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The digitalization of supply chain management in Romanian companies: an introductive research

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Abstract. *This study aims to identify from supply chain professionals employed in different Romanian companies from various industries what the digitalization status of the supply chain is. Companies, with regard to their size and industry, are not fully digitalized and this is because their focus usually lays on their main activity line and less on the rest of the processes involving supply chain management. Digitalization is adopted differently and most companies face different problems in adopting and implementing new technology. Based on a semi-structured interview with in-depth questions, this paper investigates the digitalization status of selected firms' supply chain management systems. Results aim to understand the future trends in the supply chain in Romania and identify some best practices with practical relevance for managers. The interviewed managers managed to bring up the digitalization state of their companies supply chain practices, what are the main barriers they need to overcome to remain competitive and also how they manage change within the employees ranks. The study identified within different industries that supply chain practices are partially digitalized and require constant development and improvement. Based on the discussions revealed by our study, professionals and academics can further explore what the implementation of cutting edge or disruptive technology involves for supply chain management in the broad context of digital transformation.*

Keywords: digitalization, artificial intelligence, ERP (enterprise resource planification), automation, supply chain management.

Introduction

Today, most businesses have to dwell in a highly competitive and changing market because the industrial markets have become more and more globalised. To remain relevant and maintain a sustainable competitive advantage, companies must keep pace with innovative digital technologies that can be used to upgrade the business model or develop a new one. Technology grows at a rapid pace, sometimes too fast for most companies. The decision to implement specific digital systems requires solid analytical skills from management to identify the best options on the market cost/efficiency-wise and dynamic organisational culture to be able to implement the digital transformation project. In this competitive and chaotic climate, every business's goal is to satisfy the consumer with correct product quality, quantity, and pricing in the shortest possible period (Agrawal & Narain, 2018).

Supply chain management, which includes operations management, procurement, production, information technology, and logistics, effectively addresses these issues. As a result, current advances in these areas must be presented and how emerging technology might be employed in these processes to gain a competitive advantage. Digitalization is the term used to

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describe the rising use of digital technologies in society and the resulting changes in people's relationships and behavior (Gimpel & Röglinger, 2015). For businesses and supply chain processes, digitization will open up a world of possibilities. Many businesses seek to become more "digital" as they recognize the importance and value of digital technologies in their growth and operations, and management support for such projects is growing (Bughin et al. 2015). According to Rogers (2016), "digital transformation is not about technology, but about strategy," which means that senior management teams must find fresh and unexpected business model innovations that optimize customer needs and experiences. Customers nowadays demand businesses to provide better and more affordable items and faster and more flexible shipping and other high-quality services (Zimon, 2017).

Even if senior leadership teams are internally committed to assisting the digital transformation of business models, structures, and processes, incumbent organizations confront substantial obstacles (Warner & Wäger, 2019). The competing problem of balancing the exploitation of current capabilities while also establishing new digital capabilities that are consistent with the path dependencies of the past is a big challenge for incumbents (Svahn et al., 2017). Despite these difficulties, digital transformation capabilities have received limited scholarly attention and are now an important environment for studying strategic change. Understanding the value of the technical impact on resources, courses of action, and objectives, which create a plan, is required to convert the business towards digital transformation. To aspire for a strategic change, firms must first grasp what is required for the successful implementation of digital transformation. These critical factors are defined as "those few things that must go right for a manager or an organization to succeed." (Vogelsang et al., 2018).

For the scope of this research, five qualitative semi-structured interviews were done to identify the status of digital transformation of Romanian companies and what best practices are used to achieve effectiveness and efficiency with digital tools. Experts supply chain managers and users of digital technologies from a diverse range of companies were chosen as interviewees. The interviewees held various roles and contributed knowledge from various businesses to ensure a high data quality. This process leads to a broader vision of digital transformation, with the primary goal of achieving a holistic view. Practitioners and researchers are anticipated to benefit from the findings. From experienced interview partners, a rich summary of various triggers of perceived advantages was developed. Managers can use this compilation to discover actual gaps in their own digital supply chain transformation and develop actions for resources, training, and goals. Following the interpretation of the findings, a proposition was established that other researchers might find helpful as a starting point for quantitative studies. The findings are consistent, indicating that the best process models exist for supply chain management. This is particularly relevant for global service providers that operate as process experts. While market data indicates that Romania has many shared service providers, major global business process outsourcing firms strive for best practices and standards, which consultants and enterprise resource planning solutions back. In these firms, process expertise becomes a source of added value. Business consultants and solution suppliers can use process knowledge as a benchmark.

