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IMPLEMENTATION OF E-LOGISTICS IN SUPPLY CHAIN OPERATIONS IN THE FOOD INDUSTRY

Mr. S. Kathiresan[*]

ABSTRACT

Supply Chain Performance encompasses the activities of the extended supply chain in meeting the requirements of end-customers including ensuring product obtainability, on-time transport, and maintaining the necessary inventory and capacity to provide responsive performance inside the supply chain. The supply chain handles various aspects such as handling, storage, processing, and packaging similar to E-Commerce and subscription box packaging, distribution, retail, and wholesale. In the food industry, the supply chain involves all the processes that raw food materials undergo to become available for consumers to purchase. It encompasses steps from the source, such as the planter, to the consumer's dinner table. Multiple stakeholders, including producers, providers, and stores, are involved in this chain. Operations and supply chain management. Order fulfillment, distribution, logistics, retail, sourcing, materials management, operations planning, and demand forecasting are some of the duties that fall under this category. All company actions about purchasing, production, distribution, and sales order fulfillment are planned, designed, controlled, and carried out. The supply chain operation is optimized within a six-month planning horizon to ensure a predetermined level of demand while minimizing costs such as transportation, operational, storage, and external supply costs. A food system, often known as a supply chain, is a set of operations that describe how food is generated. The hypothesis conditions that there is no significant difference between the importance of supply chain organization in the food industry and the age of the respondents. Additionally, there is no significant difference between the subsectors and producers within the food industry and their designation. Furthermore, there is no relationship between food supply chain performance and the variables mentioned.

Keywords: *Food Industry, Supply Chain, Logistics, Management.*

Introduction

Because of the peculiarities of food products and the design of the nourishment supply chain, the most significant agribusiness activities. Companies in the food sector often have a disjointed supply chain, poor inventory control, and poor production forecasting. In addition, markets are defined by fierce rivalry, rising customer expectations, and strict food safety and quality laws. E-logistics solutions have already been adopted by large agriculture firms as a way to meet consumer needs and maintain a competitive advantage.

Food policymakers are diligently working towards minimizing costs and ensuring a smooth flow within the industry. However, one of the main tests faced is the shortage of labour in food processing and packaging companies. These industries have been compelled to reduce their workforce to prevent the

[*] Chief Operating Officer, Avinoz Consulting Solutions Pvt. Ltd., Kancheepuram District, Chennai, Tamil Nadu State, India.

spread of transmissions. To ensure sustainability by putting in place a clever food production system, can effectively tackle issues related to food safety, security, control, and perishability, as highlighted by Olumide (2018). Additionally, the use of supply chain-based digital twins, as mentioned by Burgos Ivanov (2021), can provide comprehensive visibility throughout the entire supply chain, including demand charts, inventory levels, and asset management as identified by Kummu et al. (2012).

Food superiority and care are becoming more and more crucial, and if strict monitoring and traceability procedures aren't put in place, it can cause illnesses and seriously harm an organization's reputation. Aung & Chang (2014). The government's role, as identified by Vlachos (2002), has been consistently found to be crucial in encouraging SMEs to innovate technologically through the provision of direct incentives, the removal of entry obstacles, financial relief, and the development of a stable business climate. There would be a big push on other companies in the Greek food sector to look for sustainable competitive advantage in e-logistics applications if a critical mass of agribusiness enterprises emerged that have utilized e-logistics applications to achieve exceptional performance.

Bilali and Allahyari (2018) highlight the widespread adoption of big data and data analytics in various agricultural practices worldwide. This includes the use of these technologies in equipment maintenance, field mapping, and other operational activities to enhance irrigation and boost agricultural productivity. Additionally, decision support systems assist farmers in maximizing production efficiency while minimizing costs and the environmental impact of their operations. These advancements serve as a crucial foundation for the transformation of food systems.

Van der Vorst et al (2002) E-commerce is a concept that has been defined in various ways in both practice and literature. Generally, e-commerce is utilized to enhance the efficiency of existing supply chains or establish new supply chain networks with more flexible partnerships. However, due to the multitude of interpretations, it is often unclear how useful a specific type of e-commerce is for a particular supply chain situation. The study concludes by suggesting classifications and advancements of e-trade in food supply chains.

