

## WHAT CHANGES IN ORGANIZATION AND MANAGEMENT CAN EMPOWER THE DIGITAL TRANSFORMATION?

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**Purpose:** The main purpose of this research was to investigate what key outcomes of the new digital technologies are observed in selected manufacturing enterprises in Poland and what changes in organization and management area should be realized to support the digital transformation strategy.

**Design/methodology/approach:** To illuminate this uncharted field, the individual in-depth interviews with the selected management experts with extensive experience and practice in industry were tested and their interesting observations and recommendations for top managers and scientists were identified.

**Findings:** The findings from the study indicated that one of the primary effect of the digital transformation is a possibility to process and analyze a huge amount of data in real-time. This gives many significant benefits revealed in this study. One of them is shortening time and an increase quality of decision-making process. These results can provide meaningful insights for subsequent research towards designing new methods and tools for business management using advanced digital technologies.

**Research limitations/implications:** The first limitation is that this research focuses on Polish manufacturing enterprises, but it does not include a division into different type of industry sectors. Therefore, it was not possible to identify changes specific for each kind of sector. A second limitation is associated with the qualitative research which was conducted to identify new changes and cannot lead to the elimination of changes with marginal importance and indicate the most important ones. The quantitative research could bring interesting results and indicate which changes are significant.

**Practical implications:** These research results established a solid basis towards the development of new solutions, business models and methods by answering the question about what should be changed in manufacturing enterprises in digital transformation environment for their own betterment.

**Originality/value:** The article addresses the need for conducting research to develop a new approach, new perspectives and trends in business organization and management so far lacking in the scientific literature. The presented results of in-depth interviews with experts contributes to descriptive and explanatory knowledge on the influence of digital transformation on organization and management areas in manufacturing enterprises.

**Keywords:** organization and management, digital transformation, digital transformation strategy, in-depth interview.

**Category of the paper:** Research paper.

## 1. Introduction

The digital transformation process is not only implementing new technologies, tools and systems, but also a good strategy statement. Enterprises have to be able to respond to changes in all business processes to stay competitive (Albukhitan, 2020). Prior research indicated that company success does not depend only on the technologies, but more important is a strategy realized by the managers that helps to use these technologies to create value and deliver benefits (Ismail et al., 2017; Tonder et al., 2021). A digital transformation strategy (DTS) can help companies, but a main task is an identification of the key changes in organization and management in manufacturing enterprises which allow benefits from the digital transformation (DT) to be achieved.

With technological advances in manufacturing and communication in the past several years related to the Industry 4.0 implementation, multiple enterprises are beginning to experience many benefits as well as limitations. They can offer products personalized to the individual customers' needs and enable a high level of production efficiency and quality (Huang et al., 2022; Yang et al., 2020). Besides, they increase productivity, working conditions, and create new business models (Aquilani, 2020). However, the literature review shows that although the Industry 4.0 concept has concentrated on the efficiency and flexibility of industry, rather insufficient attention has been paid to industrial sustainability and worker's welfare (Xu et al., 2021). Therefore, currently the Industry 5.0 concept has gained popularity (Huang et al., 2022).

The European Commission (EC) also highlights that European industry is a key driver in current transitions and has to aim beyond efficiency and productivity, and strengthen the role of good industry impact on society. It gives an important goal of using new technologies in production processes and overall business, and points out the workers' and society's well-being as a key element of economic development. This approach is manifested in three priorities: "An economy that works for people", "Europe fit for the digital age", and "European Green Deal" (European Commission, 2020). Furthermore, the strong need to develop industry towards three pillars: human-centricity, sustainability and resilience is observed in EC activities as well as in the previous research about current trends in industry (Ivanov, 2022; Madsen et al., 2021).

A closer look to the literature on this topic reveals a number of gaps and shortcoming related to organization and management aspects in manufacturing enterprises. One of the major topics to be analyzed in this field is to identify the key expected outcomes and activities need to be carried out to manage the digital transformation. Prior research can only be considered a first step towards a more profound understanding of perspectives, trends and changes in strategic and operational management. DT is perceived very often as a disruptive process which leads to deeply change the way companies create value, compete, and interact (Said, Mouaad, 2019; Jedynak et al., 2021).

The main aim of this research was to establish what key outcomes of the new digital technologies are observed in manufacturing enterprises, and identify what changes are required in organization and management to deliver benefits from DT. The paper reveals the research results obtained on the basis of interviews with selected experts from Polish manufacturing companies. These findings can be useful for scientists, managers and practitioners to design new and improve present management methods in the digital age.

