



THE CONCEPT OF BUILDING A DIGITAL TRANSFORMATION MODEL FOR ENTERPRISES FROM THE SME SECTOR

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ABSTRACT. Background: The ecosystem of digital solutions and technologies that is a part of digital economy, present in most small and medium-sized enterprises, can be considered underdeveloped and outdated, which has a direct negative impact on the effectiveness of the implementation of activities at the operational level. An important element of building a competitive advantage of small and medium-sized enterprises may be the implementation of a model for their digital transformation as an element of a wider concept of digital supply chains.

Methods: The article uses the method of "case study" and questionnaire research to develop a model of digital transformation of enterprises from the SME sector. It is worth pointing out that small and medium-sized enterprises are the most numerous group of institutional participants in the modern market economy. The work uses the concept of the Digitization Index and quality tools, which include, inter alia, Ishikawa diagram and SWOT analysis. The research environment was a manufacturing company from the furniture industry, also acting as the main coordinator between all the links with which it cooperates within the supply chain

Results: The article describes the phenomena of digital transformation, which is the main driving force of the digital economy and digitization, which is an indispensable element of transforming business models in accordance with its principles. The final effect of digital transformation of supply chains, which is the creation of new business models based on the properties of digital solutions, called digital supply chains, was also characterized. As a result of the considerations, a concept for building a digital transformation model for enterprises in the SME sector was proposed.

Conclusions: The model of digital transformation of enterprises in the SME sector should include both the assessment of the current level of digitization of the enterprise as well as the proposal of its digital transformation. Increasing the degree of digitization of the enterprise surveyed as part of the case study will allow, in the long run, to achieve an increase in the effectiveness of the tasks performed, mainly in terms of reducing the time of their execution and improving the efficiency of information flow between all participants in the supply chain.

Key words: digital transformation model, digital index, SME sector.

INTRODUCTION

Digital economy is a term difficult to define clearly because of highly dynamic technological progress, observable in all economical processes. Main assumption of digital economy is the interchange of all data and information with as little human involvement as possible [Nowicka, 2019]. This allows for shortening the time of information and data interchange, and reducing its cost [Combe, 2006]. The most important

characteristics of digital technologies is their capability for dynamic (fast) reaction to sudden changes on the market and customer preferences. They also provide the opportunity of keeping interactive contact with main business partners [Wang et al, 2007]. The environment of digital solutions, a part of digital economy, as present in most of Polish small and medium businesses can be considered poorly developed and obsolete. This has direct, negative influence on the effectiveness of many operational level activities and as such - negatively impacts the overall strategic plans. In current market

reality an analysis and evaluation of current extent of digitalization, leading to improvements suggestions and their consistent implementation result in gradual digital transformation of entire supply chains into fully digital, is needed. Such analysis makes it possible to gradually digitally transform and reorganize entire supply chains into fully digital, keeping their competitiveness in relation to their main rivals.

The aim of the article is to present a concept of a digital transformation model for enterprises from the SME sector based on analyse and evaluate the extent of digitalization of a manufacturer-distributor company from the furniture sector. The enterprise's profile assumes the necessity of coordinating the entire supply chain. Conducted research showed clear gaps in current extent of digital solutions implementation. The information gathered and conclusions based on them will allow for suggesting potential improvements. The digitization index allows to assess the degree of implementation of digital solutions in entire economies, but it can also be used for individual companies, e.g. coordinators of supply chains.

