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Supply Chain Management Improvement in Kazakhstan E-Commerce

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Abstract— **Electronic commerce is widely considered as a part of electronic business and the result of digital transformation. This paper aims to evaluate the capabilities and development of digital technologies in supply chain management. The evaluation process is conducted on the example of Kazakhstan by comparing the country with logistics and digital adaptation leaders. The paper analyses the effectiveness of information, communication, and logistics technologies development in supply chain management (SCM). The analysis involves systematizing secondary information. This research uses statistics from open sources as a foundation for descriptive comparative analysis to achieve research goals. The indicators such as logistics performance and the spread of information and communication technologies are selected for the evaluation. The paper outlines that an effective supply chain is essential to country's development and integration into the world economy within the context of globalization and digital transformation.**

Keywords— *supply chain, supply chain management, electronic data, logistics, communication technologies, e-commerce, Kazakhstan*

1. Introduction

Digitalization trends in the modern economy, along with the Industry 4.0 principles implementation, continue to be the main tendencies in supply chain management (SCM). Nowadays, the amount of data provided through digitalization offers numerous advantages for the supply chain. However, problems still exist. Meanwhile, the possibility to obtain essential information for organizations is provided through knowledge management methods and the use of an ever-growing data volume. The ICTs development enabled enterprises in SCM to share information thoroughly. An electronic supply chain implementation in international trade is believed to improve transaction efficiency and relationships between sellers and buyers [1], [2].

The economy and society are increasingly digitizing. The high economic impact of new information and communication technologies is evident so far. The Internet of Things (IoT) has become a new paradigm where everyday objects may have identification, discovery, networking, and data processing facilities for goal achievement. Economic digitalization is considered to be a key element in innovation, economic growth, and social change. It underlines the necessity of technology application to better achieve aims mentioned above. Under the current conditions, the use of information technologies provides new opportunities for business development and access to world markets.

E-business can be arbitrarily defined as a process that uses the Internet or other electronic media as a channel for conducting business operations [3]. According to [4-12], e-business consists of three areas:
1) consumer-oriented activity;
2) business-oriented activity;
3) e-business technology infrastructure.

Within this broad definition of e-business, the attention is drawn to decision-making technologies that are employed for the SCM.

The global industrial landscape has changed deeply in the last few years due to successive technological undertakings and innovations in manufacturing processes. Various studies also paid particular attention to this topic. The new industrial paradigm brings together digital and physical worlds through the Cyber-Physical Systems enhanced by the IoT. Furthermore, this paradigm is expected to improve production processes and increase productivity while affecting the whole product lifecycle.

2. Literature review

Many attempts have been made to discuss the e-commerce influence on supply chain management [1], [4], [7]. A supply chain is the set of entities involved in the design of new products and services, procuring raw materials, transforming them into finished products, and delivering them to the end customer. This definition, or a modified version of it, has been used by several researchers [2], [9], [12]. Supply chain management is the efficient management of the end-to-end process, which starts with the design of the product or service and ends with the time when it has been sold, consumed, and finally, discarded by the consumer. The advent of e-business will lead to a multitude of challenges and opportunities within the supply chains. A Digital Supply Chain (DSC) is a smart, value-driven, efficient process. It is aimed to generate new forms of revenue and business value for organizations and to leverage new approaches with novel technological and analytical methods [13]. DSC researchers do not discuss whether goods and services are digital or physical. DSC is about the way in which supply chain processes are managed with a wide variety of innovative technologies, e.g. blockchain, cloud computing, big data amount, and the Internet of things [5], [8], [13].

In [1] believe that as more companies are becoming switched on to the benefits of e-commerce, as more it is becoming a prerequisite for all businesses. The analysis revealed that the main benefit of electronic commerce is faster transactions. This determines the conditions for improving cooperation and reducing administrative costs. In [3] mention that digitalization of supply chains connects business, information, engineering, and analytics. The authors deal with the risks associated with digital transformation, the transition to cyber-physical systems, and other modern technologies.