This paper consists of five sections and is structured in the following way. In the first section, the reasons to conduct research and aim are described. The second section includes studies in the literature which provides a brief overview of the digital transformation and the digital transformation strategy. In the third section a research methodology is explained and main information about interviews is shown. The main research results and a discussion about similar research previously published are presented in the fourth section. Finally, in the fifth section significant conclusions of the article and limitations of study are formulated and future research subjects are recommended.

## **2. Literature Review**

### **2.1. Digital transformation in the context of Industry 4.0 and Industry 5.0 development**

DT entails an integration of various digital technologies and new business models that have changed the way the company operates and delivers value to customers (Ismail et al., 2017; Kiełtyka, Charciarek, 2019). DT is a management strategy that creates new markets and customers changing a traditional industry process and an organization using technologies such as cloud computing, big data, Internet of things, artificial intelligence and create a new business model as a result (Nguyen et al., 2021). DT is a radical change which disrupts organizational culture through new IT infrastructure and new digital skillsets overloading employees as well as an entire organization (AINuaimi et al., 2022). DT can be described as a set of processes which use information technologies to increase flexibility, productivity, and agility of the organizational structure and business processes (Warner, Wager, 2019). The driver of DT in enterprises is usually a wish to support business processes (Schwaferts, Shama, 2018). Digital advancement is caused by a development of such technologies as: big data analytics, cloud computing, mobile technology, Internet of things, cognitive technology, robotic systems, blockchain technology, artificial intelligence (AI), 5G, radio frequency identifier, machine learning, etc. (Pamula, Zalewska-Turzyńska, 2022; Pilipczuk, 2021; Kessler, Arlinghaus, 2022). The prior research has shown that the change of organizational identity caused by digitization leads to the creation organization's digital identity and this is not a result of the digitization process, but it poses a new conceptual category (Jedynak et al., 2022).

DT has developed based on the Industry 4.0 and 5.0 concepts. The Industry 4.0 strategy is concentrated on technological aspects, while the Industry 5.0 puts people and the benefits for society at the center. The Industry 5.0 means human-centric, resilient, and sustainable system design (Ivanov, 2022). This concept includes four main areas: organization, management, technology, and performance assessment at society level, network level, and plant level. It creates a new triple bottom line (Huang et al., 2022; Maddikunta et al., 2022):

- human well-being,
- sustainable society,
- resilient value creation in three dimensions: profit, people, and society.

The Industry 5.0 approach helps to automate and integrate decision making using smartification and digitalization of companies (Kumar, Mallipeddi, 2022). This concept promotes talents, diversity; agility and resiliency of the systems through using flexible and adaptable technologies; and respects planetary boundaries. Generally, all activities should lead to a human centric super smart society with high-quality, comfort lives (Huang et al., 2022).

The previous studies highlighted that DT gives new opportunities not only for production but also for management processes, other operational processes and supporting processes (Gaspar, Juliao, 2020). The research revealed that the entire management in strategic and operational level is transformed as well as the organizational structure, and relations between producers and customers, suppliers and employees. Some researchers pointed out that DT leads to develop “different” company (Felsberger, Reiner, 2020; Gastaldi et al., 2022; Olsen, Tomlin, 2020). The key drivers for a successful DT are open innovations, which improve collaborations and partnerships with customers, suppliers and start-ups. An information exchange between different players is also important and can help to build new business models, new digital value and a seamless customer experience. In addition, culture and change management plays a big role in DT (Raza et al., 2023).

There are six main benefits in manufacturing enterprises from digital transformation: 1) improvement in productivity – development and design processes are faster and delivered information in real-time is better (augmented reality, 3D printing); 2) better quality – automatically indicated quality defects and wastes before they occur (machine learning); 3) cost reduction and better management of inventory (analyzing costs across all stages); 4) product customization; 5) safety at workplaces (robots, sensors) (Albukhitan, 2020; Matt et al., 2015, Jang et al., 2019); 6) lower energy and resource consumption (Kagermann, 2015; Marre et al., 2015). To achieve these benefits, firms need use in practice a digital thinking. It means that they have to collect a huge amount of data and skillfully, deeply analyze data in real-time to achieve greater flexibility, efficiency and value added (Kumar et al., 2020; Thoben et al., 2017).