THEORETICAL BACKGROUND OF A DIGITAL TRANSFORMATION AND DIGITISATION

Digital transformation, a main drive for digital economy is defined as an implementation of breakthrough changes in approach to customers and making business. Such changes rely on digital technologies and result in creation of new, innovative products, services or business models. The fundamental goal of digital transformation, just like in case of every other change of organization's operating model, is generating income and providing the growth of efficiency in the entire enterprise. Full integration of company's activities with digital technologies is the very foundation of digital transformation of business strategies. It's worth noting that mere use of digital technologies does not lead to transformation of enterprise's operating model. The key aspect is, apart from using digital technologies in operational activities, a change

of organization's culture, which should also be based on innovative values provided by digital technologies [Kersten et al., 2017, Nowicka, 2019]. Digital transformation is closely connected to those areas of organization's activities it directly influences. It includes: operational processes, current customer needs and offered range of products. Companies wanting to change their functioning via the use of digital transformation process can achieve this in two ways. The transformation may be concentrated around the entire operational model, which generates value for the customer, or just around the value itself (a product). In order to achieve the best possible results of implementation of digital technologies a company should focus on both of these aspects [Berman, 2012, Osmólski, Voronina, Koliński, 2019].

Conducting a digital transformation is an elastic process and can be applied in pretty much every single area of companies' activities. One of these areas, in which a substantial increase in activities' effectiveness can be achieved, is supply chain management. Main requirement for correct conduction of digital transformation process of the supply chain model is the support of innovative technologies with knowledge, personnel and implementing digital technologies not only in own company, but also its business partners. Digitalization is an inherent part of every digital transformation. Results of activities done within as a matter of digitalization, provided they have meaningful impact on the process realization effectiveness growth, may be qualified as the final result of digital transformation process. One needs to emphasise, that they do not have to be treated as strategic tasks. Digitalization addresses mainly the use digital technologies in selected environment, which generates an array of changes and consequences improving its efficiency. Work effectiveness growth relates to its resources and processes that are a part of given environment. Companies' need to maximize profit and increase work efficiency through development of currently used technologies and implementation of new digital solutions leads to shift in approach to supply management from traditional to digital. An important factor concerning supply chain digital transformation is constantly increasing

integrations of digital technologies and processes which are a part of organization's general business model [Nowicka, 2019]. The shift of approach to supply chain management can be defined as their digital transformation, of which main aim is easier organization, control and execution of processes currently occurring in the enterprise and its environment [Hines, 2014, Ciesielski, Konecka, 2019]. Companies which conduct the digital transformation may be in three different stages of its adaptation. First stage applies to companies digitalizing only single processes realized in supply chains. In development phase are those organizations which through technology support all those supply chain activities that involve their environment. The advanced phase is the highest level of digital transformation process development, and means the integration of all supply chain links via the use of innovative solutions. It is worth noting that companies in that final stage are the ones most effectively managing their supply networks [Wu et al, 2016, Wiczerniak, Milczarek, 2019]. It is worth noting that the digital supply chain is mainly oriented at improving the information flow process among all its participants. In digital supply chains, the user, due to the increase in the speed of data transmission using the Internet, gains the ability to react faster to unexpected disruptions that appear [Richey Jr et al, 2016, Kache et al, 2017]. The most important attributes of digital supply chains are: the interconnection of all elements of the supply chain, supporting the decision-making process by "intelligent" systems, the ability to implement supply chain processes without interruption and the ability to implement supply chain processes without interruption (continuity of operation) [Wu et al, 2016]. In order to correctly and effectively transform the supply chain into a digital one, a company should make long term implementation plan. Such actions will allow for achieving company's required result, which is generating profit thanks to implemented solutions. Main reasons of failures during the process of supply chain's digital transformation are technological barriers. It is crucial to have the necessary technical foundation which involves substantial expenses not every company can afford. Synchronizing all of company's systems is also important. This will allow for later integration

of information interchange between them [Horzela, 2019].

Literature also differentiates, apart from widely understood digital supply chain, an idea of supply chain models managed by the digital technology environments' dynamic abilities:

- Platform model - based mainly on cloud computing technology. Its main paradigm is integration of data and information interchange between all supply chain participants, coordinated by the supply chain management process' owner.
- Dispersed model - it is different form platform model in a way that makes it impossible to single out a subject acting as information interchange coordinator. It is based on blockchain technology.
- Decentralized model - combines both previous models. It allows for effective information flow between processes actors and coordinators. This type of digital supply chain model is supported by Internet of things technology [Goldfarb et al, 2015].

