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Promotingagile Supply Chain Management In The Egyptian Agricultural Food Sector: Issues And Guidelines

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1. ABSTRACT:

Food and agricultural supply chains represent a high percentage of domestic and global trade. To appraise the development of strategies to improve agricultural global supply chain practices and logistics activities, a better understanding of the challenges in supply chains and opportunities for improvement is required. As a result, by investigating current agricultural supply chain issues, this research aims to promote agile supply chain management in the agricultural sector in order to create a competitive advantage for Egyptian agricultural food products. This would contribute to sustainable practices by leading to higher agricultural productivity, profitability, and customer satisfaction. A systematic review of twenty-three published studies on agile agricultural supply chain management was conducted with the purpose of identifying the main issues of the logistics activities in agricultural food shipments, the methods used in the previous studies, the lessons learned from implementing agile supply chain management in the agricultural food sector, and the previous researchers' recommendations for the further studies. followed by semi-structured interviews with the Egyptian logistics providers, food importers, exporters, and maritime port authorities to assess the current issues and challenges that are faced by the Egyptian food importers and exporters and recommend solutions and guidelines to create a competitive advantage for the Egyptian agricultural food products. The findings revealed that logistics activities in Egypt need to be operated more efficiently, especially warehousing and transportation operations. Moreover, it provides information that can assist in developing effective strategies to ameliorate the conditions of agricultural stored products in ports and waterways through a roadmap and to identify research gaps and potentials for future research.

Keywords: *Agile Supply Chain, Agricultural Products, Logistics Activities, Competitive Advantage.*

2. INTRODUCTION

In today's competitive world, the supply chain is a crucial element for becoming competitive and successful. Uncertainty in the functioning of any of the links may lead to delays and bottlenecking and may obstruct the performance of the logistics activities. Hence, it is necessary to implement an agile strategy (Patil et al., 2021). Agile Supply Chain (ASC) could be defined as "the strategic ability to respond quickly and on the spot with the help of the effective supply chain relationships established to internal and external uncertainties." In addition, it is the ability of the organisation to use its resources in a timely and flexible manner to respond proactively and reactively to the opportunities and challenges that develop in the internal and external environment of the organisation (Çelikkol et al., 2021).

The agriculture food sector is characterised by the risks associated with its seasonality, sensitivity, increased supplies,

long delivery times, specialised transportation and storage processes, and flexibility, which can affect its freshness and health. Therefore, the improvement of its supply system from the producer of agricultural products to consumers is an urgent issue. This could be facilitated by an ASC (Syromyatnikov et al., 2020).

Agri-food business is a vital sector of the Egyptian economy, it contributes 11.4% to the country's GDP and provides 23.3% of employment. The main agricultural products in Egypt include rice, wheat, maize, cotton, sugarcane, and agricultural crops such as vegetables, fruit, and dates (Fouad, 2022). Therefore, agriculture is traditionally a driving force of the Egyptian economy, and the majority of Egyptians rely on agriculture to feed their families and earn a livelihood (FAO, 2015).

In Egypt, the agri-food business comprises three categories: the primary production of both agricultural and agro-processed products; the production of intermediate inputs that are used to produce these primary products, such as fertilizers and seeds; energy; and packaging materials for agro-processed products; and the trade, transport, and marketing of both agricultural and agro- processed goods (Hatab & Hess, 2013). However, food loss and waste (FLW) in Egypt are growing concerns, as the Egyptians throw away between 15 and 45 percent of their food every year, and more during special occasions such as festivals and holidays (FAO, 2019).

Therefore, the aim of this research is to promote agile supply chain management in the agricultural sector in order to create a competitive advantage for Egyptian agricultural food products. This aim will be achieved by three objectives comprising: illustrating the challenges and lessons learned from agile supply chain management in the agri-food sector, investigating the current agricultural food supply chain challenges in Egypt, and proposing some recommendations to achieve agile agricultural supply chain management in Egypt.