## 2.2. Digital Transformation Strategy

To survive on the market and effectively apply new technologies enterprises should develop their processes and the way of management to quickly predict and respond to changes as well as stimulate innovation (Albukhitan, 2020). Apart from digital technologies, employees' digital skills, and DTS help to drive DT and financial performance (Teng et al., 2022). DTS requires a formal and structured plan that helps a company to DT. It is critical for the success of digital implementation (Albukhitan, 2020; Ismail, 2017). DTS is defined also as corporate activities which can preemptively react to rapidly changing management environment and create continuous growth using cloud computing, big data, Internet of things, mobile, and artificial intelligence digital technologies (Verhoef et al., 2021).

DTS can improve top executives' decision-making processes (AINuaimi et al., 2022). Currently, a new business model based on artificial intelligence technology is one of the key strategic activity of global companies leads to a successful digital transformation strategy (Verhoef et al., 2021). Digital transformation starts very often from sharing big data that is accumulated through blockchain, Internet of things and cloud computing technologies. Furthermore, operating simulation and systems functioning are supported by artificial intelligence (Huang et al., 2018).

As noted Park and Yang implementation of artificial intelligence (AI) is a key management change to transform enterprise to digital era. They stated that digital transformation can be a success when artificial intelligence is adopted by new personnel and simultaneously with changes in recruitment and job structure (Park, et al., 2020). Moreover, Matt, Hess and Benlian argued that AI development and digital platform consolidation can be achieved using leading business innovation and based on data creation, collection and control management (Matt et al., 2015).

The previous research revealed that digital technology has positive influence on DTS and organizational innovations. In other words, DTS and organizational innovation play an intermediary role between DT and company performance (Tsou, Chen, 2021). In addition, top management plays the positive moderating effect on the relationship between DTS and both IT infrastructure and DT. Besides, research stated that DT has a great impact on the elements of business model (Zhang et al., 2023). In contrast, budget restrictions are a significant limit of DT, especially due to a cost-intensity.

The scientists rightly highlight that enterprises often concentrated on technical development and actualization, rather lack attention has been paid to strategic management, organizational effectiveness and implementation efficiency of new digital technologies (Kitsios, Kamariotou, 2021). Implementation of new technology and business model requires a pressure on management and apply innovations to existing processes and organizational culture. As a result of DTS company should be introduced a new data-centered business model which creates real-time enterprise (RTE) with continuously changing management environment (Kyungtae, Boyoung, 2022).

### 3. Materials and Methods

#### 3.1. Research Questions and Aim

The main aim of this research was to investigate what key outcomes of the new digital technologies are observed in selected manufacturing enterprises from Poland and what changes in organization and management should be realized to support the digital transformation strategy and deliver benefits from DT.

For this study, it was of interest to investigate what new changes in organization and management are required in the DT environment. Therefore, all the above issues have led to formulate of the following questions:

Research Question 1 (RQ1): What key outcomes of the new digital technologies are observed in manufacturing enterprises which have an influence on organization and management areas?