Review of Literature

Sellahewa & Martindale (2010) The demand for high-quality, safe, and nutritious processed foods is on the rise due to the increasing global population and affluence has made progress in reducing carbon and water footprints, as well as minimizing waste. Economic and social sustainability are equally important for the industry's success. Taking an integrated approach including farm and post operations, is essential. Life Cycle Assessment comes into play, enabling us to effectively communicate meaningful environmental messages to consumers who are increasingly conscious of the impact of their purchases and become more globalized, it is crucial to standardize social and economic factors in environmental assessments. This will allow for accurate comparisons to monitor environmental performance, regulatory compliance, and consumer communication. Reducing consumption is necessary to ensure the long-term sustainability of the worldwide food processing system.

Azoury and Miyaoka (2013) have devised and assessed a modeling technique to address the supply chain within supply chain confronts various challenges, such as managing multiple products and warehouses, adhering to production constraints, dealing with high transportation costs, and coping with limited packing size at the production facility. The inspiration for this study stems from the supply chain construction experience at Amy's Kitchen, a prominent producer of natural and organic foods in the United States. Furthermore, we have established a lower bound on the total costs for all feasible solutions to the problem and evaluated the effectiveness of our model in comparison to this lower bound.

Dong et al (2014) highlight the significance of sustainable production and distribution in the realm of production economics which stands as the main industrial sector in various developed and developing countries. Despite improvements in efficiency within food production and distribution systems, the industry still heavily depends on natural resources and faces increasing demands. As a result, guaranteeing a sustainable food supply remains an ongoing global challenge for the industry.

Rezaei & Liu (2017) Developing countries will experience significant growth, particularly in their urban populations, leading to the creation of complex and lengthy food supply chains involving multiple actors. This poses challenges in ensuring the delivery of safe, nutritious, and high-quality food. However, addressing food losses and waste in an efficient, sustainable, and integrated manner presents an opportunity to both feed people and optimize the utilization of natural and financial resources. The private sector, including the food industry, has a crucial and distinctive.

Qorri et al (2018) conducted a study on the measurement approaches used to assess different measurement approaches used in different sectors and levels of the supply chain. Challenges need to be addressed, such as data collection, standardization of metrics, and collaboration among supply chain members and stakeholders.

Tsolakis, Anastasiadis & Srai (2018) highlight a user-friendly approach that yields a comprehensive and impactful evaluation of supply chain sustainability performance. Valuable industry insights indicate a satisfactory level of sustainability performance across the entire supply chain. It is important to note that the results are solely based on the perspectives of C-level executives, so any generalizations should be made with caution. Nevertheless, these findings can be utilized by supply chain stakeholders, policy-makers, and researchers to quickly and reliably assess sustainability performance.

Shegelman et al (2020) there is a lack of emphasis on patenting the intellectual property objects that are developed methods of improving supply chain management within by examining the characteristics of advanced functional food, including its justification, formulation, and production technologies. The research also presents a supply chain strategy for different sub-sectors and producers in the food industry, as well as the effects of functional foods on consumers.

Thomé, Cappellesso, Ramos & de Lima Duarte (2021) have synthesized and conducted content analysis on the literature to provide a conceptual framework for coexistence. The requirement to add value and two primary criteria form the basis of this plan. The literature admits that their polarity is blurring. Zhou et al (2022) have highlighted the growing significance of escalating quality and risk concerns. This issue has become a global societal concern. Moreover, as the environmental landscape becomes more dynamic, the influence of dynamic capabilities on firm sustainability performance strengthens.

Kayikci et al (2022) have presented an it serves as a valuable resource for future researchers, guiding them in tackling technological and human-related hurdles in the period of business 4.0. Surprisingly, the study reveals minimal concerns in terms of the process and performance of block chain implementation in the Industry 4.0 era, this research sparks intriguing discussions and highlights potential threats that need to be addressed.

Sustainability has become a paramount concern in supply chains today. To ensure a sustainable path forward, supply chains must utilize Performance Measurement Systems (PMS) to evaluate and monitor their sustainable performance. This research paper aims to make significant contributions in bridging this gap. De Carvalho, Relvas & Barbosa-Póvoa (2022) provide a comprehensive breakdown of the main characteristics within each proposed PA. To achieve these objectives, a multi method approach combining key stakeholders in the sector and a thorough literature review is employed.

