most important) aspect	Number of indications
1	data	41	data	13
2	IT tools / systems	41	IT tools	13
3	communication	40	communication	12
4	agile methodology	16	agile methodology	6
5	customer orientation	15	customer orientation	5
6	process optimization	12	process optimization	4

Table 2. Key aspects of the relationship between digital transformation and project management (cont.)
(Source: Own research)

No.	Excluding the hierarchy of aspects	Number of indications	Indicated first (most important) aspect	Number of indications
7	management of knowledge	10	profitability	4
8	monitoring	9	business model	3
9	the role of the manager	6	competences	3
10	profitability	6	mobility	3
11	way of work	6	way of work	3
12	risk management	6	design	3
13	time / speed	5	virtualization	3
14	innovation	5	organizational culture	2
15	competences	5	team	2
16	mobility	5	profitability / efficiency	2
17	design	5	adaptation	1
18	cooperation	5	AI	1
19	resources	5	algorithms	1

According to the above demonstrated results, the most important aspects considered as the impact of DT on project management are as follows:

1) Access to data on the course of the project possible for the entire team implementing the project, regardless of the place of working (... *working groups involved in the project, having quick and easy access to the necessary data collected in the "cloud," can carry out their tasks without having to delay them in time due to the lack of the necessary information, as it used to be when the workflow of data in a "paper" form was functioning*¹), the speed of data processing and its quality ensuring better management decisions, as well as access to external data, essential for the implementation.

2) IT tools supporting project management processes (*The use of digital technology greatly facilitates project management. Digital programs are tools for effective planning, management, and control, thanks to which they increase their efficiency, contribute to their development, and increase profits.*), embracing

communication processes (*the use of tools supporting modern communication in project management is necessary in this case*).

3) Internal communication in project teams (*Communication with the entire team responsible for project implementation can take place in real time without the need to meet in one place. Currently, we can easily send technical documentation of any size and view it and edit it on screen, our mobile devices.*) and with external stakeholders (*partners who, thanks to new technologies, have the opportunity to co-create and improve products*).

4) Project management methodology, or rather its change toward the introduction of agile approaches (*The first thing we notice is the widespread use of agile methodologies in the area of project management. It is clearly visible that this approach to projects ... is becoming more and more popular not only in the area of companies who may be most interested – especially in the IT industry, but also in completely different environments such as banks or in various industries.*).

¹ Texts in italics present the citations of respondents' opinions.

5) Possibility of ensuring greater customer orientation (*They also allow the customer to constantly involve the customer in every stage of the business – through websites, applications, notifications, fun pages, promotions, etc. They also give them the opportunity to have a real impact on certain activities, because you must be aware of this, that nowadays customers are not just passive consumers. They expect almost partnership treatment.*).

6) Process optimization (*... consists in changes related to clearing business processes and liquidating information silos*), shortening the time of their implementation (*process automation allows for shortening the time of carrying out a given task, which in turn translates into the entire project*) and improved monitoring (*Virtually, all processes are controlled by indicators, and the results are analyzed*).

Table 3. Changes in project management in relation to the specificity of projects
(Source: Own research)

Changes perceived by respondents	Respondents' opinions
1) Project outcome	
the outcome of the project (product) is not precisely defined at the beginning of the implementation	<i>...also the purpose of the project changes during its implementation or is not even fully defined until the final stages of the project</i>
less focus on day-to-day operational activities allows for greater focus on goals and results	<i>Digital technologies make it much easier for project managers to focus on results by setting goals ...</i>
2) Time – temporality, specific start and end of a project	
shortening the implementation time thanks to IT tools	<i>Process automation allows managers to shorten the time spent on a particular project, improve the management of the entire project ...</i>
shortening the project delivery time thanks to better communication	<i>- organizing online meetings. This change not only reduces the time ...</i>
the time of reaction to changes, including the unpredictable ones, is shortened	<i>... Reaction time in unforeseen situations is particularly important in terms of the duration of the entire project</i>
3) Team performance	
work online (remote, virtual), no need for direct contact and common location	<i>The project team no longer has to be composed of people working together in one place. The multitude of digital platforms for project management equipped with instant messaging and videoconferencing allow for remote work ...</i>
efficient recruitment and the possibility of acquiring specialists and experts from around the world	<i>requires project managers to integrate a dispersed team, sometimes even in different time zones, but also gives the opportunity to recruit specialists for the project that they could not find in their territorial area, and bring them ... would be unprofitable for the project</i>
project teams are becoming international, new challenges of multicultural management and diversity management	<i>... Providing a common language of communication for multicultural project teams. And it is not about overcoming the language barrier as such, but about ensuring that all team members have the same understanding of the tasks and know what the expected results are.</i>
4) Limited resources	
improving the allocation and monitoring of resources thanks to IT tools	<i>Data sharing tools such as Sharepoint can reduce both time and cost.</i>
easier access to human resources, no restrictions resulting from their location	<i>... the restrictions resulting from the location of employees in the world have disappeared</i>
new opportunities to reduce costs	<i>This change not only reduces the time, but also reduces the cost of travel, per diem and hotel rental.</i>