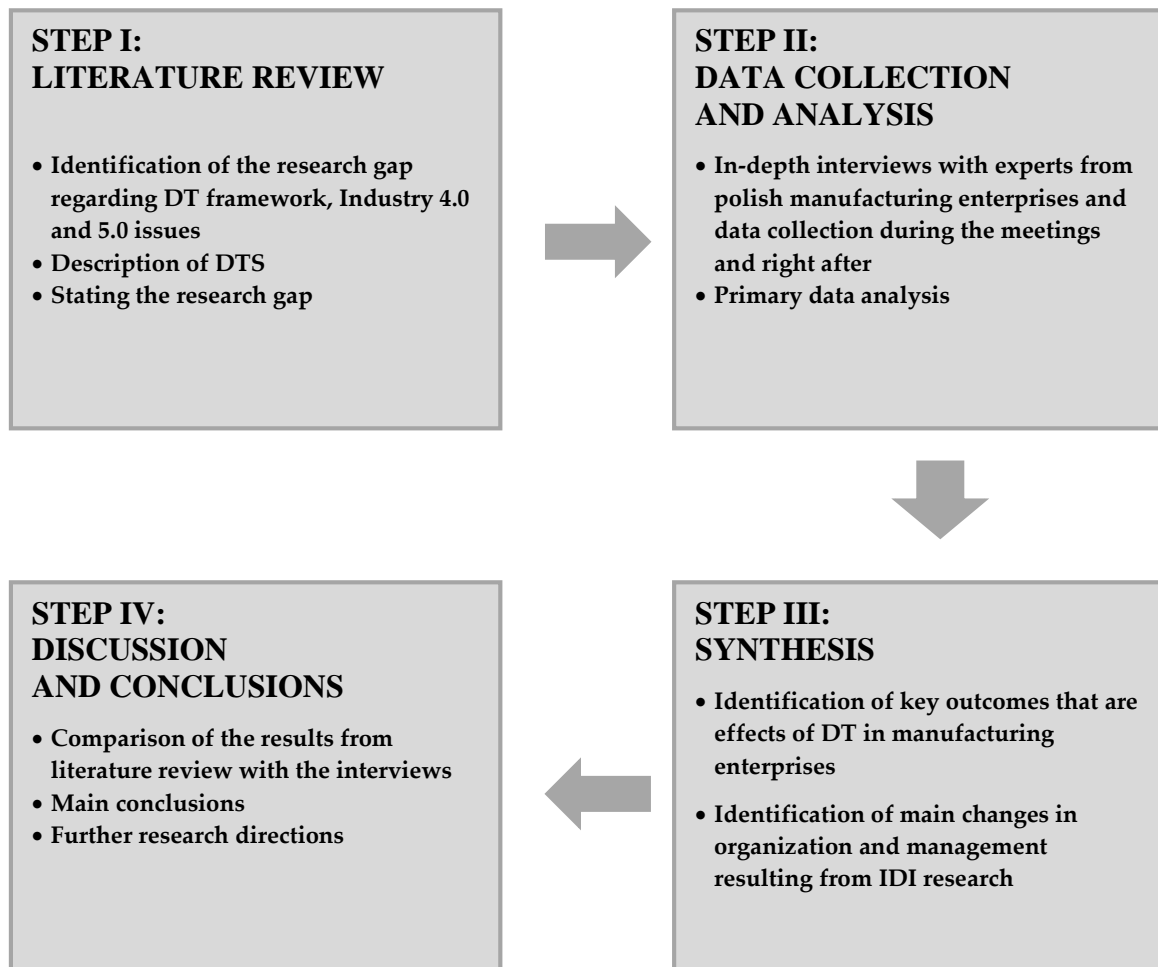
Research Question 2 (RQ2): What changes in organization and management areas are required to create value and deliver benefits from DT?

#### 3.2. Research Methodology

Given the research aim of this study, the qualitative approach was used. The quantitative research was difficult to conduct due to the inability to verify the competences and experience of the respondents. In addition, qualitative research enabled the selection of respondents from various industries, which leads to more valuable results. This paper reports on the results obtained of the in-depth interviews with experts from polish manufacturing enterprises.

In this research, a four-step methodology was developed and applied. The overview of the applied methodology is presented in Figure 1. In the Step 1. an academic literature was analyzed and an attempt was made to structure the problem area and identify the research gap. The systematic literature review allowed the conceptual framework of DT related to the development of Industry 4.0 and Industry 5.0 as well as the idea of DTS to be synthesized.

In the Step 2. a data collection and analysis were made. For the aim of this study the in-depth interview was used to gather data from interview participants. The in-depth interview (IDI) is a qualitative research technique that is used to conduct intensive individual interviews with a small number of respondents to explore their perspectives on a particular situation, idea, or program (Boyce, Neale, 2006; Rutledge, Hogg, 2020). This kind of review requires a time-consuming conversation with each participant and leads to a discovery-oriented approach. Interview questions are primarily open-ended. IDI enables to get detailed information that sheds light on an individual's experiences, and the derived meaning about a particular topic or issue (Rutledge, Hogg, 2020).



**Figure 1.** The overview of the applied methodology.

Source: own study.