Literature review

According to a survey of the world literature on Supply Chain Management, there is a considerable gap in many studies for Small and Medium Enterprises (Dumitrascu & HHila, 2017). Because of the fragmented nature of research, there are no comprehensive and cross-sectional studies in this domain; hence the authors focus on tiny research samples. The relationship between the SMEs

sector and their performance in the investigated nations is important for supply chain management research. It has been demonstrated that a lack of effective Supply Chain Management implementation in SME (small and medium enterprises) sectors using technology and systems results in a loss of competitiveness. A focus on strategic supply chain performance can efficiently improve SMEs sector operations to achieve a competitive advantage (Androniceanu, 2017).

To safeguard incumbent advantages in established industries, digital transformation of big and old businesses has become a strategic necessity on leadership agendas (Hess et al., 2016). Digital transformation varies from conventional types of strategic change in that it has increased the rate of change, resulting in far more environmental instability, complexity, and unpredictability (Loonam et al., 2018). According to Hess et al. (2016), a digital transformation must consider how improvements in digital technologies can affect a company's business strategy, organizational structure, and procedures.

Studies of Kot (2018); Onwuegbuchunam et al. (2018) relate with this topic and note that certain SMEs see the benefits of supply chain management activities. Among them, we can find collaboration contributing to a focus on value-adding activities, more transparent strategy development, and supply chain member cooperation in improving competitiveness. Nonetheless, an SME sector segment views Supply Chain Management as a strategy for achieving customer satisfaction through considerable expenditures in information technology.

The focus is on the digital innovation perspective, which has its roots in the information systems literature, to explain why digital technology is transforming the nature of strategizing. Scholars of information systems have studied the impact of digital technology on an enterprise's strategy, innovation, and business models during the last two decades, attempting to explain their disruptive impact on organizations (Warner & Wäger, 2019).

D. M. Diaconu and C. Alpopi (2014) investigated the strengths and shortcomings of contemporary Romanian SCM (supply chain management) at many levels, including strategic direction, process and IT support management and organization, collaboration, and measures. Even though many events have occurred since the study began, the authors observed that the overall levels have improved, but stock levels have not reduced as predicted as one of the essential parts of logistic cost. Finally, it has been determined that communication between internal departments and external suppliers has improved (Kot et al., 2018). Companies that focus on SCM can get a competitive advantage by cutting costs and enhancing customer satisfaction at the same time. ERP (enterprise resource planification) software has grown in popularity in Romania, particularly among medium and large businesses. The report provides statistics on the logistics business and identifies software platforms used by Romanian SMEs.

In their paper called "Actual state of knowledge in the field of Supply Chain Management," Dumitrescu and Hila (2017) analyze the current state of scientific knowledge in the subject of Supply Chain Management, as well as the potential gaps in knowledge in this area. It also identifies possibly undiscovered research avenues. According to the authors, performance evaluation can be performed by generating Key Performance Indicators (KPI) with influence on the supply chain for the creation of specialized literature in the field of Supply Chain Management. Ghicajanu (2014) believes that the performance criteria connected to SCM in the present business climate are the value provided to customers, quality, service, and speed. One must seek solutions and business models that match these criteria at the highest levels. In this regard, SCM must always be open to new ideas, modifications in some domains, and program redesign (Shpak et al., 2017).

Established business models can become inactive and deteriorate over time due to path dependencies, which are substantial hurdles to business model transition (Cavalcante et al., 2011).