Petruzzelli et al (2023) Broad info graphics show how these advantages relate to both sets of global sustainability objectives. The 348 benefits gathered demonstrate differences between benefit categories, chain topologies, and continents in the topic's current study initiatives have shown benefits. Few parts of scientific research have been studied about quantifying the causal implications for their targeted utilization worldwide.

The importance of ensuring food security for the growing global population cannot be emphasized enough. Over the years, the combination of efficient agricultural policies, effective implementation, and advancements in science and technology have played a crucial role in meeting the increasing demand for food worldwide. Pelé et al (2023) However, it is essential to recognize the challenges and limitations associated with food supply chains, as well as the potential risks of security breaches. To prevent any unnecessary damage, securing food supply chains is of utmost significance.

Fortunately, recent advancements in IoT and block chain technology have provided opportunities for enhancing security in this field. In light of this, Pelé et al (2023) focused on food supply chains, particularly the logistics aspect, and developed a comprehensive framework that incorporates IoT and block chain technology. This framework aims to strengthen security measures and ensure the smooth flow of food from production to consumption.

By leveraging IoT, we can monitor and track various aspects of the supply chain in real time. Pelé et al (2023) This enables us to identify any potential vulnerabilities or disruptions promptly, allowing for immediate action to mitigate risks.

With the implementation of this framework, Pelé et al (2023) can enhance the overall security of food supply chains, safeguarding against potential threats and ensuring that through such innovative approaches, they can continue demand for food while maintaining the highest standards of quality and safety. Fourth position worldwide in terms of implementing a Sharia economic system. With such potential, to establish itself as a prominent halal hub regionally and globally. report by Muttaqin et al (2023) Strengthening and promoting the halal industry are crucial strategies to propel Indonesia toward becoming a key player in the global halal market.

Rodriguez et al (2023) consist of producers, traders, and processors who transport specific methodologies required for diagnosing, evaluating, and improving food supply chains. Based on this review, a new taxonomy is proposed, which includes the following methodological groups: management, qualitative analysis, quantitative analysis, multi-criteria decision-making (MCDM), statistics, machine learning, mathematical modeling, discrete simulation, system dynamics, and others. Logistical means and modes. The researchers also identified the greatest normally used performance measures in these methodologies.

In their study, Panghal et al (2023) investigated the factors that influence the adoption of six significant challenges, including limited resources, cooperation problems between partners, concerns about data breaches, technology synchronization issues, high capital requirements, and difficulties in handling bulk orders. By effectively managing these challenges, organizations can improve the efficiency of their operations.

Kaur et al (2023) results of their study help companies in sharing technology costs and choosing the appropriate technologies for their supply chain. Additionally, they propose a conceptual outline to guide future research on enhancing discernibility and working efficiency in the FSC through Industry 4.0 technologies.

Kumar et al (2023) aim to explore and set out to investigate and prioritize different factors that contribute to its adoption findings that can inspire managers to incorporate block chain IoT into their planned preparation, considering the categorized enablers as cause and effect. Moreover, the research findings can be utilized to develop effective methods for deploying Block chain-IoT.

Reddy et al (2023) the food supply chain's job is to make things more efficient and transparent so that partners, clients, and suppliers can get important details about the movement of properties and journey history. To guarantee food safety, safeguard the public's health, and make sure that food is uncontaminated, traceability is essential. Businesses can make sure that food is sourced from licensed suppliers by monitoring the food's journey through the supply chain.

Umar & Wilson (2023) look into the resilience of logistics operations and how they react to disruptions and natural disasters. Remarkably, resilience in this setting is attained despite a low degree of integration, a simple technology environment, and a vulnerable logistics infrastructure. Resilience can yet be improved more. The present research adds to the limited body of literature that investigates how logistical operations impact supply networks during natural disasters and other disturbances. Moreover, revealing the underlying framework of logistics resilience initiatives and, somewhat unexpectedly, the connections between intrinsic and adaptive resilience donate to the rising corpus of literature.

Kumar & Agrawal (2023) current issues about supply chain drivers along with the duties and responsibilities of each link in the chain. But the challenges associated with agricultural products—like those related to packaging, quality, processing, sustainable practices, human resources, etc have received the most attention.

