

BUSINESS IN THE ENVIRONMENT OF FAST CHANGING TECHNOLOGIES: DIGITALISATION OF SUPPLY CHAIN MANAGEMENT IN THE CZECH REPUBLIC

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Purpose/Motivation: *The research assessed the state of supply chain management of companies in the Czech Republic.*

Problem: *To identify the current state, and to analyse how digitalisation is transforming supply chain management in the Czech Republic.*

Methods: *A quantitative methodological process was adopted to analyse data gathered through an online questionnaire, and simple statistical analysis was used to assess the proposed hypothesis.*

Results: *The results showed that the current supply chain operations are relatively sophisticated based on current production IT. However, the level of digitalisation is still quite low.*

Conclusions: *Based on the results and considering the limitations faced when conducting the research, further research effort is recommended to ensure a much deeper level of assessment of the depth of digitalisation within the supply chain industry in the Czech Republic.*

Key words: *digitalisation, digital transformation, supply chain, digital supply chain, qualitative research*

1. INTRODUCTION

Digital Transformation is often interchangeable with the term ‘digitalisation’ - the use of digital technologies to change a business model and provide new revenue and value-producing opportunities. Čermák and Svoboda (2017, p. 27) comments that “digitisation is a boon to some sectors and a curse to other.” For supply chain, digitisation is proving to be more of a boon than a curse. This can be seen in how digitisation may lead to a reduction in demand for a particular product, a reduction or complete removal of barriers to entry, or lead to new production techniques. For a company or organisation to achieve a successful digital transformation, it is a prerequisite for every partner along its value chain to also be able to successfully achieve a level of digital transformation that will significantly reinvent all the processes and information flows between them.

This paper aims to investigate how digitalisation is transforming supply chain management in the Czech Republic. The research will attempt to answer the primary research question: What is the current state of digital transformation of supply chain management in the Czech Republic? How is digitalisation impacting on supply chain management efficiency in the Czech Republic?

This research contributes to the existing body of knowledge on digital business transformation in the Czech Republic specifically as an outlet for all research focused on digitisation of the

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supply chain, this will be done by reviewing current trends and benchmarking them against best practices of process analysis and modelling in supply chain management that utilise digital technologies in other jurisdictions that are well ahead in their quest for achieving industry 4.0 implementation in their manufacturing processes.,

2. LITERATURE REVIEW

Mussomeli, Gish, & Laaper (2016, p. 2) argues that the traditional supply chain is linear in nature, functions along a discreet progression of design, plan, source, make, and deliver. They further argued that “historically, supply chain professionals managed the ‘four Vs’, which are volatility, volume, velocity, and visibility.” This was necessitated by the desire to optimise results across a series of objectives that covered issues such as total cost, service, quality, and support for innovation (Mussomeli et al., 2016). Lummus and Vokurka (1991, p. 11) view the supply chain management from a more practical perspective, they comment that supply chain management covers “all the activities involved in delivering a product from raw material through to the customer including sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, delivery to the customer, and the information systems necessary to monitor all of these activities.”

Mentzer et al. (2001, p. 4) makes a distinction between the supply chain management as a phenomena that exist in business and the management of the supply chain. They argue that supply chain is simply something that exists (distribution channels), while supply chain management requires deliberate management efforts by the organisations within the supply chain. These views are consistent with that held by other authors who are also in agreement about the deliberateness of planning required in efficient supply chain management(Chandra & Kumar, 2000; Janvier-James, 2011; Manuj & Mentzer, 2008; Vrijhoef & Koskela, 2000).

For the impact of digital technologies on supply chain management, Mussomeli et al. (2016, p. 2) argues that supply chains “are being transformed from a staid sequence to a dynamic interconnected system that can more readily incorporate ecosystem partners and evolve to a more optimal state over time.” This is made possible by the phenomenon of digitalisation which is a consequence of the technological evolution that has given rise to Industry 4.0 or the fourth industrial revolution. Lin and Jones (2008, p. 590) argue that “the main process of a digital

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supply chain includes three major components: (1) true on-demand product availability, (2) ease of use and speed for content search and activation, and (3) pricing”. While Pflaum, Bodendorf, Prockl, and Chen (2017, p. 4179) state that smart products in combination with innovative data-driven supply chain services pave the way for a paradigm shift in supply chain management, leading to more self-organizing and self-optimizing systems. This paradigm shift results in Cyber-Physical Systems (CPS), optimization of a supply chain using direct digital manufacturing (DDM) amongst others.