According to Laudien and Daxböck (2016), exogenous and endogenous shocks are frequently required to cause modifications in traditional product-based logic. On the other hand, most incumbents are unlikely to create new disruptive business models since they are more likely to employ digital technologies to incrementally extend, amend, or discontinue existing activities (Foss and Saebi, 2018). Research has shown that it necessitates a series of calculated and interdependent strategic decisions. Such an approach is due to the digital transformation of incumbents' business models, such complex change processes involving both the corporation's and business units' business models (Aspara et al., 2013).

Developing dynamic digital transformation capabilities is a useful tool for analysing organisational strategy transformation (Barreto, 2010). Thus, such capabilities can be used "(a) to identify and shape opportunities and threats, (b) to take opportunities, and (c) to preserve competitiveness by augmenting, combining, protecting, and, when necessary, reconfiguring the commercial enterprise's intangible and tangible assets," (Teece, 2007). Dynamic capabilities are different from operational capabilities in that they are based on innovation (Ambrosini and Bowman, 2009). According to Helfat and Winter (2011), operational capabilities are standard in the sense that they assist a firm in the present by sustaining the status quo. However, they leave the firm vulnerable to environmental change.

Dynamic management competencies and business units dedicated to scenario planning are critical for detecting unanticipated trends, although both have analytical limitations (Helfat and Peteraf, 2015). This is evident in the "big" or "smart" data context, where companies use digital infrastructures like IoT (internet of things) platforms to collect and analyze large-scale, real-time granular data in order to forecast and capitalize on human behavior (George et al., 2014). Because of advancements in computational speed, data storage, data retrieval, sensors, and algorithms, the cost of machine-learning-based predictions has dramatically decreased, implying that some businesses are turning to artificial intelligence (AI) to anticipate new trends and overcome cognitive limitations (Agrawal et al., 2017). The key AI challenges for executives, according to Agrawal et al. (2017), will be as follows: shifting employee training from a focus on prediction-related skills to judgement-related skills; assessing the rate and direction of the AI technology adoption to properly time the shifting of workforce training (not too early, not too late); and developing management processes that build the most effective teams of judgement focused humans and prying machines.

Digital transformation will substitute the automation pyramid with the digitalization network in the industrial version of the digital enterprise. This is the scenario for Industry 4.0. Vertical integration, end-to-end integration, and horizontal integration are all needed for Industry 4.0 to succeed. Vertical integration and networked manufacturing systems describe the intelligent cross-linking and digitalization inside the different aggregate and hierarchical levels of a value generation module (Kagermann et al., 2013). An integrated supply chain has four levels of maturity (PWC, 2013): level 1, reactive supply chain management; level 2, internal supply chain integration with planned buffers; level 3, collaboration across extended supply chain networks; level 4, dynamic supply chain adaptation and flexibility. Vertical integration and networked manufacturing systems describe the intelligent cross-linking and digitalization inside the different aggregate and hierarchical levels of a value generation module. End-to-end integration refers to the intelligent cross-linking and digitization of a product's lifespan, from the acquisition of raw materials to the manufacturing system, product consumption, and product disposal (Kagermann et al., 2013).

A supply chain's collaboration between the parties involved must be managed holistically. A cloud-based platform for an improved data and information exchange process amongst all

stakeholders is a basic prerequisite for greater collaboration throughout the supply chain (Gnimpieba et al., 2015). The Internet of Things (IoT) is one technique to help solve challenges related to information exchange in a beneficial way. A mix of mobile, cloud, and smart systems is a significant facilitator for establishing new SCs (supply chains) that combine physical and digital flows (Barata et al., 2018). Companies can evolve into real-time firms due to this, where the physical and information flows are interwoven (Tu et al., 2018). Supply chain responsiveness can be improved through the indicated real-time information transmission (Dweekat et al., 2017).