Poshan et al (2023) important disruptions to numerous supply chains, particularly the cold chain, which is more difficult to operate and demands additional conditions. Another topic worth mentioning is digital transformation. The value that digital transformation brings to cold supply chain transportation will also be covered in this chapter. In addition, this chapter will provide an overview of how the digital cold chain's added value addresses food safety. It will also highlight some Chinese business examples that have leveraged digital technology to strengthen the cold chain's resilience during the pandemic, serving as a guide for businesses and nations looking to strengthen their cold chain's resilience.

Methodology

Primary data on the motives were collected using a survey method and the instrument used was an unbiased, structured questionnaire. Secondary data were collected from various journals, books, and the internet. A quantitative check was proposed in December 2023. The survey was dealt with online and offline. Population of the study in Chennai city. The sample size is 183 implicit actors who penetrated the online check taken, through the software “Raosoft”.

Analysis and Interpretation of Data

Table 1: Gender

Gender	Frequency	Percent
Male	125	68.3
Female	58	31.7

The number of male accused is about 68.3% higher than female suspects. The low response of females is about 31.7%.

Table 2: Age

Age	Frequency	Percent
18-24 Years	43	23.5
25-35 Years	32	17.5
36-45 Years	63	34.4
46-55 Years	37	20.2
Above 55 Years	8	4.4

About 183 defendants are 36-45 Years ethnic majority in this research. 18-24 Years is the second 23.5%, and the third age group people 46-55 Years is 20.2%, 25-35 Years of people is 17.5%.

Table 3: Designation

Designation	Frequency	Percent
Technical operator	43	23.5
Executive	7	3.8
Assistant Manager	36	19.7
Manager	89	48.6
Senior manager	8	4.4

The majority of the respondents are technical operators (23.5%), followed by Executives (3.8%), Assistant Managers (19.7%), and Managers (48.6%). About 4.4% of respondents are Senior managers.

Table 4: Education Qualification

Education Qualification	Frequency	Percent
Diploma	56	30.6
Graduate	20	10.9
Post Graduate	71	38.8
Others	36	19.7

The majority of the defendants are diploma holders (30.6%), followed by Graduate degree holders (10.9%), master degree holders (38.8%) and others (19.7%).

Table 5: Year of Experience

Year of Experience	Frequency	Percent
<5 yrs	65	35.5
6-10 yrs	6	3.3
11-15 yrs	48	26.2
16-20 yrs	33	18.0
Above 20 yrs	31	16.9

About 35.5% of respondents have worked more than <5 yrs and 3.3 % have work experience 6-10 yrs. About 26.2% of respondents are working in the 11-15 yrs, About 18% of respondents are working in the 16-20 yrs and 16.9% of Above 20 yrs.

Table 6: Marital Status

Marital Status	Frequency	Percent
Single	72	39.3
Married	111	60.7

Overall, sixty-seven percent (60.7%) of all defendants reported they were married at the time of the survey, and 39.3% reported they were accused reported they were single.

Table 7: Importance of Supply Chain Management in the Food Industry and the Age of the Respondents

ANOVA						
		Sum of Squares	**DF**	**Mean Square**	**F**	**Sig.**
E-commerce and online grocery shopping	Between Groups	18.416	4	4.604	14.890	**.000**
	Within Groups	55.037	178	.309		
	Total	73.454	182			
Direct-to-consumer deliver	Between Groups	18.517	4	4.629	9.062	**.000**
	Within Groups	90.936	178	.511		
	Total	109.454	182			
Subscription-based models	Between Groups	22.433	4	5.608	10.129	**.000**
	Within Groups	98.551	178	.554		
	Total	120.984	182			
Data analytics and automation	Between Groups	23.187	4	5.797	22.655	**.000**
	Within Groups	45.545	178	.256		
	Total	68.732	182			
Sustainability and environmental responsibility	Between Groups	24.261	4	6.065	11.552	**.000**
	Within Groups	93.455	178	.525		
	Total	117.716	182			
Customization and personalization	Between Groups	15.446	4	3.862	8.928	**.000**
	Within Groups	76.991	178	.433		
	Total	92.437	182			
Partnerships and collaborations	Between Groups	46.180	4	11.545	21.592	**.000**
	Within Groups	95.175	178	.535		
	Total	141.355	182			

E-commerce and online grocery shopping, Direct-to-consumer delivery, Subscription-based model, Data analytics and automation, Sustainability and environmental responsibility, Customization, and personalization, Partnerships, and collaborations. All the significant values are less than the p-value of 0.05.