Many studies examine the relevance of the use of information and communication technologies (ICT). The knowledge exchange and electronic markets involved in digital transformation of SCM have also been widely investigated [6], [14], [15]. E-infrastructure in the services sector reduces every kind of expenditures and improves the buyer-supplier relationship. Digital technology has revolutionized almost every business. In [7] mention that businesses cannot unlock the full potential of digital without re-inventing their supply chains. In [16] discuss potential SCM challenges, trends, and strategic goals, as well as the application of a set of pre-defined innovative use cases in their current and future SCM practices. In [17] outline that the business process integration is based on standards and reference architectures, which should offer end-to-end integration of

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product data. In [12] focus on the supply chain management issues, supplier relationships, related to the Internet, and new problems emerging in e-business. Researchers outline that the rapid growth and adoption of the Internet have strongly influenced the use of supply chains. First, it has facilitated the use of enterprise resource planning (ERP), advanced planning and optimization solutions (APS). Second, the ability to obtain real-time information and access to large computer systems is enabling firms to develop detailed supply chain models that can be utilized to make decisions immediately. Last, the Internet has created opportunities to integrate information and decision making across different functional units. Thereby it has created a need for supply chain models that go beyond a business unit to study an extended enterprise.

The Internet has increased the opportunity for consumers to buy products and services without going to a store [12]. Though the practice of direct selling through catalogs and phone was used earlier by a few firms, the Internet has made this form of sales more significant. At the same time, the Internet has opened up opportunities for firms to share information and efficiently coordinate their activities with other entities in the supply chain. This created several new directions in traditional supply chain areas [12]. The fundamental limitations and DSC prospects are also reviewed by [13]. In [1] offer a model that will encourage entities to adopt e-commerce in the supply chain. Chen and Kong [2] provide an example of an effective electronic supply chain based on an innovative transaction process with electronic support. Moreover, the authors describe the process of its implementation into an international trade process.

In this day and age, development and sustainability are often combined in the analysis of regional and local processes. If so, the definition of both competitiveness and sustainability of development require adequate interpretation and quantitative assessment. The main objective of the research provided by [16] is to analyze the methodological and practical aspects of the sustainable development strategy of the Kazakhstan regions' competitiveness. Among the crucial indicators of territorial marketing, tackled [16], supply chain management draws a particular interest. Many researchers [17], [18], [19] have carried out a study on the supply chain and development in various sectors of the Kazakhstan economy.

The analysis carried shows the necessity to study the issues of assessing the maturity of supply chain management in the field of digital transformation. Its results determine the potential value for economic practice, as well as for the scientific community, maturity assessment models.

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2.2   Problem statement

Nowadays, effective digital economy infrastructure is the major requirement to improve international competitiveness. Lately, many studies were published on supply chain management, digital transformation, e-business and the prospects of information and communication technologies. From a national perspective, investment in the digital economy can support sustainable development and increase the speed of regional convergence. In this regard, comparative studies on the national and regional development of the digital economy should be regarded as an urgent scientific task.

The present paper aims to assess the capabilities and development of digital technologies within the Kazakhstan supply chain management compared to industry leaders.

Today, the usage of supply chain potential provides new opportunities for access to world markets as well as for electronic commerce development. This paper conducts a descriptive analysis of the digital transformation, LPI and TIDL. Thus, it characterizes the competitive status and means of improving SCM in the modern world.

3.   Methods and materials

This study uses statistics for descriptive analysis [20-25], as well as research results and world ratings from the public domain for 2012-2019. To carry out statistical analysis the capabilities of the Microsoft Excel spreadsheet processor are used. Data processing is conducted in several steps. At first, an initial analysis of the available statistical information is performed and a qualitative selection of indicators with the logical-heuristic approach is made. Secondly, data from different sources are aggregated and evaluated for consistency. Thirdly, an integral estimate, conclusions, and recommendations are formulated by measuring the selected indicators.

The Logistics Performance Index (LPI) is used to evaluate efficiency across the entire supply chain of logistics services [23]. Considering that logistics have many directions, measuring and summarizing indicators is a challenge for different countries. Often, a consolidated performance indicator of the logistics sector is used. It combines data on the main components of efficiency into a single value [23].