3. METHODOLOGY

The research adopts a quantitative methodological approach. It involved the use of a questionnaire to obtain data. The data was obtained from research conducted over a period of 2016 to 2017 and 100 industrial companies in the Czech Republic were covered by the survey. This is in line with the stated aim of assessing the current state of supply chain management practices in the Czech Republic, the core area of proposed methodology lies in the ability to identify most important trends in the emerging digitized supply chain adopted and implemented in industrial companies. The following scientific hypotheses were identified for verification of the latest trends in the area of digital supply chain:

- H0: Industrial companies are able to identify emerging trends in the area of full digitization and automation of supply chains that fit their own production process planning, scheduling and management requirements.
- H1: Existing digital supply chain strategies are built on the assumption of stability, lean operations and inventory, customer flexibility.
- H2: Digital supply chain process has potential for flexible production layout, low cost tools implementation and process improvements.
- H3: New technologies, such as social, mobile, analytics and cloud can disrupt traditional supply chain operations.
- H4: Industrial Companies seek for the following attributes in productive digital supply chain network for adoption between production workplaces – suppliers – customers.

4. CURRENT STATE OF SUPPLY CHAIN MANAGEMENT IN THE CZECH REPUBLIC

In relations to the stated hypotheses H0 – H4, the following results were obtained from analysis of data from previous studies:

Performance ability of digital supply chain (86% companies), parametrical configuration of digital supply chain process to business needs (83%), reducing supply chain complexity (67%), reduction of supply chain costs in combination with production layout costs to improve total profitability of production process (64%), inventory optimisation (34%). Partial contributions of selected industries were following: automotive industry 47 companies, electronics and machine industry 35 companies, mechanical industry 18 companies.

For H1, Testing and verification process by H1: 72% of automotive companies declared strong orientation on the existence and practical utilisation of digital supply chain operating model, this is able to build standardised digital architecture in cloud environment. While 34% of companies acknowledged that leveraging the potentials of digital supply chain improves the possibilities in achieving flexible production layouts through digitized supply chain processes.

For H2, Testing and verification process by H2: effective supply chain processes required knowledge of input and output process parameters in changing production environment, adequate identification of vision and operative strategy is crucial for value added through effective supply chain processes and service operations (92% companies). Also, digital supply chain contributes to optimal performance improvement by production layout and cell workplaces internal production layouts.

For H3, Testing and verification process by H3: 76% of respondents answered that they transportation management systems (TMS) in combination with digital supply chain management (DSCM) on a daily basis. However, only 25% from the 76% is able to connect the logistics processes through their customers and suppliers via the global trading networks and global process hubs to achieve cloud integrated process chains that can radical multiply the effects of Industry 4.0 principles in the area of digital supply chain management. Digital connectivity and available technological capabilities can help to reduce the conflicts in triangle “customer requirement – production workplace capacity availability – supply chain information and action”.

For H4, Testing and verification process by H4: 75% of companies implement the sensor based location of supply directly by workplace “just in sequence”, 21% of companies reported stability in digital supply chain as a result of no-latency responses on changing conditions and unforeseen situations. 56% stated their interest to implement the intelligent stocks optimisation method through the data-driven analytics and proactive actions. Only 12% of companies connect the digital supply chain with holistic decision making, based on performance optimisation by companies’ production and supporting processes. About 89% of companies reported that they prefer the connected community (suppliers-producers-customers) combined with the supply chain agility in real time.

Based on primary result of testing and verification of proposed hypothesis H0 – H4, it may be stated that implementation of digital supply chain by industrial companies should concentrate their implementation drives on digital technologies that leverage artificial intelligence connected with analytical and scenario analysis to be able to share required information between digital processes and digital managers. It is also important to take into consideration the need for knowledge of the physical parameters of processes, and the knowledge of possibilities of digital algorithms and decisions based on effective data collection, transformation and management.