Consequently, this paper is structured in five sections: first, the introduction, then, the research questions are addressed and the methodology used; furthermore, a systematic literature review (SLR) is conducted with the aim of highlighting the challenges and learned lessons from implementing agile supply chain management in the agricultural food sector; followed by a semi- structured interview to investigate the challenges and opportunities in Egypt. Finally, the research is concluded and a roadmap is proposed to provide a summary of the issues and guidelines for the supply chain of agri-food sector practitioners.

3. METHODOLOGY

In order to provide a comprehensive study that help the Egyptian agricultural food supply chain practitioners in achieving a competitive advantage and agile supply chain management, the following research questions will be investigated:

RQ1: What are the challenges and lessons learned from agile supply chain management in the agri- food sector?

RQ2: What are the current agricultural food supply chain challenges in Egypt?

RQ3: How to achieve agile agricultural supply chain management in Egypt?

To begin with, to investigate the first question, a systematic literature review was conducted. To report a systematic literature review, there are indispensable nine steps that should be followed. It should start with formulating clear research questions. Followed by writing a systematic literature review procedure. Then using selected keywords to get relevant data from databases. Once the articles with related keywords are collected, date restriction is used to refine the results only based on recent data. Afterward, abstract screening and full text screening. Subsequently, select the relevant sources that only bring about the desired outcome. Later, after analyzing the data and assessing the required data. Finally, a systematic review report was followed by publication (Knoll *et al.* 2018).

Accordingly, based on this systematic procedure, the keyword are selected to be "agile supply chain," *"agricultural food," "logistics activities," and "maritime transport,"*. Then, three research engines are used, including Emerald Insights, Research Direct, and SCOPUS to collect related articles such as peer-reviewed journals and conference proceedings and restricted from 2012 to 2022. This inclusion criteria could be shown in the following figure:

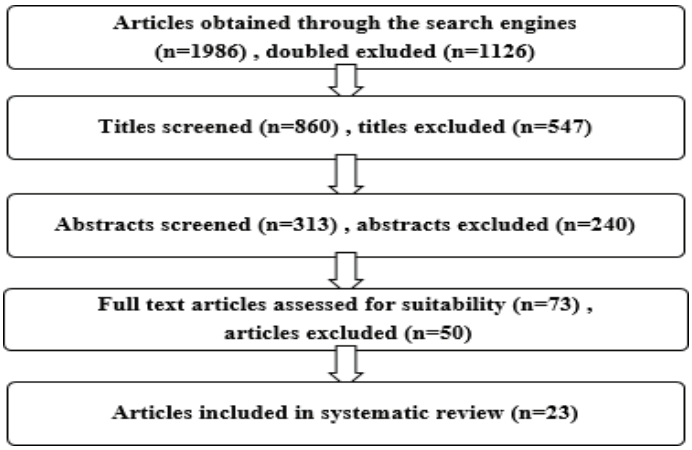

Figure. 1: Flow chart of selection of studies

While for the other two questions, three semi structured interviews were conducted with the Egyptian practitionars including a logistics specialist from logistics provider company, an operational manager from food import and export company, and a representative from cargo handling company in Alexandria port. The interviews are divided into two sections; the first section includes open ended

questions that assess the Egyptian Agri-food supply chain challanges, and the second section inlcudes questions that ask the interviewees about their recommendations to acheive agile supply chain management in the Agri-food supply chain sector.

This conducted methodology could be shown in the following figure:

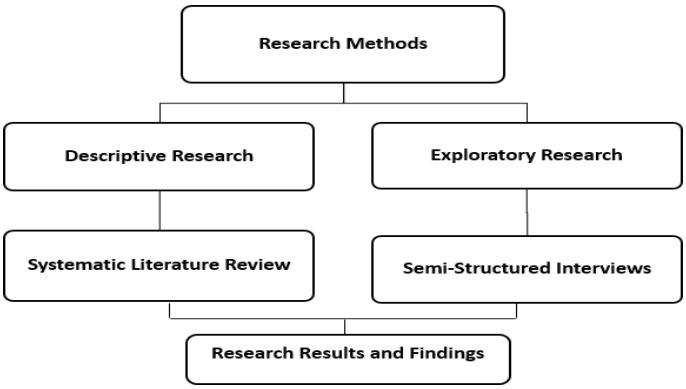

Figure. 2: Research Design

4. DISCUSSION & RESULTS

4.1 The Challenges and Lessons Learned From Agile Supply Chain Management In The Agri- Food Sector

From the conducted systematic literature review, the previous studies have revealed the following recommendations to overcome the challenges faced by agri-food practitioners to achieve an agile supply chain and reduce wastes:

- (Adams et al., 2021), (Aramyan et al., 2021), (Syromyatnikov et al., 2020), (Nketia & Quaye, 2015), & (Driouech et al., 2014) stated that improving communication between all stakeholders through integrated systems could ensure the process- and market-induced standards and quality requirements in order to minimise food wastes and achieve an agile supply chain in the agri-food sector.

- In addition, (Remondino & Zanin 2022), (Yadav et al., 2021), (Abideen et al., 2021), (Syromyatnikov et al., 2020) (Steur et al., 2016) & (Zecca & Rastorgueva 2014) stated that transformation towards agricultural food supply chain 4.0 and value-stream mapping (VSM) creates transformation both in the quality and safety of food products. Moreover, technology has been adopted to improve resource efficiency and productivity in food systems. This has reduced agricultural raw material inputs to reduce environmental externalities. It is also necessary to legislatively regulate the partnership between agribusinesses participating in digital platforms and blockchain technologies.

- Furthermore, (Álvarez et al., 2021), (Raut, & Gardas, 2018), (Kresnanto et al., 2021), (Driouech et al., 2014) revealed that effective multi-modal transportation may be used to significantly save transportation time for perishable food products. Also, the selected transportation mode should be environmentally friendly. Moreover, the loading and unloading activities should be carried out under supervision to reduce the wastage of the produce. In addition, to reduce the handling of the individual packages and save time on handling machinery such as forklift trucks, last but not least, the drivers of the vehicles play a significant role in reducing the transportation losses, hence, responsible and experienced drivers should be employed.

- Besides, (Carter et al., 2022), (Rahimi, & Artukoglu, 2021), (Islam et al., 2021), (Kharaishvili et al., 2021), (Szerb et al.,2018), (Nketia & Quaye, 2015), (Driouech et al., 2014), (Rueda et al., 2021), (Alvarez et al., 2021), & (Barana & ïak 2014) revealed that constructing more efficient infrastructure and links between countries and cities could reduce the food wastes as the distance between them will be shorter in time. In addition to constructing new logistics areas supported with refrigerators and reefer containers for storing, and transporting Agri-food products. Also, dry ports are essential for providing logistics services for food to minimise waste, avoid the waiting time in ports, and increase the added value of domestic export items.

- Finally, (Nunes et al., 2014), (Li et al., 2015), & (Albaar et al., 2016) stated that in order to achieve a sustainable and competitive food supply chain, using green transportation and packaging is essential, especially for maritime transportation and short sea shipping modes. And minimise the dependency on road transportation. Also, it is crucial to have sufficient insights into product temperature during transportation.

Therefore, the following table summarizes and identifies the main challenges and opportunities of the supply chain and logistics activities in agricultural food sector:

Table 1. A systematic literature review

No	Year of Publication	Title	Focus	Findings
1	2012	Determining Factors in Port Competitiveness: The Case of Fresh Fruit and Vegetable Produce Traffic in Spanish Ports	Analyze the factors of competitiveness of ports with regard to agri-food products. 27 Spanish port authorities was used as a data panel.	• For Any port to become competitive with regard to agri-food products, the existence of a logistics area inside the ports for transporters, the availability of high capacity and dry-port facilities are essential.
2	2014	Supply Chain Management and Sustainability in Agri-Food System: Italian Evidence	Examine the main challenges for the supply chain sustainability in the Italian agri-food value chain. A case study on Italy is used by collecting data from different sources.	• Italy is lacking knowledge sharing, logistics technologies, and collaborated and integrated views.
3	2014	Improvement in fresh fruit and vegetable logistics quality: berry logistics field studies	Explore a blueberry supply chain and illustrate how using accelerated shelf-life loss data to manage inventory rotation by first expiring first out (FEFO) versus first in first out (FIFO). A field study is used on blackberries in Mexico.	• FIFO inventory strategy is not capable of eliminating waste caused by accumulated, invisible, shelf-life loss. Hence, RFID temperature monitoring technology is important to significantly reduce waste and increase quality, profit, jobs in producing countries.
4	2014	Multiple Criteria Evaluation of transportation performance for selected agribusiness companies	Evaluate transportation performance of transportation in agribusiness companies. A Multiple Criteria Analysis (MCA) is used.	• Bad transport quality. • Lack of safety precautions. • Lack of fleet utilization.
5	2014	Agri-Food Logistics In The Mediterranean Region: Challenges And Opportunities	Assess the performance of logistics, and the challenges facing the agri-food trade to develop the logistics sector, especially transport and cold chain, in the Mediterranean region. Secondary data collection is used.	• Mediterranean ports are not able to meet the specific requirements for the transport and distribution of fresh fruit and vegetables. • Road transport is still by far more expensive than sea transport and only possible for intra community goods transport. • Road transport is faced with external constraints such as traffic jams, pollution, and highway maintenance.
6	2015	Appraisal of Logistics Management Issues in the Agro-Food Industry Sector in Ghana	Investigate the existing logistics management practices in 20 selected agro-food enterprises in Ghana. In-depth case studies is used.	• Inadequate cold storage facilities. • Lack of training in logistics management among others. • Inadequate cold vans. • Poor road networks.
7	2015	Cutting Food Waste through Cooperation along the Food Supply Chain	Investigate the causes and effects of food wastes and to find methods to reduce it. 44 qualitative expert interviews were conducted in Germany.	• Food waste occurs at all stages in the food chain especially in the agricultural process and transportation process which results in rejecting the quality of the food. Hence, it is important to improve it.
8	2015	Assessingthe transfer of risk due to transportation of agricultural products	Assess the significance of the transportation of agricultural products in Health risk assessment (HRA). A case study on Taiwan is used.	• Transportation of agricultural products is the major factor causing the transfer of risk between different countries as the agri- products will be more exposed to pollution.