During the information age, the country's competitiveness is determined by long-term factors: the application of innovation and global integration. The Index of Digital Life (TIDL) [24] reflects a consistent capacity of countries to encompass a digital life through these three main categories:

1) digital transparency, meaning how far the country digital infrastructure provides open access to information;

2) digital trust; which means how easily and confidently people and organizations interact with the country digital infrastructure;

3) digital entrepreneurship, referring to how easily citizens and organizations use digital infrastructure for entrepreneurship and innovation.

In line with this, the index not only allows assessing the digitalization level of the country but also evaluates the use of digital technologies and business innovations. The latter characterizes the potential and readiness for the economy post-industrial transformation.

The Global Competitiveness Index (GCI) 4.0 assesses those factors that determine productivity and long-term growth in the era of the fourth industrial revolution [25]. The GCI index analyzes competitiveness on 12 distinct pillars: public and private institutions, infrastructure, the macroeconomic environment, health, education, goods market efficiency, labor market efficiency, financial market development, technological readiness, market size, business sophistication, and innovation. The adoption of ICT is of most interest from the perspective of evaluating digital transformation processes. Since general-purpose technologies are being introduced into the structure of the economy more frequently these days, ICTs are becoming as necessary as the energy and transport infrastructure to all countries.

Thus, to assess the potential and effectivity level of supply chain management in the digital transformation era, it is offered to compare the country's logistics performance and development in ICT. Together these actions will determine the state's potential for improvement.

4.   Results

Together these actions will determine the state's potential for improvement. According to LPI methodology [23], all represented countries are divided into three groups. The average number of countries in each group should be balanced and their scores need to fall within a reasonable range. The LPI index allows for comparisons across 160 countries with a range of scores from 1.95 to 4.20 [23]. Countries that scored high (3.0 or higher) and fell to either of first 55 places in the ranking can be categorized into the first group. According to statistics, Germany occupies the first place, and Saudi Arabia concludes the list of 55 countries. The second group of countries consists of countries that ranked 56th to 114th [23].

Brazil tops the list with an overall score of 3.01, while

Nepal closes it with an LPI of 2.51. The third group includes all countries with the LPI index lower than 2.50. The first country in this group is Congo, which ranked 115th with a score of 2.49, and the last place is occupied by Afghanistan with the LPI index of 1.95. It is worth noticing that Kazakhstan found its place in the second group of countries, occupying 71st position and having an overall score of 2.81. Figure 1 shows balancing of LPI value range for each group.
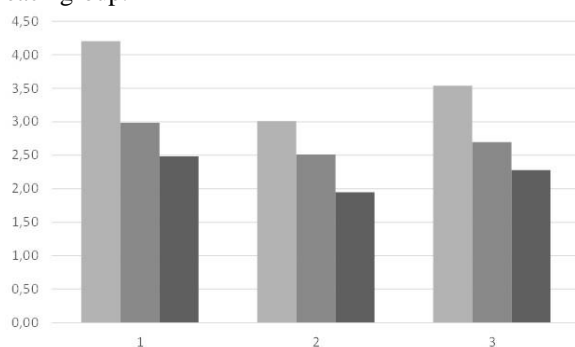

Figure 1. LPI values for three groups, reproduced from World Bank Open Data [23]

According to Figure 1, the second group is the most balanced. Kazakhstan holds a position above average. Consequently, an effective supply chain is crucial to the country's development. Therefore, problems of integration, infrastructure development, and information management need to be solved.

The second essential analysis component is the ICT development level of the country. It is a prerequisite for digital transformation and e-business growth in all economic sectors. To assess the country's position in terms of information technology development, the data from The Global Entrepreneurship and Development Institute (GEDI) were examined [24]. The Telefonica Index on Digital Life (TIDL) captures the systemic capacity of countries [24]. In overall, the TIDL characterizes digital transformation processes within 34 countries. Data analysis revealed remarkable results. It has shown that there is a substantial difference between countries in the ranking. The USA leads the TIDL ranking with a score that is two times higher than that of the bottom country (Nicaragua). Moreover, there is a link between country's TIDL value and its per capita GDP [24]. Among countries in the ranking [24], the USA holds the top spot with 96.3 points out of 100, followed by Germany (81.0 points), Israel (78.5 points), and France (78.3 points). Russia, in turn, also holds good positions (66.9 points). South Africa ranked 19th, having a score of 62.1. The bottom place is taken by Nicaragua (47.6 points). Classification into groups

was performed as follows.

