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Development of Electronic Supply Chain Management Strategy for food industry

Abstract. In the current era of communication and competition, companies should concentrate on their main abilities and resources with electronic concept to enhance a reliable priority and get a stronger position in market. In other words, the manufacturers make efforts to develop their qualifications, whilst electronic supply chain management (E-SCM) is used as the supportive tool for the companies' development and reaching their goals. The operation of E-SCM plays a vital role in market and management section which can positively influence the profit and operations of the companies.

The main purpose of this research is to investigate the impact of electronic supply chain integration management, supply chain risk management and competitive advantage through modelling the impact of the variables: production, distribution and procurement on the performance of food industries. The present research is based on the objective of the applied type and based on the nature and method of data collection; it is of the descriptive-correlation type. The study population of this research is the companies active in the food industry in Central Asia, from which a sample consisting of 211 companies was selected based on the Chu-Bentler method. Exploratory factor analysis method was used in this research due to the exploratory investigation of different indicators of the E-SCM variable. According to the results of exploratory factor analysis, SCM operations were grouped based on the three factors of procurement operations, production operations, and distribution operations, and the effect of these factors on the company's performance using the structural equation modeling approach using the partial least squares method (PLS) was analyzed.

The results indicate that the procurement operation does not have an effect on the company's performance. Also, the research findings show that the production and distribution operations have a direct and positive effect on the company's performance and improve the performance.

Keywords: Electronic Supply Chain Management; E-SCM; Food Industry; Procurement; Production; Distribution Operations; Company Performance; Economics; Risk Management; Competitive Advantage

JEL Classifications: E24; E41; E64; I18; J28; J31

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1. Introduction and Theoretical Framework

Supply chain needs for transparency by application of digital technologies. Consumers are fed up with dishonest action in the food industry, such as incorrect labels, and the need for transparency has increased. This issue filters the supply chain and affects the way manufacturers label and produce their products. Digital technologies are key tools that upper and mid-chain suppliers can use to prove their authenticity, how they work, and their ingredients. An example of this is the use of smart tags (de Souza et al., 2023). Smart tags use IoT system to check and monitor goods by the E-SCM (Kittipanya & Tan, 2020).

Artificial intelligence optimizes the SCM. According to the findings of Kittipanya and Tan (2020), about 45% of food waste occurs over the insufficient SCM. Apart from wastage, this high rate of product loss is very costly for business-to-business food companies. This is another area where the adoption of artificial intelligence opportunities is increasing. Food industry companies can analyze large amounts of data using AI analytics. In this way, they can measure the market demand (Bjelica et al., 2023). By the application of AI analytics, the food industries are able to evaluate big data in the producer-to-costumer chain which provides a clear path to their marketing and allows them to gauge market demand. This leveraging on a bed of data is in stark contrast to previous analytical methods. These strategies usually include customized studies. Today, new trends in the food industry are increasingly born almost overnight. For this reason, the previous trend analysis models are very slow.

Companies operating at the upper levels of the food supply chain cannot respond to digital trends in time without immediate data analysis. This lack of accountability leads to unnecessary waste and inefficiency in the supply chain. In addition, the opportunity cost will be significant. Without real-time analytics, industries as the main source and first chain of the production cannot meet the customer demand as the last chain of the system, which reduces the efficacy of the SCM and causes dissatisfaction of the costumers and, consequently, results in losing the market. In the food industry, market evaluation is necessary to reduce wastes as well as lost revenue.

Business-to-business companies in the food supply chain must focus on food management practices to remain competitive (Kumar et al., 2020). Consumers' focus on food quality has increased. Naturally, this demand has affected all levels of the food supply chain. Companies operating in the food supply chain, from production to transportation and warehousing, must ensure compliance with quality standards and even beyond. For many types of food, even if only one part of the supply chain is missing, quality and safety may be compromised. Food safety is of great importance, because rotten food, if consumed, can lead to the death of the consumer.

Production of healthy and good quality food has always been an essential issue in the industry. Nowadays, consumer awareness and influence is also increasing. Modern market issues caused high and medium level SCM companies to experience more pressure regarding maintaining food healthy. The procedure in which this fact makes digital transformation is through the use of AI systems. AI systems can control conditions e.g. temperature and provide information for the producer and costumers. This data can be employed to better store and transport systems. Transportation system automation forecasts show that labor shortages are increasing. For this reason, the food industry is moving to automatic systems. It is becoming increasingly complicated to fill storage and transportation. As a result, food industry companies are expected to implement a range of automation technologies (Reshitov, 2023). These solutions include the use of driverless trucks and the use of mobile and autonomous robots in the warehouses.