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- *Performance and efficiency improvement in administration and production processes with using of selected methods and techniques of industrial engineering.*
- *Process operation management methodology based on performance indicator systems*
- *Optimization of business processes using intercompany controlling mechanisms*
- *Using value flow mapping to model controlling processes in industrial production*
- *Optimization of business processes model using the lean administration principles*

The Czech Republic that performs creditably well in terms of automation and adoption of digital technologies for enhanced productivity and process optimisation within its supply chain, is the automotive manufacturing industry. The sector contributes about one fourth of all industrial production in the Czech Republic. It also accounts for the same share of total exports from the Czech Republic. The Czech Republic is home to three global manufacturers – Škoda, Toyota-PSA and Hyundai, and many other original equipment manufacturers (OEMs) who make up the automotive industry value chain. There is a high level of sophistication within the industry. This places the Czech Republic among the ranks of leading automobile manufacturers globally; this in turn translates to a high degree of efficiency within all segments of the automotive value chain especially the supply chain which is significantly digitalised.

Table 1: 5 year comparison of supply chain industry performance in Czechia. Source: FM Global Resilience Index Report

	2013	2014	2015	2016	2017
Supply chain resilience	32	37	32	32	34
Supply chain score	66.2	64.3	64.8	65.6	67.3

The study conducted by Kopp and Basl (2017) show that as at 2017, only 11.17% of Czech companies covered in their survey of 197 respondents in companies covered had applied Industry 4.0 principles within the framework of their operations. The research concludes that while some companies in the Czech Republic are already transitioning the operations to be in line with Industry 4.0 trends, the overall representation of Industry 4.0 transition within the Czech Republic still remains low. They suggest that this could be attributed to the cost requirements for such investments. The research findings cuts across all segments of production related industrial activities in the Czech Republic and did not limit its assessment to supply chain operations.

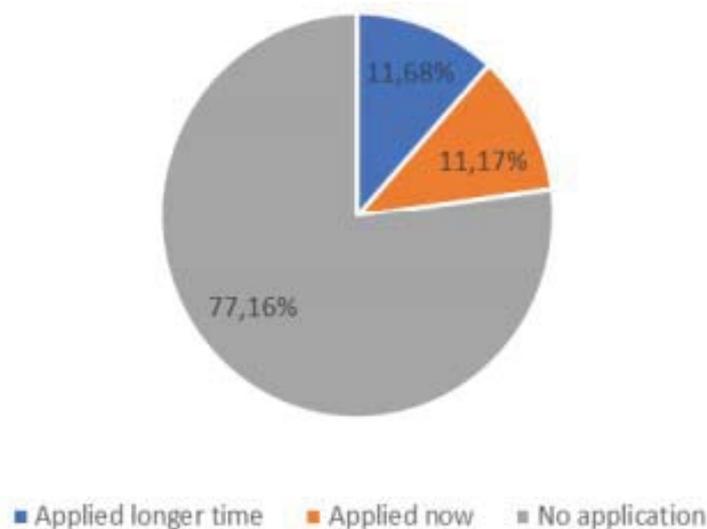


Figure 1 Application of Industry 4.0 Principles by Companies (Source: Kopp and Basl, (2017))

5. DISCUSSION AND CONCLUSION

The state of supply chain management efficiency is well advanced as evidenced by the ranking over a 5-year period. While it is commendable the level of sophistication of supply chain operations in the Czech Republic when benchmarked against other countries, there is a hint of

some level of stagnation in developments within the sector as evidenced from the fact that there is relatively low levels of fluctuations in terms of ranking score. It is pertinent to restate that only the factor that relates to attributes of the supply chain itself is being considered in this assessment, and it comprises of the following four drivers: control of corruption, quality of infrastructure, local supplier quality and supply chain visibility.

However, the data does not reveal the impact of digital technology adoption within the industry. Also, digital technology adoption is viewed from the perspective of digitalisation - which is about how digital technologies are applied in changing business models so as to provide new revenue and value-producing opportunities for the company and not from the normative concept of technology adoption which can be analysed in terms of perceived ease of use and usefulness of such technologies to the individual or organisation. One of the respondents interviewed stated that while their supply chain operations was significantly sophisticated in terms of automation, there was no deliberate effort in terms of reinventing it towards achieving a digital supply chain.

Hence, it becomes expedient for more research to be conducted into supply chain operations in companies operating in the Czech Republic with the sole aim of understanding the trends towards digitalisation and evolution of the digital supply chain.

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