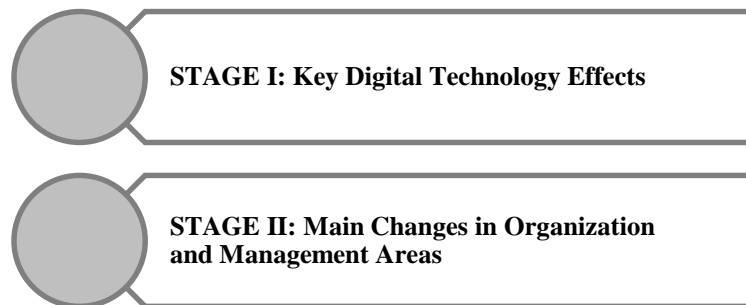
These interviews are useful to explore new issues in depth. Their main advantage is that they provide much more detailed, and valuable information than other data collection methods (e.g. surveys). Besides, they allow a more relaxed atmosphere to collect information to be provided (Boyce, Neale, 2006). With this method, it is possible to easily react based on participants' responses to previous questions. Sometimes a question can be changed or more questions can be asked to get detailed answers or when the participant misunderstands the question (Rubin, Rubin, 2011). The primary limitation of IDI is a time-intensive evaluation activity. Sometimes also there are observed situations that respondents are prone to bias (Boyce, Neale, 2006).

All the aforementioned issues have led to provide the IDI research which has tried to reveal new changes in organization and management related in the DT environment. It should be highlighted that it was a qualitative research. With this aim in mind, in this study, less attention was paid to determining which of the changes is the most important.

The group of medium manufacturing enterprises from Poland which use solutions based on at least one of the following new technologies: Big Data, Cloud Computing, Internet of Things, blockchain technology or augmented reality were selected for this research. Then, specially

selected interdisciplinary experts combining knowledge and at least three-years' experience in fields of organization, management, and new technologies in industrial enterprises in Poland were chosen. These interviews were provided from September 2021 to October 2022 with 46 experts who agreed to be interviewed from the group of specially selected 114 people. The average interview time was 34 minutes.

The provided IDI – within Step 2 - consist of two stages. Firstly, key effects of digital technology were perceived. Secondly, main changes in organization and management of manufacturing enterprise in the DT environment were identified (Figure 2). The interview questions were organized in “funnel” format (Rubin, Rubin, 2011). Firstly, broad questions were asked, and then more specific. The general rule on sample size for IDI is that when the same issues, topics and observations are emerging from the interviewees, then a sufficient sample size has been reached (Boyce, Neale, 2006).



**Figure 2.** Main stages of the in-depth interviews.

Source: own study.

In the Step 3., the synthesis of data collection was performed. Thereafter, the findings of qualitative research and their implications were described based on discussions with experts. Finally, concluding remarks and future research directions were presented in the Step 4.

## 4. Results and Discussion

This IDI research has tried to identify new changes in the area of organization and management characteristic for the manufacturing enterprises and their reasons. The comparison of different directions of change in organization and management indicated by IDI, and common directions of change proposed by both IDI, and previous research is presented in Table 1.



**Table 1.**

*Comparison of the expected changes in organization and management resulted DT based on IDI research and previous studies*

Area of changes	Common directions of change proposed by IDI and previous research	Different directions of change proposed by IDI research
Organizational structure	<ul style="list-style-type: none"> <li>• flexible structure</li> <li>• flatter structure</li> <li>• with decentralized decision-making</li> <li>• with flat hierarchy data</li> </ul>	<ul style="list-style-type: none"> <li>• horizontal structure</li> <li>• simple procedures</li> <li>• less bureaucracy</li> <li>• more responsibility of employees</li> <li>• smaller role of hierarchy in the enterprise</li> <li>• lack of competition between departments</li> <li>• lower degree of formalization</li> <li>• partnership in the implementation of tasks</li> <li>• with quick decision making</li> <li>• with easy implementation of innovations</li> <li>• with process as a central point data</li> </ul>
Organizational learning	<ul style="list-style-type: none"> <li>• digital knowledge necessity</li> <li>• interdisciplinary team work</li> <li>• new skills</li> <li>• new competencies of employees</li> <li>• easier application of changes</li> <li>• faster opportunity recognition</li> <li>• openness for innovations</li> <li>• interdisciplinary employees' knowledge</li> </ul>	<ul style="list-style-type: none"> <li>• a need of increasing motivation of employees</li> <li>• openness for change management</li> <li>• interdisciplinarity of teams</li> <li>• a need of team work</li> <li>• increased responsibility of teams for results</li> <li>• a quick information flow in both direction</li> <li>• a completely new division of remote and on-site work</li> <li>• an increase of the employees' independence</li> </ul>
Strategy	<ul style="list-style-type: none"> <li>• orientations for organizational agility</li> <li>• orientation on processes</li> </ul>	<ul style="list-style-type: none"> <li>• quickly implemented strategy</li> <li>• orientations for changes</li> <li>• orientation for innovations</li> <li>• orientations for new technologies</li> <li>• outsourcing</li> </ul>
Cost	<ul style="list-style-type: none"> <li>• new cost model</li> <li>• new system of cost measurement</li> <li>• detailed monitoring and control of costs</li> </ul>	<ul style="list-style-type: none"> <li>• continuous monitoring and control return of investments</li> <li>• increase of indirect costs</li> <li>• costs measurement/cost calculation based on data actualized in real-time</li> </ul>

Source: own study.