The first leader group consists of countries with a digitalization index higher than 70.0. The USA leads this group and the bottom place is occupied by Spain having a score of 70.1. The second group is composed of countries with TIDL from 60 to 70: Saudi Arabia (69.4 points), Russia (66.9 points), South Africa (62.1 points). The third group includes all countries with the digitalization index below 60. Among them are Turkey (59.5 points), Poland (58.3 points), and Egypt (50.5 points). Figure 2 shows balancing of LPI value range for each group.
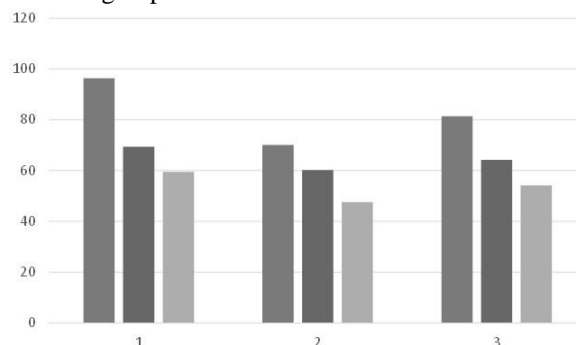
Figure 2. TIDL values for three groups, adapted from the GEDI Institute data [24]

The diagram analysis reveals that the gap between the maximum and minimum values varies between groups. A significant limitation of this ranking and subsequent classification is the small number of countries for which data are available. Kazakhstan was not included in the GEDI ranking [24]. Thus, it can be assumed that countries outside the ranking can be classified into a group based upon the GCI competitiveness data [25]. The GCI ranks 140 countries, which provides unique information on the economic growth factors. These data allow a thorough analysis of different circumstances that determine economic competitiveness of the country. Moreover, GCI evaluates the role of ICT and digitalization level in the context of global competitiveness. All index and sub-index values are presented on a scale from 0 to 100. Hence, a country's level can be conditionally defined as follows: the first group embraces countries with a score of 75 and higher, the second group consists of countries that ranked 45.01 to 75, and the third group (poorly digitalized countries) includes countries that ranked 0 to 45. Korea, with a score of 91.3, leads in terms of ICT distribution. According to GCI data [25], Kazakhstan's ranked 64.9 on ICT adoption. Consequently, according to the provided classification, Kazakhstan corresponds to the second group and holds a 44th position in the ranking [25]. Jamaica received a score of 44.4 on ICT adoption, ranked 91st and thus leads the third group of countries. The last place is held by Chad with a score of 12.8.

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Thus, a diagram can be built to compare Kazakhstan with advanced countries in terms of logistics performance and the use of ICT. Figure 3 demonstrates LPI values and ICT development levels of Kazakhstan, Germany, and Korea. In the context of LPI, Germany is considered to be a leader. In turn, Korea is a leading country in ICT development. For better perception, all indexes were converted to relative values.
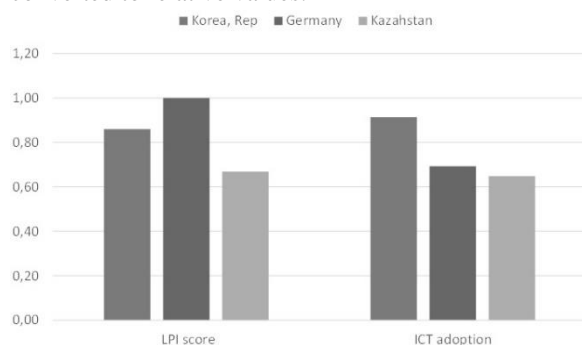
Figure 3. A comparative diagram of countries' LPI values and ICT development levels.