CONCEPT OF DIGITAL TRANSFORMATION MODEL

Model of digital transformation of enterprises from the SME sector should include both of assessment of the current level of digitization of the company as well as a proposal for its digital transformation. The following figure 1.1 presents the phases that are essential when trying to digitally transform the business model of digital transformation of enterprises from the SME sector.

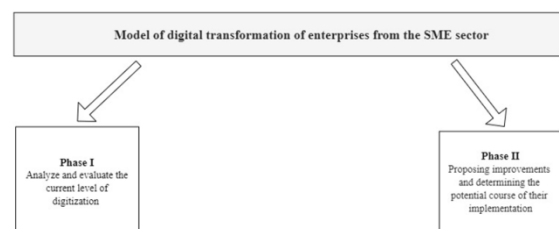


Fig. 1.1. Model of digital transformation of enterprises from the SME sector

The first phase of digital transformation of the company's operating model includes the

assessment and analysis of the current level of digitization. In order to measure the general work effectiveness when it comes to digitalization of processes and the transformation of business models through the use of innovative digital technologies a so called Digitalization Index, as shown below in table 1.1, is used. It consists of 21 sub-indexes.

It is used to measure digital demand and supply in entire economies, but may also be used to analyse the extent of effective implementation of digital solutions in companies operating independently or as a part of supply chains [McKinsey&Company, 2016].

Table 1.1. Digitalization Index

Index		Description	
Digital resources supply	Digital assets spending	Hardware spending	Share of ICT hardware (PCs, servers) expenses in relation to total expenses
		Software and IT services spending	Share of software and IT services expenses in relation to total expenses
		Telecommunications spending	Share of telecommunications expenses in relations to total expenses
	Digital assets resources	Hardware assets	Share of ICT hardware in relation to all assets
		Software	Share of software in relation to all assets
	Digital assets spending per employee	Digital technologies for employees spending	ICT hardware expenses calculated per single employee
		Software and IT services spending per employee	Software and IT services expenses calculated per single employee
		Telecommunications spending per employee	Telecommunications expenses calculated per single employee
	Digital capital growth	Hardware assets per employee	ICT hardware assets calculated per single employee
		Software assets per employee	Software assets calculated per single employee
Work digitalization	Digital workstations	Share of workstations that are digital in character (IT systems managers, web developers, system administrators, database administrators, Big Data analysts) in relation to all workstations	
Digital resources demand	Transaction	Companies selling online	Yearly volume of sales realized via computer networks (websites, EDI and other electronic data interchange methods, excluding e-mail)
		Companies buying online	Percentage of companies procuring at least 1% of their resources via computer networks
	Contacts between companies, customers and suppliers	Digital supply chain	Companies sending/receiving information regarding sales chain (stock levels, production plans, predictions, delivery status) via computer networks or websites
		Use of social media	Companies using at least two types of social media: social networks, company blogs, microblogs, knowledge sharing tools based on wiki services, multimedia publishing websites
		Companies in which IT and telecommunications technologies are a part of everyday operations	Data from statistical research (regarding entire economies)
		Companies profiting from external tools addressing customers	
		Companies using social tools to cooperate with partners	
	Companies of which at least half of activities is digital in character		
	Processes	Use of ERP systems	Companies using ERP software to interchange information between departments (i.e. accounting, production, marketing)
		Use of CRM systems	Companies using CRM systems, a software for analysing data about customers for marketing purposes