In the interviews, firstly the respondents were asked what DT implementation effects they noticed. Next, they recognized changes within organization and management areas which help to support enterprise functioning within the DT environment. The interviewees clearly perceived them within organizational structure, organizational learning, strategy, and cost measurement.

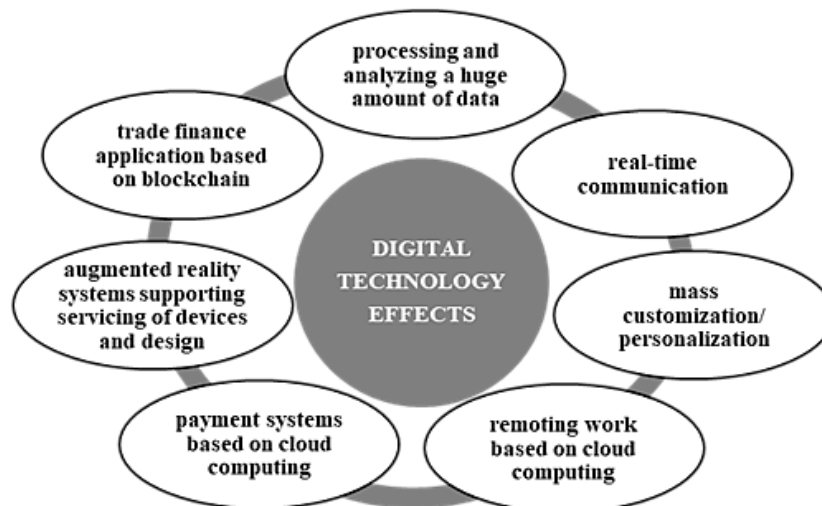
The experts proposed some types of changes. The continuous changes are especially expected in strategy and organizational learning in the DT environment. In contrast, discontinuous changes are relevant in the organizational structure and cost measurement. Furthermore, there are generally all three kinds of changes identified in IDI according to the change strategy criterion: changes aimed at the structure; changes aimed at technology; and changes focused on people.

#### 4.1. Key Effects of the Digital Transformation

The previous studies generally have expressed that the effect of digital technologies is a need of internal changes in organizations (Tonder et al., 2021) and a direct influence on organizational behavior is clearly observed (Foerster-Metz et al., 2020; Jedynak et al., 2021). The bibliometric analysis of the literature available in Web of Science database reported that the main pillars of business management conclude: value chains, SMEs, B2B, B2C, cyber-physical networks, sustainable development and globalization (Grabowska, Saniuk, 2022). These research results have shown that the most often a large number of existing studies in the broader literature is strongly related the principles of management, relations with the environment, the interaction, cooperation among people, companies, and governments worldwide. The literature review pointed out that common directions of change focused on the decision making flexibility, outsourcing and talent management (Grabowska, Saniuk, 2022).

Undoubtedly, the results of IDI, in comparison with the previously conducted research described in the literature, clearly identified several new, more detailed directions of change as an effect of digital technologies in manufacturing enterprises. Most experts highlighted a processing and analysis of a huge amount of data as an important effect of DT. They also often indicated a real-time communication (RTC). The research participants often claimed that Big Data Analytics, Internet of Things and edge processing enable to analyze business processes in real-time what leads to make decisions “in a second” or “in seconds” and can increase a competitive advantage significantly increasing the quality of decision-making processes in the enterprise. The key digital technology effects for manufacturing enterprises are presented in Figure 3.

Furthermore, some respondents specified mass customization or personalization as a result of digital technologies. They clearly indicated that this trend leads to different production planning (especially customization). It is possible to introduce client’s special requirements. The big data and Internet of things technologies enable very quickly design a huge amount of different variants of products and simultaneously help to organize and prepare production processes for these variants. Some of experts indicated cloud computing as a technology which supports personalization and sometimes customization of different product variants. Hence, some production processes can be easily realized outside enterprise. It was noticed that some experts treated the terms personalization and customization as meaning the same thing during the interviews. Therefore, not every participant of the study precisely formulated and assigned changes to these two types of production strategies, which can be considered a disadvantage of this study.