Table 3. Changes in project management in relation to the specificity of projects (cont.)
(Source: Own research)

Changes perceived by respondents	Respondents' opinions
5) Risks	
faster identification of threats	<i>enables faster identification of threats, much better control of threats during the duration of projects (e.g., by ongoing control of project costs) ...</i>
more precise, multi-faceted threat prediction	<i>... access to data along with their analysis enables prediction of threats and risks related to both external and internal factors</i>
use of available data and their processing	<i>the possibility of cataloguing and using in subsequent projects experiences from projects implemented ...</i>
use of modern technologies, including AI	<i>Having access to current data, it is possible to reliably assess ... the occurrence of risk and its impact on a particular stage of the project. In the implementation phase, you can easily monitor risks - both positive and negative</i>
6) Specific management methods	
increasing importance of agile methodologies	<i>directing project teams towards using agile management methods...</i>
traditional methods and techniques have been programmed, most of the computational and visualization work through IT tools	<i>budgeting, planning, and risk calculation, which have been known in the literature for several decades, have been implemented in computer applications ... tools such as MS Project, SpiraTeam, Jira, and many others (also dedicated to specific industries or companies) do most of the computational work</i>
hybridization of project management methodologies	<i>... the use of technical solutions and the availability of information resulting in changes in the late stages of the project may reduce the share of "traditional" methodologies</i>

It can be concluded that the impact of DT, according to the respondents, concerns both general issues, typical for a company undergoing DT (e.g., process optimization) and specific to projects and project management (e.g., management methodology).

Therefore, in the next stage of the research, the focus was put on the peculiarity of projects' transformation. Consequently, the attention in the analyses was directed toward the perceived changes in relation to the most important characteristics of the project.

Considering the definition of the project: a complex, unique undertaking (an organized sequence of activities) aimed at a specific result, within a specified time, with a distinguished beginning and end, implemented as a team, using a limited amount of resources, associated with a high level of risk, and thus requiring the use of special preparation and implementation methods (Trocki, 2013, pp.19-20), the most important features of the project activity were identified.

As part of this research, closed coding was carried out based on the distinguished characteristics, such as a specific result, a specific time, team execution, limited resources, implementation risk, and special management methods. The results of this stage of the study have been presented in the form of a table (Table 3) containing noticed changes together with quotations of respondents' opinions, illustrating typical reflections appearing in the discussion.

When summing up the results demonstrated above, the significance of IT tools and the increasing popularity of agile project management are to be underlined. IT systems and applications for project management could impact significantly all above-mentioned characteristics, allowing project managers to focus on goals, not daily operations, shortening the time of planning and monitoring, decision-making (thanks to the available data), ensuring better access to resources (such as labor), and the ability to reduce costs, as well as enabling risk identification and faster responses.

Table 4. Positive and negative sides of DT from project management perspective
(Source: Own research)