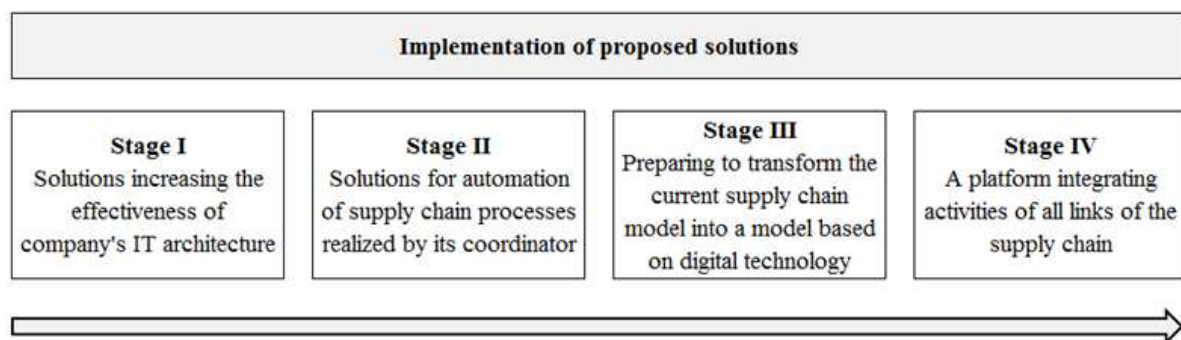
Source: McKinsey& Company, 2016

The Digitization Index is most commonly used to measure the effectiveness of digital solutions used in the whole economy. It is worth noting, that all sub-indexes of the main

digital supply index in the entire economy or a single enterprise have their own respective formulas, as shown above. It allows the final results to be presented as percentage values.

Digital resources demand indicators are applied to the number of enterprises meeting the criteria of sufficient use of digital business innovations. Calculating percentage values of these indexes for a single enterprise is therefore impossible. It is proposed, in case of the analyzed enterprise, values of indicators from this specific group were based on questionnaire interview with company's owners and key personnel.

The second phase of the digital transformation model of enterprises from the SME sector includes proposing right solutions in the area of digital economy and defining the potential course of their implementation. The course of proposed solutions implementation regarding the digital transformation of the companies model is presented in figure 1.2. It was divided into four stages in order to make it easier to integrate them into company's long term strategy, which main goal is to provide the enterprise with a competitive edge.



Source: own study

Fig. 1.2. Implementation of proposed solutions

ANALYSIS AND EVALUATION OF THE DIGITALIZATION LEVEL FROM SUPPLY CHAIN COORDINATOR'S PERSPECTIVE – CASE STUDY

Table 1.2 represents the values of each sub-index of the Digitization Index (digital resource supply), for the analyzed Polish manufacturer of school and office furniture, a coordinator and manager of its own supply chain. The values were calculated in cooperation with company's management. Showing the detailed calculations would require compromising company's sensitive data regarding its spending. With that in mind only the final results are shown.

Table 1.2. Digitization Index (digital resources supply) in analyzed enterprise - index values

Digital resources supply in analyzed enterprise	
Index	Value
Hardware spending	3,2%
Software and IT services spending	5,4%
Telecommunications spending	1,7%
Hardware assets	2,8%
Software assets	4,9%
Digital technologies for employees spending	3,3%
Software and IT services spending / employee	4,8%
Telecommunications spending / employee	1,3%
Hardware assets / employee	2,6%
Software assets / employee	3,4%
Digital related jobs share	2,8%

Source: own study

For the analyzed company the Digitization Index (digital resources supply) is 3.29%. The value was calculated as the arithmetic mean of sub-indexes' values shown in table 1.2. It is worth emphasising that the Digitization Index (digital resources supply) for the entire Polish economy throughout the years is 7%. The

company's management plans on reaching that value in the future. Achieving this goal will be made possible through implementation of digital innovations, procurement of larger amounts of hardware and software. Despite this causing a sudden spike of expenses, the company will get the opportunity to increase work effectiveness and to realize many of the processes of its supply chain. The Digitization Index value was determined through the

questionnaire interview conducted in the company. Participants of the survey were both management associates and three foremen from production departments. Their task was determining values of each of the Digitization Index's sub-indexes, according to the Likert Scale. Table 1.3 shows the results of the survey. Final results were calculated as the arithmetic mean of all marks.