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9	2016	Applying Value Stream Mapping to reduce food losses and wastes in supply chains: A systematic review	Investigate the impact of applying Value Stream Mapping (VSM) on reducing Food Losses & Wastes (FLW) in the supply chain. A systematic review of 24 articles was conducted.	• VSM has shown to improve the visibility of supply chain and creates information sharing method that is necessary to reduce FLW. • It improve production efficiency through the reduction of production costs, and hence the prices of food. • It eliminates unnecessary inventory and excess stock by eliminating uncertainty in supply chain.
10	2016	Influence of secondary packaging on quality of carrots during transportation	Illustrate the influence of packaging on quality change of carrots during transportation. A case study on farmers in Ciherang is used.	• The kind of packaging especially using plastics and longtime of transportation will negatively influence the level of damage.
11	2018	Logistic Challenges In The Short Food Supply Chains	Identify the logistical problems and solutions in the short food supply chains (SFSCs). A review was conducted on the Hungarian food supply chain.	• Refrigerated storage should be handled with operators who have the required knowledge to minimize logistics costs and limit emissions. • Transport vehicles should be loaded to its full capacity.
12	2018	Sustainable logistics barriers of fruits and vegetables - an interpretive structural modeling approach	Identify the causal factors of post-harvesting losses occurring in the transportation phase. Literature survey and expert opinions are used and analyzed by Interpretive structural modelling (ISM).	• Improper packaging, • Improper handling of packages, • Non-availability of refrigerated vehicles, • Packages getting exposed to the sun and rain while loading and loading, • Vibration of the vehicle, • Bad condition of roads, • Rash driving, • Excessive loading on the vehicles.
13	2020	Agile Supply Chain Management in Agricultural Business	Study agile supply chain management methods in agricultural business in small and medium-sized enterprises in Russia. A survey is conducted with the supply chain participants including manufacturers, wholesalers and consumers.	• Lack of digital platforms in the agricultural business market, • Weak partnership of manufacturers, • Poor awareness to use flexible supply chain management methods • Insufficient legislative regulation in the field of agricultural production and supply chain management • Lack of staff training sessions.
14	2021	A systematic literature review of the agro-food supply chain: Challenges, network design, and performance measurement perspectives	Identify the challenges in the Agriculture Food Supply Chain (AFSC). A systematic review of 108 articles are reviewed.	• Food waste, food safety and security, and miscellaneous are the main challenges including • Transportation, poor packing, strict export standards, improper cooling, poor storage facilities and inventory management. And for the common key indicators to measure the performance of AFSC are efficiency, flexibility, food quality and responsiveness.
15	2021	Achieving sustainability in food manufacturing operations and their supply chains: Key insights from a systematic literature review	Identify how food manufacturing companies implement sustainability in their supply chains and the barriers to waste and recycling management. A systematic review of 130 articles were reviewed.	• Insufficient transport quality • packing failure • Distribution among all the entities and • Lack of reverse logistics activities. Hence, shipments delays might occur which will result in causing negative impacts on the environmental sustainability
16	2021	Food waste reduction in supply chains through innovations: a review	Analyze the drivers and the barriers that affect the decision of supply chain operators to adopt innovations to reduce food wastes. A narrative literature review was carried out.	• Types of innovations have a high potential in reducing and preventing food wastes along the supply chain; however, they still must be economically feasible to be adopted by decision makers in the food supply chain.

17	2021	Efficient agri food supply chain in a sustainable transportation perspective	Discuss transportation sustainability in support of a sustainable supply chain from warehouses to end users, especially in agri-food products. A comprehensive review of several previous studies is used.	• The use of multimodal is the most rational consideration to meet green transport and sustainable food agriculture objectives in terms of travel costs and environment.
18	2021	Food Supply Chain Transformation through Technology and Future Research Directions – A Systematic Review	Review the digital and smart supply chains in eliminating waste in the food chain. A systematic review is used by reviewing articles from 2010 to 2021.	• Achieving transformation in the food supply chain would need a significant shift in operator's attitudes, as well as the roles and duties of public sector actors to apply smart packaging and warehousing using RFIDs and transportation using IoT.
19	2021	Finding Competitors And Strategies In Maritime Transportation Of Fruits And Vegetables In Spain	Propose model to the maritime traffic flow of some food products, traded internationally from Spain to reduce wastes. Complex network analysis (CNA) is used.	• There is a potential for the development of intermodal transport in general and maritime transport in particular in the area, which could certainly be helped by the effective development for the implementation of corridors.
20	2021	Problems Facing Agricultural Product Exporters and Solutions : A Case Study from Afghanistan	Investigate problems faced by agricultural product exporters in Afghanistan and propose solutions. A questionnaire is used with practitioners in Afghanistan.	• Inadequacy of government support • taxes and customs clearance • Transit transportation problems • Lack of quality control systems.
21	2021	Conceptual Study of Problems And Challenges Associated With The Food Supply Chain in Developing Countries	Review the main problems associated with the food supply chain in developing countries. A narrative review was conducted	• Absence of infrastructure for cold chains • Lack of modern processing facilities that result in high inadequacies and losses of food.
22	2022	Supply chain disruptions and containerized agricultural exports from California ports	Investigate the trade effects of the 2021 supply chain disruptions on containerized agricultural exports from California ports. A case study and Panel Data Collections are used.	• Port congestion and container shortages for containerized agricultural exports are the main challenges due to the world economic recessions.
23	2022	Logistics and Agri-Food: Digitization to Increase Competitive Advantage and Sustainability. Literature Review and the Case of Italy	Examine the current challenges faced by logistics with a focus on the agri-food sector in Italy. A review is conducted by presenting Italy as a case study.	• Digitization and new technologies are essential to support logistics and sustainability such as IoT, Bloch chain, and bridging an Infrastructure gap with digitization.