**Figure 3.** Key effects of DT for manufacturing enterprises based on IDI.

Source: own study.

The interview participants reported also remoting work as well as the payment systems based on cloud computing technology as the outcomes of DT. Many interviewees indicated the trade finance applications based on blockchain technology as important effect as well as an augmented reality system supporting the design and servicing of devices.

#### 4.2. Changes in the Organizational Structure

The previous studies clearly stated that usually enterprises have too inflexible structure to implement digital technologies and it can generate many problems (Albukhitan, 2020). Also they established that a decentralized decision-making is necessary. Especially, the big data technology creates a completely new foundation for management decision-making and enables to improve significantly data mining, optimization and simulation, statistical methods, deep learning and risk analysis (Yang, Wang, 2020). As the prior research indicated the high-performance and flexible smart manufacturing systems require rapid decisions from humans. Accordingly, production planners have to confront with a high level of complexity (Maddikunta et al., 2022). Both the participants of presented interviews and the scientists in previous studies agreed that the organizational structure must be changed in the conditions of DT (Tonder et al., 2021; Gasparetto et al., 2018), and should be flatter and more flexible (Ozkan-Ozen, Kazancoglu, 2021). However, the IDI results show more detailed changes, not just general guidelines.

The participants of IDI call for less bureaucracy, which means shortening the time of making and accepting decisions. Such a solution requires increasing the responsibility of employees for tasks, but also other rules for the employee's control. The interviewees suggest the completely different solution of the employee's control, which seems to be the opposite of those usually used. Namely, they believe that the final results of the implemented tasks should

be controlled, and only in the case of results that do not meet expectations, a thorough detailed control of the stages of task implementation should be made.

The IDI participants highlighted that the quick making decisions can be obtained to apply simple procedures, less bureaucracy, and more responsibility of employees for their tasks. They proposed a horizontal structure. Moreover, they reported that a process should be “a central point” of enterprise. Accordingly, managers have to strive for flexibility of processes and easy implementation of innovations. The experts underline a need of lower degree of formalization in organizational structure as well as an increase of remote work in the DT environment.

### **4.3. Changes in the Organizational Learning**

The previous studies reported that new knowledge, skills and competencies are necessary in the DT environment (Saniuk et al., 2021). Moreover, enhancing employees knowledge has to be integrated with implementation of digital technologies (Albukhitan, 2020; Tonder et al., 2021). First of all a digital knowledge is necessary to provide DT, but also engendering trust and developing teams are very significant (Warner, Wager, 2019). In the DT environment, enterprises should be innovative in terms of new product, process and service development; should continuously create new competencies, knowledge and skills; and strategic alliance being able to enhance capabilities, build innovation and respond quickly to market changes. Besides, the studies show that the organizational culture should be transformed towards more openness, and an easier application of changes within the technological sphere. Moreover, an organizational agility is also important (Tonder et al., 2021). The scientists identified a need of interdisciplinary knowledge of employees and an increased role of interdisciplinary team work which goes towards very quickly adaptation to frequent changes and opportunity recognition (Letmathe, Rössler, 2022). A necessity of multi-disciplinary approach, new skills and capability were also underlined in prior research (Culot et al., 2020).

The big data technology and networked sensors make faster and easier to analyze and collect a huge amount of data and open the possibility for customization in manufacturing processes (Nahavandi, 2019). Many studies highlighted that the flexibility is expected in a DT era which can be achieved through a better coordination all company activities focused on processes. Besides, a traditional paper-based processes are no longer accepted, because are too time-consuming and generate too high cost. Employees spend a huge number of man-hours taking their time performed many redundant, repetitive tasks (Albukhitan, 2020).

The interview participants reported that a role of the organizational learning is significant in the DT environment. Besides, they pointed out that motivation of employees, openness for change management and new interdisciplinary employees' knowledge are also necessary. Interestingly, the interviewees identified a strong need for team work. They also noticed that teams should be responsible for results and interdisciplinary. Simultaneously, the employees' independence should increase. This leads to a faster decision making and a better decision

quality. IDI showed also that a quick information flow in both direction is necessary to shorten the information flow and make decisions faster. The much better quality of making decisions based on analysing a huge amount of data was highlighted very often.