Table 1.3. The Digitization Index (digital resources demand) in analyzed company - survey results

Demand for digital resources in analyzed company - the extent of digital resources' utilization in current operations								Arithmetic mean
Index	Low			Medium		High		
	1	2	3	4	5	6	7	
Online sales					2	1	2	6
Online procurement					3	2		5,4
The extent of IT and telecommunications utilization in current operations				1	3	1		5
Use of the social media			2	1	2			4
Use of the ERP and CRM systems		2	2	1				2,8
Digital supply chain	3	2						1,4

Source: own study

Summarising the Digitization Index's analysis results, both for the supply and demand of digital resources, one can determine that its value for the surveyed company, a supply chain coordinator, is very low. It means that the substantial current operations effectiveness increase can be achieved through the implementation of new digital technologies and higher utilization of company's digital resources. It needs to be pointed out that determining the Digitization Index value (in this case very low) is the main reason for the organization's management to make decisions regarding the implementation of solutions increasing work digitalization and reorganizing company's current structure according to digital transformation paradigms. In order to survey the current situation even further, the Digitization Index should be supported with quality analyses such as Ichikawa Diagram and SWOT analysis. In case of the surveyed company the Ishikawa Diagram analysis was supposed to diagnose the reasons for low Digitization Index and its sub-indexes values. SWOT analysis was conducted in order to characterize current solutions implementation in terms of their strengths and weaknesses. It also allowed to determine the opportunities and threats regarding current digitalization extent and potential expansion chances. This information is crucial when creating long term

and strategic plans of company's business model digital transformation. One needs to emphasise the fact, that in case of companies acting as supply chain main coordinators the conducted analyses (Digitization Index and quality analyses), can be conducted just for that particular company without the need to take other links partaking in increasing supply chain's value.

Conducting a detailed analysis of current extent of digital solutions implementation in the surveyed company, acting as a supply chain coordinator, allowed the author to define its state. It was deemed underdeveloped. This means that through increasing company's digital resources utilization and implementing new digital technologies, it is possible to achieve a substantial effectiveness growth of current operations.

The first of four stages (compare figure 1.2) of the company's transformation according to the paradigms of digital transformation, accompanied by the digitalization of supply chain processes, assumes increasing currently owned IT architecture's efficiency. Such action may be considered as the preparation phase for the proper implementation of technologies deemed crucial in fully digital supply chains.

Main recommendations for this stage are as follows:

- Modernizing currently owned digital assets in order to increase the data and information throughput between them.
- Achieving the speed up of the entire network through the use of cables allowing for faster clocking speed in comparison to currently used devices.
- The second stage consists of solutions regarding the automation of company's currently realized processes. The main improvements include:
 - Implementation of additional ERP modules in current activities.
 - Use of the ERP module based on CRP system. It could potentially substantially increase customer relationships management effectiveness and enable the company to gather data on customer preferences.
 - Use of the WMS and linking it to such digital technology elements as sensors and automated identification of goods stored in the warehouse (RFID). It would allow for greater control over manufacturing resources stock.
 - Modifying the machines of highest utilization in the entire manufacturing process using the CNC technology and supporting them with additional 3D printing technology.

Third phase consists of transforming the current supply chain model into a one managed through digital technology. The recommended technologies for implementation are Cloud Computing, Internet of things, Blockchain and advanced data analysis.

The final effect of correct implementation of fourth phase will be transformation of the entire supply chain into a digital one. Author suggests implementing a model based on a digital platform, integrating operations of all supply chain links, with the company in question as its coordinator. The model should be based on cloud computing technology and supported by the tools for advanced data analysis, as well as Blockchain and Internet of things technologies.