Popova et al. (2023) have done the research called «Green supply chain management and environmental performance among tea technology companies in Kenya». The purpose of the

research is to investigate the effect of green SCM on the environment. The relationship between the variables has been done using correlation analysis and multiple regression model. The results show the direct and positive impact of the management of SCM on the company's environmental performance. In other research Alam et al. (2023) to investigate the effect of SCM operations on organizational performance related to SCM and organizational performance of medium-sized companies in metal products and machinery industries with general use in Turkey, from different indicators compared to past researches to measure SCM operations benefited. The results of this research show that the operation of the timely production system, the use of many suppliers, and keeping the safety stock have the highest level of application in the investigated companies. On the other hand, in small and medium-sized companies, common operations such as outsourcing, use of logistics service providers, and electronic procurement are relatively less used (Iakovou, 2021).

Modern companies with high-tech increasingly rely on data, which provides the easy managerial process and transparency for them. Large companies in the food industry are collecting increasing amounts of data at high speed. Managing, storing and working with this data can be expensive and complex. AI technology is something that can help companies interpret their data in meaningful ways. Machine learning provides the ideal analytics solution for data sets that are large and dynamic. The adoption of digital marketing is increasing. E-SCM has established itself as a mainstream marketing method. Forecasts suggest that digital marketing spending will increase to at least 70% of total global advertising spending by 2030. Some of the key trends that are happening are the increased implementation of SEO and the use of social media. Targeting and personalizing ads is also becoming a growing trend. These programs allow businesses to optimize their marketing processes.

2. Research Methodology

In order to obtain experimental results related to the presented model, the focus of this research is on the company's active in the food industry of Central Asia. Meanwhile, companies that were medium and large in terms of size (number of employees) were considered. Because the topic of E-SCM is generally understood in relation to companies that have a suitable size. Based on this, the statistical population of this research includes manufacturing companies active in the food industry in the cities and industrial areas of Central Asia. According to the statistics and information received from the Ministry of Industries of The Republic of Kazakhstan in 2022, the number of these companies is equal to 210 companies in the countries of Central Asia, namely: Kazakhstan, Kyrgyzstan, Uzbekistan, Turkmenistan, Tajikistan, and Mongolia. These companies are the local ones which are working from production to selling the food products. Using Cochran's formula at a confidence level of 95% and an acceptable error of 0.08, the minimum number of statistical samples of the research was determined to be 91 companies, and the designed questionnaire was distributed among the companies active in the food industry. The distribution of the research groups for the study is described in Table 1.

Table 1:
Research groups in the food industry

Food types	Snacks and chocolates	Drinks	Fruits	Meat products	Edible oils	Dairy
Surveyed companies %	13%	21%	9%	24%	10%	23%
Company activity (year)	Over 5	Over 5	Over 5	Over 5	Over 5	Over 5
Responds	CEO (8%) Technical Officer and Quality Control Manager (33%) Commercial Manager (39%) and Factory Manager (20%)					

Source: Authors' findings (survey)

Also, in order to measure the reliability of the research tool, the retest method, Cronbach's alpha, was used. The results showed that Cronbach's alpha of different dimensions of E-SCM operation variable is more than 0.75 and the data related to procurement, production, and distribution dimensions are used to measure the E-SCM operation variable.

Hypothesis:

The first hypothesis: integrated management of the electronic supply chain of goods affects the performance of the food industry company.

With the increase of integration in the supply chain, companies should pursue a basic challenge that can prepare the ground for improving business performance, and that is paying

attention to the risk of the electronic supply chain. If risk management mechanisms are taken seriously in organizations, it can be expected that organizations will be successful in the field of risk and its benefits and use this issue in order to achieve higher performance. Therefore, risk management can make companies in the electronic supply chain perform better than in the past against environmental challenges and be resistant to them, so the second hypothesis of this research is presented.

The second hypothesis: risk management of the electronic supply chain of goods affects the performance of the food industry company.

Risk management in the electronic supply chain allows companies to have different options for improving performance and managing environmental changes, which prevents waste of resources. Another issue that is raised is the competitive advantage of companies, which is very much considered in the business environment. Most companies are trying to improve the quality of their products and services, improve product innovation, product delivery time, or in other words, the ability to deliver their products, to prepare the ground for improving business performance in the supply chain.

The third hypothesis: competitive advantage in the electronic supply chain affects the performance of the food industry company.

In order to gain a competitive advantage, companies today take extensive measures to be effective in improving their business performance by achieving a higher level of competitive advantage. Competitive levers give companies the possibility to provide their services and products better and more powerfully than their competitors, and if this capability in providing services cannot be imitated and copied, companies can use this tool extensively and have a distinctive performance compared to their competitors. In order to achieve sustainable competitive leverage, which is the aim of this research, companies should make good use of their intangible resources, such as organizational knowledge and human resources, so that they can strengthen the level of innovation in all organizational processes by improving value creation in their actions to be able to improve their business performance.

Also, in order to measure the reliability of the research tool, the retest method, Cronbach's alpha, was used. The results showed that Cronbach's alpha of different dimensions of E-SCM operation variable is more than 0.75 and the data related to procurement, production, and distribution dimensions are used to measure the E-SCM operation variable.