Positive impact		
1)	Project effectiveness, including cost savings, reducing the time spent on ineffective activities (e.g. travel), selection of resources and their proper allocation	<i>... we can purchase a software subscription needed only for a given project, taking into account the time and needs of the team</i>
2)	The possibility of allocating the time saved as a result of eliminating repetitive and tedious calculations for creative and adding value activities	<i>... changing the profile of the desired project manager from a person scrupulously performing repetitive calculations to an employee characterized primarily by creativity</i>
3)	Shortening the project delivery time thanks to automation, new tools supporting project management	<i>today, using costing software, we are able to directly load the bill of quantities from the project into the software</i>
4)	Ability to use a large amount of current data, real-time access, and fast data processing	<i>saves all project component data in the same way, a new person in the project or a new manager is able to easily implement and read the project and continue the work</i>
5)	Mobility and the possibility of remote cooperation	<i>you do not even need a computer to use the data to work on the project, all you need is a tablet or smartphone</i>
6)	Flexibility of work and results	<i>... the availability of digital methodologies starts the era of independent, self-organizing and more flexible project management</i>
7)	Improvement of risk management processes in the project, identification of risk sources, quick response to threats	<i>... much better control of threats during the project duration, e.g., by ongoing control of project costs</i>
8)	Improving the relationship with the client or recipient of the project product, improving communication, better recognizing the needs and expectations of the client or end user	<i>focusing on areas related to the client's experience and better understanding of his needs</i>
9)	Positive impact on communication in the team and cooperation	<i>communication between individual team members and the trend related to agile management ... affects the team management model itself, in which the project manager plays the role of facilitator rather than manager</i>
10)	Improving knowledge management in the project	<i>universal access to knowledge about the project for the team and clients - Jira / Confluence platforms allow easy documentation, testing, and modification of projects by various stakeholders</i>
Negative impact		
1)	information overload, information noise, redundant data that requires constant prioritization or plausibility checks	<i>... the amount of information we receive from colleagues is often so large that we are not able to read them all</i>
2)	required expenditure for the implementation of new digital solutions, for new systems and applications	<i>... digital transformation is perceived as an additional cost</i>
3)	risk of data loss, undesirable access, or industrial espionage or as a result of a planned hacking attack	<i>data that is sensitive to an enterprise or project may leak outside the organization, either as a result of negligence, e.g., a lost unencrypted flash drive</i>
4)	the need to acquire new competences, the competences held may turn out to be insufficient, the need for continuous training and learning	<i>the manager should be proficient in using or at least understanding these tools to efficiently perform the tasks entrusted to him</i>

The agility of the approaches (methodologies) results from the need to adapt to changes in the environment, as well as from the incremental creation of project products. Moreover, it is a consequence of the implementation of numerous IT projects, promoting and supporting the diffusion of knowledge and skills in the use of agile practices.

It can also be noticed that the word that appears very often in the context of time is shortening, and not meeting the deadline. Shortening the implementation is perceived as the effect of the use of IT tools, automation, cooperation, and solving problems in real time, working on shared data and files, as well as mobility and decision-making at any time or anywhere.

A similarity can be discovered when analyzing opinions about the project's resources, also here the respondents paid attention not so much to limited resources as to the lack of limitations in obtaining human resources.

The traditional approach to project management, based on the use of methods of optimizing the course of the project over time, meeting deadlines as a key success factor or minimizing resources to ensure profitability, has been replaced by an approach based on incremental product development, by a mobile, collaborative online team using modern IT tools, and dealing with data and experience as an important project resource.

The next part of the research was directed toward the recognition of the respondents' perception of positive and negative sides of DT. Most of the respondents positively assessed the impact of DT, as evidenced by the general tone of many statements and a relatively large lexical group containing words such as improvement, development, speed, and efficiency.

Based on the analysis of the coded fragments, the positive and negative sides of the transformation were distinguished and divided into these that were clearly assigned to the project (they appeared in the context of project management terminology) and general comments, assessing the impact not only on the project, but on the entire organization.

The most important advantages and drawbacks of DT, assigned to the domain of project management, are demonstrated in Table 4.

Summing up, it is possible to point to the predominance of positive opinions and the perception of rather positive sides of the changes caused by DT, superior functioning of the organization, and the improved delivery of projects in the new conditions of the digital economy.

6 Discussion and summary of research results

DT is one of the important phenomena considered as a crucial factor shaping contemporary project management, not only as to processes or methods, but also in the broad economic and social context.

Summarizing the results of the empirical research presented above, one can refer to the question regarding the impact of DT in two perspectives: transformation, that is, change and its implementation in the organization (including: business design), as well as the results of changes related to the digitization of products and processes, in the form of automation, new remote collaboration technologies, data access or access to work resources.

Undoubtedly, this opens up a wide field for discussion about the outcomes of such changes in relation to project management, both from the "hard" perspective of tools or process optimization, and from the "soft" perspective of team collaboration, new roles and management practices.

In consequence, the changes lead to both the expected positive effects (shortening the time, effectiveness of project delivery) and negative ones, for example, related to the emergence of new risks.

The results of the empirical research demonstrated above can be presented synthetically by referring to the Vial (2019) model presented earlier in this paper.