Table 8: Food Industry Sub-Sectors and Producers and the Designation

ANOVA						
		Sum of Squares	**DF**	**Mean Square**	**F**	**Sig.**
Production of functional meat products	Between Groups	5.301	4	1.325	1.345	.255
	Within Groups	175.431	178	.986		
	Total	180.732	182			
Production of meat by-products.	Between Groups	3.080	4	.770	1.194	.315
	Within Groups	114.735	178	.645		
	Total	117.814	182			
Production of functional fish or fish-growing products	Between Groups	6.917	4	1.729	3.313	**.012**
	Within Groups	92.897	178	.522		
	Total	99.814	182			
Production of functional products from grains and cereals	Between Groups	8.161	4	2.040	3.160	**.015**
	Within Groups	114.921	178	.646		
	Total	123.082	182			
Production of functional products from plant raw materials	Between Groups	8.691	4	2.173	4.294	**.002**
	Within Groups	90.063	178	.506		
	Total	98.754	182			
Production of functional bakery products	Between Groups	24.806	4	6.201	5.105	**.001**
	Within Groups	216.211	178	1.215		
	Total	241.016	182			
Production of functional confectionery products	Between Groups	19.773	4	4.943	3.871	**.005**
	Within Groups	227.276	178	1.277		
	Total	247.049	182			

Production of functional extracts	Between Groups	25.715	4	6.429	8.376	**.000**
	Within Groups	136.624	178	.768		
	Total	162.339	182			
Production of functional dairy, cheese, and fermented milk products	Between Groups	6.669	4	1.667	4.078	**.003**
	Within Groups	72.784	178	.409		
	Total	79.454	182			
Production of functional beverages.	Between Groups	13.948	4	3.487	6.801	**.000**
	Within Groups	91.265	178	.513		
	Total	105.213	182			
Production of functional biologically active additives	Between Groups	5.310	4	1.327	3.394	**.011**
	Within Groups	69.619	178	.391		
	Total	74.929	182			

Production of functional fish or fish-growing products, and Production of functional products from grains and cereals. Production of functional products from plant raw materials, Production of functional bakery products, Production of functional confectionery products, Production of functional extracts, Production of functional dairy, cheese, and fermented milk products, Production of functional beverages, Production of functional biologically active additives. All the sig values are less than the p-value of 0.05. The production of practical essence crops and the production of meat by-products these two factors do not significant.

Table 9: Food Supply Chain Performance

Correlations					
		Reduced loss	**Better food security**	**Improved stakeholders trust**	**Higher chain transparency**
Reduced loss	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	183			
Better food security	Pearson Correlation	.194**	1		
	Sig. (2-tailed)	**.009**			
	N	183	183		
Improved stakeholders' trust	Pearson Correlation	.325**	.180*	1	
	Sig. (2-tailed)	**.000**	**.015**		
	N	183	183	183	
Higher chain transparency	Pearson Correlation	.537**	.369**	.279**	1
	Sig. (2-tailed)	**.000**	**.000**	**.000**	
	N	183	183	183	183

Better food security with Reduced loss PC (Pearson correlation) value 0.194 is significant value .009. Improved stakeholders' trust with Reduced loss and better food security, PC (Pearson correlation) value .325 and 0.180 is significant value .000 and .015. Higher chain transparency with Reduced loss, better food security, and Improved stakeholder trust, PC (Pearson correlation) value .537, 0.369, 0.279 is significant value .000

Suggestions & Conclusion

Food supply chains have become increasingly complex and lengthy due to changing food consumption patterns and trade globalization. This necessitates a shift in mindset from the traditional approach of addressing food loss at each stage of the supply chain to a more integrated approach. To improve competence and decrease loss, it is important to invest in efficient and sustainable processing technologies, storage and packaging solutions, road infrastructure, and market linkages. Additionally, providing training and education to all actors involved in the chain, including consumers, can make a significant difference.

In summary, new technologies and changing consumer tastes are causing major changes in the food distribution business. In 2023, key inclinations out for include e-commerce and online grocery shopping, direct-to-consumer delivery, subscription-based models, data analytics and automation, sustainability and environmental responsibility, customization, and personalization, as well as partnerships and collaborations. By embracing these trends, food distributors can stay competitive and meet the changing demands of the market.

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