The COVID-19 pandemic has also affected the management of relations with the supply chain. Decreased interactions cause gaps at the informational level, which can lead to information ambiguity and a lack of clarity and precision (Gunessee and Subramanian, 2020). In addition, this has reduced supplier engagement, making it difficult for companies to develop a collaborative approach by integrating all parties involved (Remko, 2020). Opportunistic behaviors could also increase (Gupta et al., 2020), and providers who are not disrupted may charge higher prices if they see that other suppliers have been affected by disruptions (Gupta et al., 2020). Several of the impacts described in the studies are not related to a specific area of the supply chain, but rather related to the entire supply chain management area. Activities in a supply chain are interconnected, therefore disrupting one of the functions leads to a propagated wave effect encompassing other functions (Gunessee and Subramanian, 2020). This finding suggests that general operations are interrupted when a segment is not working properly (Queiroz et al., 2020). The combination of these effects on supply, supply, production, transport, logistics and relationships can cause the total collapse of supply chains (Yuen et al., 2020).

Methodology

With above background insight, our research aims to identify the digital transformation status of Romanian companies in the supply chain management segment, to understand how they stay competitive from a technology point of view and how they implement such change. The main research question was: How do Romanian supply chain managers approach digital transformation? The research objectives were formulated as follows: 01) to identify the manager's level of understanding of a digital supply chain; 02) to identify what digital solutions the companies have implemented; 03) to investigate how managers implement digitization projects; 04) to investigate how do the managers handle change at employee level when they implement a digitization project; 5) to understand what plans of digitalization are and what are emerging technologies in the segment.

With the objectives set up, the structure of the interview was split into three parts, each to match-up and integrate the managers in the thematic of study. The first part, composed of two questions, was meant to identify the manager and present his experience in digitalisation and digital transformation of the supply chain management segment. The second part had three questions aimed at understanding how the managers defined a digitalised supply chain, what are the most and least digitised aspects of a supply chain and give some examples of digitalisation projects that took place in their current company. The third and main part of the study aimed questions at the managers with the scope of understanding how digitalisation changed or improved the business model of their respective companies. In order to explore the current challenges of digital supply chain management, the interviewed persons were asked to relate regarding the major challenges they are going through. These challenges included:

- Business model improvements as an effect of digitalisation
- AI technology adoption in different processes

- Employee adaptation in new technologies and measures taken to keep them updated
- Job description structure adaption to match new implemented technologies
- Implementation of software robots & automation (RPA)
- Necessary future employee skills to remain competitive in digitised supply chain departments
- Future technology trends in supply chain, how will technology transform the processes of supply chain

In February 2022, in-depth interviews were conducted with 5 Romanian managers currently working in supply chain Romanian and multinational companies in Romania involved in digital transformation projects. The respondents were different position managers from CEO (1) to middle management (4) within the tobacco industry, fast moving consumer goods (FMCG), furniture manufacturing, clothing industry, and pharmaceutical food supplements.

From the received responses, using a deductive analysis, the responses were clustered for each question in order to compare them and formulate appropriate conclusions. Since the respondents come from different industries, the comparison interpretation is done at the topic level, as the scope of study is to understand the impact and level of digitalisation of the supply chain in Romanian companies.rdering, and connected processes but was lacking digitalization in the logistics and warehousing areas.

One aspect of interest was how much of an impact digital transformation has on the

Results and discussion

Understanding first the experience of the interviewed managers, the study firstly points out that supply chain management responsibilities vary to different positions in the companies and are not standardized. The managers have solid experience in supply chain operations and considerable involvement in digitalization projects ranging from replenishment activities automation to production systems digitalization, ERP implementation, and various platform developments for suppliers and distributors integrations. When asked what their definition of a digitalized supply chain was, they all answered that data acquisition and process automation are based on accurate information. Having precise data acquisition helps in the decision-making process by previewing effective reports of a clear situation both in-house and supplier's activities. All interviewees clearly stated that having this type of data can lead to developing artificial intelligence systems for the scope of forecasting material needs and sales. Also, an essential part of a digital supply chain would be automating labor work by introducing robots in warehousing and production processes (RM, top-management, RB, middle-management).