A simplified model of adaptive changes in project management induced by DT is demonstrated in Fig. 2.

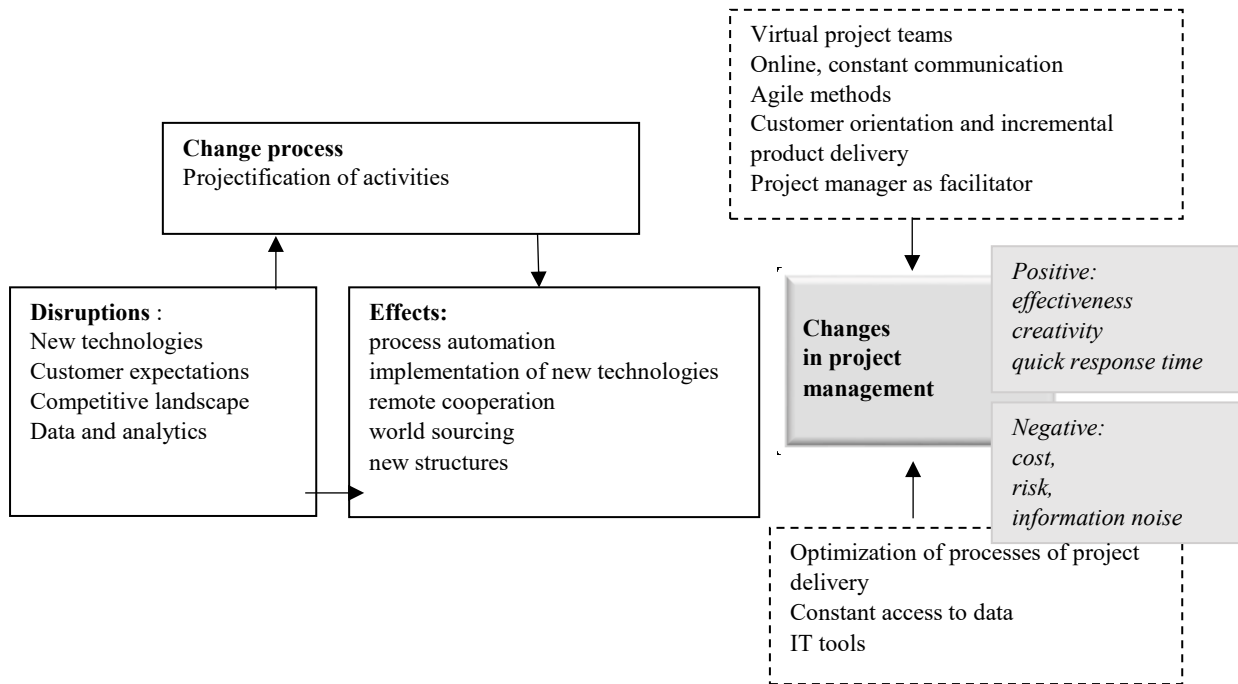


Figure 2. Model of the impact of DT on project management
(Source: Own research)

7 Concluding remarks

The last decade has witnessed an increase in interests in digital economy and induced challenges. The impact of DT on project management constitutes a very broad and complex research field. It is also, undoubtedly, a trendy and cognitively relevant topic. In this work, on the basis of qualitative empirical research, the most important specific issues of the influence of DT on projects were identified, and the manifestation of change was designed in the form of a model depicting the context, areas of change, as well as the most important positive and negative aspects.

The topicality of the issues presented in the paper means that it is possible to identify further avenues of research. There is a bundle of possible research topics concerning specific issues, such as new risk sources or changes in project management practices resulting from process automation. Moreover, the matter presented here requires also investigations conducted within other research approaches and strategies, including quantitative surveys or comprehensive and detailed case studies.

The development of digital technologies, the growing range of applications of solutions based on artificial

intelligence and automation will not be without impact on the management of organizations. Project management in such new, changing conditions will remain at the center of attention for the coming years.