5.   Discussion

Globalization of supply chains makes their management and control more difficult. Blockchain technology, as a distributed digital ledger technology that ensures transparency, traceability, and security, is showing promise for easing some global SCM problems. Saberi, Kouhizadeh, Sarkis, and Shen critically examine blockchain technology and smart contracts with potential application to supply chain management [14].

A range of issues related to the supply chain covers a variety of concepts and problems. It includes both: slightly raised ones and a whole series of new difficulties arising from e-business development. Some issues are related only to supply chain management, rather than the e-business specifics. Among them are unsolved problems after an active implementation of Internet technologies. These include issues of buffering or stock size. Besides, In [12] note that the uncertainty involved in decision making may have decreased with the availability of more information. With the prevalence of the Internet, the firm might more easily obtain a lower procurement price or salvage excess capacity. However, a firm still needs to take into account the interplay between fixed and variable costs, while making decisions related to procurement or setting up additional capacity.

However, the supply chain issues in SCM have become an important e-business result. For example, leveraging risk-pooling concepts can greatly benefit

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Internet channels because products may be stored at fewer locations as compared to a traditional distribution channel [12]. Similarly, owing to Internet technologies, flexible customization capabilities were developed. Nowadays, companies can allow customers to specify settings for their offers interactively. Many authors note that during the last few years one more category of SCM problems has emerged [7], [11], [12]. They include linking the dynamic pricing of products to inventory and capacity decisions. Another example is coordinating the Internet and traditional distribution channels in terms of prices as well as information and product flows. Additionally, the advent of electronic marketplaces and auctions has opened a whole new set of issues related to procurement and supplier relationships.

Despite the variety of SCM research, little attention is paid to the use of Big Data Analytics for increased information exploitation in a supply chain. The aim of the provided by [15] is to contribute to SCM theory development by investigating the potential impact of Big Data Analytics on information usage in a corporate and supply chain context.

The availability of real-time information has raised the following important questions:

- degree to which information sharing protocol should be standard or proprietary;

- information amount and type that should be shared with the rest of the supply chain partners;

- beneficial types of collaborative processes [12].

In [26] provide a literature review of domestic (Kazakhstan) and foreign authors who researched the practice of SCM to develop the food industry. As a result, the theoretical and practical aspects of the food industry research were systematized. Apart from that, a conceptual framework was built to identify indicators, drivers and barriers and achieve sustainability in the food supply chain. In [19] have conducted a study, aimed at assessing SCM in small and medium enterprises in Kazakhstan and Poland. Besides, their research identifies similarities and differences in the approach to the SCM concept in selected countries.

In [10] have scientifically developed a maturity model concerning the digital transformation of companies within the manufacturing industry's supply chain. Such a model is intended to address fundamental components, complementary innovations, and relevant terminologies (smart products, Cyber-Physical Systems (CPS), Big Data Analytics). Scientific rigor is achieved by conducting grounded theory research and in-depth interviews as methods of data collection and evaluation. Moreover, relevant aspects concerning the development and construction of maturity models are discussed, before a suitable and scientifically elaborated maturity

model emerges from the course of investigation. What is more, mentioned above maturity models are also considered before their value for economic practice and the scientific community is specified.

Thus, the results presented can have both theoretical and practical value in studying diverse digital transformation aspects and the e-business development within the field of SCM.

6. Conclusions

The economic importance of the Asian region is growing continually. People are becoming wealthier and the role of local politicians in the world increases. The involvement in global production networks significantly affects the economic growth of Asian countries. Proper supply chain management allows maintaining a competitive advantage in the markets. During the process of socio-economic development, the SCM methods in Kazakhstan continue to be among the priority areas. The present findings will be of use to practitioners when developing strategies to ensure the success of value chains as a complex system.

New digital technologies appearing every day are improving traditional business processes in many fields. Digital transformation becomes a priority task. Since the modern economy is developing within a technological format, it is gradually transforming into a virtual economic system. In modern organizations, almost every process including the SCM is affected by digitalization. It has an enormous impact on the ongoing changes. The digital economy represents a new paradigm of economic development and is reformatting business relationships through the use of information. Hence, managers must recognize digitalization significance and trends.

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