The status of digitalization in companies varies as the managers confront different situations in terms of modern and effective systems. One straight line answer was that all companies utilize an ERP for administrative processes and other management systems for suppliers' integration or material management that communicate with the ERP. The lack of digitalization varied from one business model to another. Production and MRP (material resource planning) were highly digitalized in the FMCG company compared to sales forecasting and suppliers ordering/confirmation integration. In the case of the two production companies, they contrasted because one had an excellent digitalization grade in the materials management, billing, and exports but lacked forecasting and price adjusting concerning production prediction.

In contrast, the other company had a digitalized production and retail but lacked materials, supplier integration, and acquisitions. The tobacco company has recently implemented a digital platform where supplier management was done by fixed criteria, leaving no more room for subjective choices. However, the acquisition of the non-essential goods was the least digitalized,

as the company had little interest in developing. Lastly, the company from the supplements sector was significantly developed in the client interaction, business model in terms of processes, culture, employees, and other specific aspects. All the managers stated that precise data reports generated by their ERPs improved production and delivery processes and saved different costs. It is very important in the decision-making process to have an accurate picture of the activities and developments in the company. "The process is transformational, the business model is redefined because you upgrade old automation that got passed on from manager to manager and the knowledge gets diluted in this way" (A.D., upper-management).

Artificial intelligence is still an emerging technology for most SMEs. While it gives considerable competitive advantages, three of the analyzed companies did not have any such system. However, the furniture company production manager explained that they have such a system that uses historical data to analyze sales and other company activities that the IT department uses to make sales predictions and stocks. Also, the international tobacco company has an AI track & tracing algorithm that generates diverse reports and intervenes in special situations where quick action is required in the logistics segment.

In terms of software automation, especially robotic process automation (or RPA), meaning software robots that can execute significant data transfer and repetitive processes, no company had such a technology implemented except for the FMCG one. "There are many areas where RPA is used, and once results become visible, most managers express their intention to implement this technology in their departments." (AD, upper management).

Asked if there are any software or platforms implemented for the entire supply chain in the way of a fully integrated supply chain at every vertical level, all interviewed managers responded that there is no such system in place. The reason for this is that they work with a large variety of suppliers, and they have separate practices and systems. "There are a lot of specific suppliers, and they each have a different complex system, so the solution was just to develop separate integrations with each of them" (AD, upper management). "We had only one situation when all suppliers had to implement the labelling software, so they could design them directly in it, where we could have access ."(CS, top management).

A critical issue in digital transformation is the human resource training and adaptation to use digital solutions. Furthermore, of importance is the fact that older employees had even less contact and affinity for using advanced digital products. The transition from fully analog to full digital and generational differences occur. The managers confirmed that this was indeed a problem, and they had to figure out various solutions to overcome these effects. They also never fired anyone when implementing new technology but rather changed attributes and responsibilities for the individuals. "The young employees adapt much quicker to new technologies, but there are not any big differences in utilization. The older ones are indeed reluctant to change, but we organize group and individual training to help them gain new skills. I have also developed new procedures for those employees to better understand the informatics systems (CS, top management)." “Generally speaking, employees under 40-45 years old have an advantage for being more open to digitalization. We help them to learn quickly and adapt to the new solutions by giving them roles and tasks in the implementation process (RM, upper-management)." When asked what they considered to be the most important qualities an employee should have in these times to be performant, they all had a common answer: to be open to change and be a flexible mindset. "Critical thinking is the main quality to learn new processes and technologies and adapt to any new system into the company (RB, upper-management) ." They must be open-minded and know how to use a

computer, apart from this, they need to be responsible and pay attention to details to understand what is happening (MM, upper-management)".