CONCLUSIONS

The purpose of the article is to introduce a concept of building a digital transformation model for enterprises from the SME sector. The proposed model was implemented in the surveyed enterprises in the furniture industry. A thorough analysis of the current degree of implementation of digital solutions in the analyzed company, which is the body coordinating activities throughout the supply chain, was carried out. Also, an analysis of a number of possible solutions to the problem of digital transformation of the entire supply chain was performed. It was found that it is possible to achieve a significant increase in the effectiveness of the implementation of current activities by raising the level of use of digital resources and the implementation of new digital technologies. A number of solutions in the field of digital transformation of the functioning of the manufacturing company and the entire supply chain were proposed.

The developed concept requires further works in the field of detailing the selection of the most effective digital tools adapted to the conditions of the company's operation within the supply chain. An important element of future research remains the identification of the premises for undertaking the research problem related to determining the differences in the selection of methods and tools for the digital transformation of an enterprise depending on its role in the supply chain in which it occurs.

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KONCEPCJA BUDOWY TRANSFORMACJI CYFROWEJ PRZEDSIĘBIORSTWA DLA PRZEDSIĘBIORSTW SEKTORA MŚP

STRESZCZENIE. Wstęp: Ekosystem rozwiązań i technologii cyfrowych wchodzący w skład gospodarki cyfrowej, obecny w większości małych bądź średnich przedsiębiorstw w większości przypadków można uznać za słabo rozwinięty i przestarzały, co wpływa w bezpośredni sposób negatywnie na stopień efektywności realizacji ich działań na poziomie operacyjnym. Istotnym elementem budowy przewagi konkurencyjnej małych i średnich przedsiębiorstw może być implementacja modelu przeprowadzenia ich transformacji cyfrowej jako elementu szerszej koncepcji cyfrowych łańcuchów dostaw.

Metody: W artykule zastosowano metodę „case study” oraz badanie ankietowe do opracowania modelu transformacji cyfrowej przedsiębiorstw z sektora MSP. W pracy wykorzystano koncepcję Indeksu Cyfryzacji oraz narzędzia jakościowe, do których zaliczono m.in. diagram Ishikawy oraz analizę SWOT. Środowiskiem badań było przedsiębiorstwo produkcyjne z branży meblowej pełniące również funkcję głównego koordynatora, pomiędzy wszystkimi ogniwami, z którymi współpracuje w ramach łańcucha dostaw.

Wyniki: W artykule opisano zjawiska cyfrowej transformacji, będącej główną siłą napędową gospodarki cyfrowej oraz cyfryzacji stanowiącej nieodzowny element przeobrażania modeli funkcjonowania przedsiębiorstw zgodnie z jej zasadami. Scharakteryzowano również końcowy efekt transformacji cyfrowej łańcuchów dostaw, którym jest tworzenie nowych modeli biznesu opartych na właściwościach rozwiązań cyfrowych nazywanych cyfrowymi łańcuchami dostaw. W efekcie rozważań zaproponowano koncepcję budowy modelu transformacji cyfrowej przedsiębiorstw w sektorze MSP.

Wnioski: Model transformacji cyfrowej przedsiębiorstw w sektorze MSP obejmować powinien zarówno ocenę obecnego poziomu cyfryzacji przedsiębiorstwa jak również propozycję jego transformacji cyfrowej. Zwiększenie stopnia cyfryzacji badanego w ramach case study przedsiębiorstwa pozwoli w dłuższej perspektywie czasu na uzyskanie wzrostu efektywności realizowanych zadań głównie pod kątem redukcji czasu ich wykonywania oraz poprawy sprawności przepływu informacji między wszystkimi uczestnikami łańcucha dostaw, zapewniając jednocześnie możliwość uzyskania przewagi konkurencyjnej na głównymi rywalami, którzy nie przeprowadzili cyfrowej transformacji funkcjonowania swojego modelu biznesu.

Słowa kluczowe: model transformacji cyfrowej przedsiębiorstwa, indeks cyfrowy, sektor MŚP

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