#### **4.4. Changes in Strategy**

The previous research noticed that a digital strategy without doubt enables an effective and efficient DT process (Tonder et al., 2021). The research suggests to develop procedures to promote organizational agility, because more agility of enterprises leads to the successful DT. Therefore, enterprises have to change their structure, processes and management towards more intensive agility (Tonder et al., 2021; Warner, Wager, 2019).

The respondents of the presented interviews highlighted that strategy should be strongly oriented on “quick changes”, “innovations” (most often “organizational innovations”) and “new advanced technologies”. They indicated most often Big Data Analytics, Cloud Computing, Internet of Things and mobile networking. Besides, they have observed a need of focusing on outsourcing, which helps to increase flexibility and agility of manufacturing enterprises. The IDI research also has shown that a strategy has to be implemented very quickly and constant monitoring and control of its realization is necessary.

#### **4.5. Changes in Cost Measurement**

Many scientists pointed out that a new cost model is necessary in the DT environment. Moreover, a new system of cost measurement and detailed monitoring and control of costs based on information collected and processed in real time nowadays is necessary (Zhichao et al., 2021).

The IDI respondents indicated “strong pressure to control and monitor costs and the return of investment in DT”. They have observed that a saving cost is now a main cause to implement the digital technologies in manufacturing enterprises. The experts reported a need of using “a new costing method” and/or “new cost model”. This need is especially highlighted when an enterprise offers customized products. Many interview participants expect a new costing method which can measure costs included data actualized in real-time. They pointed out that it is a real problem currently to achieve a unit product cost in real-time for different variants of products or to measure a real unit cost of customized products by using nowadays applied costing methods.

## 5. Conclusions

This study set out to find answers to questions: 1) What key outcomes of the new digital technologies are observed in manufacturing enterprises which have an influence on organization and management areas?; and 2) What changes in organization and management areas are required to create value and deliver benefits from DT?

The findings of IDI clearly indicate that DT is a huge challenge for manufacturing enterprises and can lead to many benefits if there is complex and correctly prepared for changes in all company areas. The provided interview experts revealed many effects of the digital technologies implementation which have impact on management and organization. They have established that processing and analyzing a huge amount of data in real-time mode is significant, and means multi-criteria analysis of huge amounts of data and receiving analysis results in a few seconds. This is possible thanks to tools based on Big Data technology. Besides, the participants highlighted an important role of a real-time communication (RTC). They indicated also remoting work, payment systems based on cloud computing technology, the trade finance applications based on blockchain technology, as well as an augmented reality system supporting the design and servicing of devices as the important outcomes of DT.

The most obvious finding to emerge from this study is that there is a strong need of changes within organization and management in manufacturing enterprises which can empower DT and deliver benefits. The most important of them include shortening the response and decision time, reducing costs and increasing the competitiveness of the company. This study has shown that the organizational structure should be horizontal with simple procedures, more responsibility of employees, smaller role of a hierarchy in the enterprise and a competition between departments. The findings reported that less bureaucracy, lower degree of formalization and partnership in the implementation of tasks are also expected.

The next major result was that the organizational learning in the DT environment should be oriented on an interdisciplinary knowledge of employees, a team work and an increased responsibility of teams for results. The interviewees noticed an orientation on building a systemic approach among employees, open to changes and new knowledge and skills. Besides, an importance of a quick information flow in both direction and a completely new division of remote and on-site work are observed. The strategy should be oriented on new technologies, innovations and methods and tools which help quickly to realize strategic goals. This study reported that the DT environment requires continuous monitoring and control return of investments and a huge challenge is a change of cost methods and models which can actualize data in real-time. These study results contribute to descriptive and explanatory knowledge on the influence of DT on organization and management areas in manufacturing enterprises.

The provided IDI research is not without limitations. This study focuses on Polish manufacturing enterprises, but it does not include a division into different type of industry sectors. Therefore, it was not possible to identify changes specific for each kind of sector. Although they could be included in future research, but this represents a big challenge. In addition, a second limitation is associated with the qualitative research which was conducted to identify new changes and cannot lead to the elimination of changes with marginal importance and indicate the most important ones.

The main direction of future studies is to build new management methods, tools and business models which support development of manufacturing enterprises in the digital era. They should base on information revealed in above described in-depth interviews. Besides, the quantitative research could bring interesting results and indicate which changes are the most significant.

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