4.2 Assessing the current situation of the Egyptian agri-food sector

In order to identify the challenges and issues that are faced by the egyptian agri-food sector practitioners and recomend solutions and guidelines to create a competitive advantage for the egyptian agricultural food products, three semi-structured interviews were conducted. The interviews revealed that in order to achieve agile supply chain management, there are a lot of challenges in Egypt should be managed including: unavailability of equipped transportation means (reefer trucks), inadequate storage facilities for perishable agricultural products, lack of skills of new innovative farming methods, lack of integrated systems that alerts for wastes and losses, inadequate trucks and containers for carrying agri-food products that causes pollution, competition between different exporters, mainly in terms of prices, product quality and standards, and promotional efforts, raising sea level, land drought, spillage, damage or contamination causing quality and quantity loss due to inadequate processing and packaging methods, damage and spillage during transport because of inadequate transportation and distribution systems, spilled or damaged crops and products in market due to inadequate infrastructure and poor handling, and deterioration in quality and pests/disease attacks due to inadequate storage facilities and techniques.

4.3 Recommendations To Achieve Agile Agricultural Supply Chain Management In Egypt

The following roadmap represent the interviews outcomes of the current issues with their aggregated guidelines to achieve agile supply chain management in the agri-food sector.

TABLE 2. Roadmap for The Current Issues And Opportunities In The Egyptian Agri-Food Business

Agri-Food Supply Chain Issues	***Guidelines***
Lack of logistics activities management	• Conducting awareness campaigns. • Encourage private and public partnerships to increase logistics efficiency with foreign logistics investors • Enhance the educational level in Egypt concerning the logistics concept.
Climate change and Land Use Issues	• Assess the impacts of climate change on the domestic industries and environment and build a policy framework to minimize its impacts.
Competition in International Markets	• Explore the global opportunities for Egyptian products
Lack of digitized systems and Green Transportation	• Supporting market information flows, access to knowledge and training, and vertical linkages among small-scale farmers, traders, transporters, and buyers • Developing a monitoring system for losses.
Physical Infrastructure	• Develop a plan for multimodal infrastructure development. • Establish a successful partnership with foreign countries to implement their road and maritime infrastructure strategies in Egypt.
lack of qualified labor force	• Training in post-harvest handling for value chain actors focusing on packaging, marketing, distribution, research & development (R&D).

5. CONCLUSIONS AND FURTHER RESEARCH

In conclusion, this research contributed to knowledge by providing an overview on the main issues of the supply chain and logistics activities in agricultural food shipments with the aim of promoting agile supply chain management in the agricultural sector in order to create a competitive advantage for Egyptian agricultural food products. The findings revealed that logistics activities in Egypt need to be operated more efficiently as mentioned in the previous roadmap which discusses the problems including the inadequate infrastructure, limited transport capacities and resources, a lack of skilled labor force, the need to comply with carbon emission standards, and increasing operational costs due to warehousing issues. The major problems in Egypt which results in the over costs are the warehousing and transportation operations as they are considered from the highest logistics cost. Hence, a further research could be proposed to find and apply more solutions as follows:

- To conduct a research that investigates the impact of investing in agri-food integrated supply chain systems on the efficiency of the agri-Food supply chain.
- To conduct a research that investigates the applicability of applying multimodal networks and new logistics areas for transporting and storing agri-food products in Egypt.
- To conduct a research that investigates the development of the Egyptian seaports to be able to handle agri-food products in an efficient manner.
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