3. Results

The efficiency of the supply chain depends on the availability of the required information at any time. In order for the supply chain to be able to guarantee its survival, it needs enough information, at the right time and place, with acceptable quality and accuracy, and finally with an acceptable speed in its information network. Supply chain design follows three competitive advantages: product competition, price competition and time competition. Fortunately, in the world of electronic business, fast and cheap customer orientation has become more possible than before. Designing the E-SCM is the thing that brings us to the goal (IT form). It can connect all the separate activities of the supply chain into an integrated system that is fast, responsive and very cost-effective on a large scale. With e-SCD, suppliers, manufacturers, Integrate and unite the supply and customer channels with the help of IT. By this means, the necessary information to coordinate the supplier's activities to satisfy the customer's needs can be transmitted at all levels of demand delivery.

Table 2 shows the descriptive statistics and correlation matrix of the dimensions of the research variables. Referring to this table, it can be said that the research tool has predictive validity. Because according to the correlation matrix of research variables, it is determined that the variable dimensions of E-SCM operations have a significant correlation with the company's performance variable (Nahas et al., 2022)

Table 2:
Descriptive methods of research variables

Variables		Mean	SD	logistics	Production	Distribution	Performance
E-SCM	logistics	3.99	0.68	1	-	-	-
	Production	3.87	0.66	0.611	1	-	-
	Distribution	3.76	0.65	0.801	0.772	1	-
Performance		3.33	0.64	0.452	0.501	0.633	1

Source: Authors' own findings

In this research, in order to analyze the data obtained in order to test the research hypotheses, partial least squares approach was used using PLS-Graph software. Due to less dependence on the sample size, this approach is considered a suitable approach for measuring the hypotheses of the present research. The structural model of the research is shown in Figure 1. As can be seen, on each path, the coefficient of the path and the coefficient of significance (in parentheses) are specified.

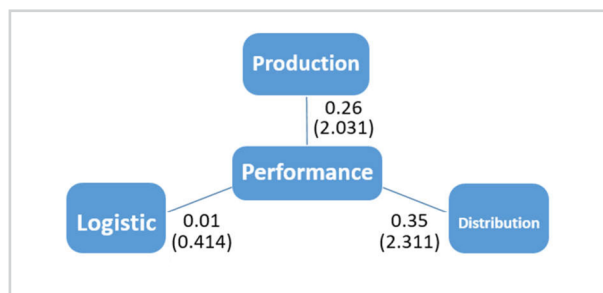


Figure 1:
Structural model of research
Source: Authors' own findings

Also, according to Figure 1, it can be said that distribution operations have a greater effect on performance compared to production operations. Because the path coefficient related to distribution operations on performance (equal to 35%) is higher than the path coefficient of production operations on performance (equal to 26%). The results of relationships between structures for the three hypotheses presented in this integrated E-SCM model, supply chain risk and competitive advantage using *t*-test are presented in Table 3.

If the absolute value of the *t*-statistic is higher than 0.92, then it can be concluded that the assumption is confirmed at the confidence level of 95%. As the results show, all three hypotheses are confirmed and the competitive advantage with the highest *t*-value and the path coefficient is the most effective.

Table 3:
Relationships of variables with t-test and hypothesis testing

H	Variable		Path coefficient	T-value	Results
	Independent	Dependent			
H1	Integrated ESCM	performance	0.301	7.89	confirmed
H2	Supply chain Risk	performance	0.332	6.04	confirmed
H3	Competitive advantage	performance	0.351	8.53	confirmed

Source: Authors' own findings

4. Conclusion

Undoubtedly, paying attention to organizational performance is an issue that every organization takes any kind of activity to strengthen and improve it. In the meantime, it seems that if the organizations can create a suitable and favorable coordination in the entire supply chain, they will be able to improve this performance more powerfully than in the past. In other words, this approach has been welcomed that the supply chain through the two factors of production and distribution can play an important role in improving organizational performance. The failure of companies in the integrated supply chain will cause a kind of inconsistency between the entire supply chains and increase the costs of companies in organizational activities. Therefore, integration will be a very suitable topic in order to improve performance. On the other hand, paying attention to the issue of risk and its management has always been one of the concerns of managers in the electronic supply chain. Many managers are facing the doubt that if they cannot identify and manage the risks of the entire supply chain well, they will face problems in order to achieve optimal performance.

On the other hand, achieving a competitive advantage can also affect organizational performance. The competitive advantage and levers that companies carry with them in competitive markets make the organization work better than in the past in order to improve sales and also strengthen market share, which will undoubtedly improve the business performance of companies. Rogerson & Parry (2020) and Bhat et al., (2021) stated that improving competitive ability has

a constructive role in improving organizational performance, and these results are in line with the current research. According to the results of the present research, a strategic policy is presented as a proposal to improve the performance of the food industry in such a way that the continuous design and revision of the integrated E-SCM system and making it user-friendly. The perspective of the East Asian food industry is to be present in the market and compete with other domestic and foreign competitors and producers, which can be considered a big challenge for the food industry. The new conditions require a change in many strategies and mental and operational models in this industry, and more precisely in the food industry of Central Asia as one of the main suppliers of the world's food resources.

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