8 References

- [1] Andriole, S.J., 2017. Five Myths About Digital Transformation. *MIT Sloan Management Review*, 58(3), pp.20-22.
- [2] Berghaus, S., Back, A., 2016. Stages in Digital Business Transformation: Results of an Empirical Maturity study. *Mediterranean Conference of Information Systems*, Cyprus.
- [3] Berman, S.J., 2012. Digital Transformation: Opportunities to Create new Business Models. *Strategy & Leadership*, 40(2), pp.16-24.
- [4] Dingsøyr T., Nerur S., Balijepally V., and Moe N.B., 2012. A Decade of Agile Methodologies: Towards Explaining Agile Software Development. *Journal of Systems and Software*, 85, pp.1213-1221.
- [5] Fitzgerald, M., Kruschwitz, N., Bonnet, D., and Welch, M., 2014. Embracing Digital Technology:

- A New Strategic Imperative. *MIT Sloan Manage. Rev.*, 55 (2), pp.1-12.
- [6] Guinan, P.J., Parise, S., and Langowitz, N., 2019. Creating an Innovative Digital Project Team: Levers to Enable Digital Transformation. *Business Horizons*, 62(6), pp.717-727.
- [7] Mangla, S.K., Raut, R., Narwane, V.S., and Zhang, Z., 2020. Mediating Effect of Big Data Analytics on Project Performance of Small and Medium Enterprises. *Journal of Enterprise Information Management*, Vol. ahead-of-print. <https://doi.org/10.1108/JEIM-12-2019-0394>
- [8] Matt, C., Hess, T., and Benlian, A., 2015. Digital Transformation Strategies. *Business Information Systems Engineering*, 57 (5), pp.339-343.
- [9] Morakanyane, R., Grace, A.A., and O'Reilly, P., 2017. Conceptualizing Digital Transformation in Business Organizations: A Systematic Review of Literature. *Bled eConference*, Slovenia, pp.427-444.
- [10] Nambisan, S., Wright, M., and Feldman, M., 2019. The Digital Transformation of Innovation and Entrepreneurship: Progress, Challenges and Key Themes. *Research Policy*, 48(8), 103773.
- [11] Papadonikolaki, E., van Oel, C., and Kagioglou, M., 2019. Organising and Managing Boundaries: A structurational View of Collaboration with Building Information Modelling (BIM). *International Journal of Project Management*, 37(3), pp.378-394.
- [12] Prensky, M.R., 2012. *From Digital Natives to Digital Wisdom: Hopeful Essays for 21st century Learning*. Thousand Oaks: Corwin Press.
- [13] Remane, G., Hanelt, A., Nickerson, R.C., and Kolbe, L.M., 2017. Discovering Digital Business Models in Traditional Industries. *Journal of Business Strategy*, 38(2), pp.41-51.
- [14] Rogers, D.L., 2016. *The Digital Transformation Playbook: Rethink Your Business for the Digital Age*. Chichester: Columbia University Press.
- [15] Schoper, Y.G., Wald, A., Ingason, H.T., and Fridgeirsson, T.V., 2018. Projectification in Western Economies: A Comparative Study of Germany, Norway and Iceland. *International Journal of Project Management*, 36(1), pp.71-82.
- [16] Singh, A., Hess, T., 2017. How Chief Digital Officers Promote the Digital Transformation of Their Companies. *MIS Quarterly Executive*, 16 (1), pp.1-17.
- [17] Trocki, M., 2013. *Nowoczesne zarządzanie projektami (Modern Project Management)*. Warszawa: PWE.
- [18] Vial, G., 2019. Understanding Digital Transformation: A Review and a Research Agenda, *The Journal of Strategic Information Systems*, 28, pp.118-144.
- [19] Warner, K.S., Wäger, M., 2019. Building Dynamic Capabilities for Digital Transformation: An Ongoing Process of Strategic Renewal. *Long Range Planning*, 52(3), pp.326-349.
- [20] Westerman, G., Calmédjane, C., Bonnet, D., Ferraris, P., and McAfee, A., 2011. *Digital Transformation: A Roadmap for Billion-dollar Organizations*. MIT Center for Digital Business and Capgemini Consulting, pp.1-68.
- [21] Whyte, J., Stasis, A., and Lindkvist, C., 2016. Managing Change in the Delivery of Complex Projects: Configuration Management, Asset Information and 'Big Data'. *International Journal of Project Management*, 34(2), pp.339-351.
- [22] Yoo, Y., 2013. The Tables Have Turned: How Can the Information Systems Field Contribute to Technology and Innovation Management Research? *Journal of Association of Information Systems*, 14 (5), pp.227-236.
- [23] Yoo, Y., Boland Jr., R.J., Lyytinen, K., and Majchrzak, A., 2012. Organizing for Innovation in the Digitized World, *Organization Science*, 23 (5), 1398-1408.