When asked about their opinion on which technology will be important for supply chain management in the following 5-10 years, the answers varied in every case. "SaaS solutions that can be easy to implement and have good pricing, with blockchain and data-mining and AI capabilities (AD, upper management)." "Everybody will be working on a fast-to-market/just-in-time framework with low lead time, and for this stocks and sales forecasting must be very well done (CS, top management)." "In the furniture industry, tracking the raw material (wood) for quality and origin guarantee will have to be done with a specific technology (MM, upper-management) ."In Romania, the companies do not spend too much on supply chain management. However, the more mature the companies will become, these costs will start to rise, and process automation, especially in the warehouse department, will play an important role (RM, upper-management)."

A future vision of the supply chain management department indicates that there are still many processes to become automated. The managers agree that data accuracy is key to fully automated, and the production-to-customer experience will become even more integrated end-to-end. "Basically, the client will overlap augmented reality content over the area where he wants a new piece of furniture, select the colours and materials and finish the order. The factory will stock up, produce, and in a few days deliver the product to the client's door (MM, upper-management)". In the end, "the interaction and documents flow with the clients should be 100% automated; AI systems should receive data and create statistical models to make the business more performant. After all this, the warehouse will be filled with autonomous robots and devices (RM, upper-management)."

Conclusions

The status of the supply chain management departments for the interviewed Romanian managers presents both a series of representative similarities and differences regarding digitalization. The efforts to keep up with technological advancements and business efficiency are ongoing. Digital transformation impacted their companies and business models in many ways, from product selection to employee training. They are aware of the improvements such information-based systems bring to the table and, at the same time, challenge management to invest and get involved in such projects. With production and other processes becoming more automated due to digital technology, much valuable data is being generated that managers can use in the decision-making process and curate to develop artificial intelligence algorithms. Even if it may still be too expensive or too complex to develop an internal AI system for different uses, all managers agreed that with such technology in place, accurately forecasting production and sales could become a reality and allow the companies for quick, just-in-time production and fast to market. Regarding any new technology implementation, one manager warned out about researching the supplier of the solution. It is vital to avoid "hit & run" suppliers who can create more trouble than their solution can solve and figure out sturdy and honest suppliers who spend time explaining all the implementation parts and help out with support, maintenance, and training.

From what the managers presented, most companies have developed an ecosystem of digital tools used in different processes. These systems allow for better management of the processes, materials and paperwork, and communication. These systems create an essential value for the companies and the suppliers who have integrated their systems. This means that communication of orders, requests, and needs now comes straight from the data registered in the management systems.

Adopting this type of technology challenges the manager's ability to implement and train the employees to new practices. It required them to modify job descriptions, create training plans and find different solutions to even out the generational differences of the employees. Some of them developed new strategies to help with change reluctance, like involving the employees in the implementation process or creating new practices, especially for older workers.

Nevertheless, to remain proficient in a digital supply chain, all the managers agreed it is vital to have a flexible and agile mindset and stay open-minded to new technology.

As the managers expressed, the future of supply chain management has integrated end-to-end flows. This can be done with accurate data mining, heavy automation, and AI algorithms that forecast sales and materials needs. In the interviewed Romanian companies, there is still much room to improve any of the above-presented aspects, depending on the competitiveness level of the market players. Complex systems can solve many problems and still cause new ones. A company should first identify its maturity level for absorbing such technology, which most of the time is quite expensive to implement.

This study's limitation comes from the fact that a lot of contacted managers have rejected the interview fearing that it would show up negative aspects of their business. Another limitative aspect is the fact that different industries have niched systems that cannot be compared in a direct manner thus requesting for specific research for each industry. There is much room to research how a company should evaluate integrating a new platform or system. Such companies must also understand that the benefits technology brings come with new responsibilities to the employees and business model. There is a need for an implementation framework to avoid unnecessary costs and failed projects to make the most of technology. Future research could imply even a more detailed picture of how technology is implemented in traditional companies as well as in multinational companies regarding cultural aspects for adopting digital change. Also with the constant development of technology, this study can be expanded to include the new advancements and what effect they produce. Another future extension of this study could follow-up on the adoption of technology that the interviewed companies have not implemented yet and will most likely adopt soon. The information update would further make for understanding if new practices were adopted for digital transformation and how the managers handled the change strategies.

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