Logistics Chain Processes KPIs in The Egyptian Food Processing Industry

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Logistics Chain Processes KPIs in The Egyptian Food Processing Industry

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Abstract:

The vital impact of logistics chains has been acknowledged all over the world upon the food processing companies supply chains, and it is considered not only the backbone of any supply chain but also it is the vertebral cored for both sides the delivery of services, security, safety, transportation, inventory, warehousing management and cost efficiency and optimization perspective. The food processing industry key players are persisting to aligning their logistics with the Food processing supply chains potential requirements of delivery, movement, and storage.

Research limitations:

The outcomes of the research's empirical study, through the exploratory research which are based on, limited survey that are distributed to about one hundred and fifty logistics and supply chain food processing firms managers in great Cairo region. It was recognized that further researches is necessary to establish the exact nature of the causal linkages between Key performance indicators KPIs measures and strategic intent in order to gain insights into practice elsewhere. The major processed foods in the Egyptian food processing industry as listed in Table (1) below.

Table 1: Major Processed foods of the Food Processing Industry in Egypt

	Processed foods	**Companies**
1	**Milk and Fruit Juices**	Juhayna - Viva - Fargalla – Enjoy - Kaha - Domty - Edfina - Beyti – Dina Farms – Al Maray
2	**Soft Drinks**	Pepsi – Coca-Cola
3	**Ice cream**	Nestle - Iceman - Movenpick - Hawai
4	**Cheese (White and Cheddar versions)**	Domty – Greenland – Beyti - Bel Egypt - Panda Katilo - El Masrien – Halayeb
5	**Sweet and Salty Snacks**	Edita – Chepsi – Pepsi – Lays- Cadbury Egypt BimBim craft foods- Leader foods – Sinoerita - Timmys El Shamaadan
6	**Processed Food oil and Margarine**	Savola Sime - Ifeco Egypt - Arma Food Industries Migob Food Industries - Misr Gulf for Food Oil Integrated - Oil Tanta for Food Oil
7	**Drinking Water**	Nestle – Baraka – Hayat - Siwa - Aqua Mina Aqua – Aqua stone – Delta – Safi – Dasani – Sheweps
8	**Processed food and meat**	Chicken and vegetables Americana – Fargalla - Farm Frits - Fresh Foods El Sedour - Fast Foods - Meat Land – Aga -Montana Heinz – Agwaa-Gobar- Vitrac- Halwani- Kangari

Source: Industry studies Association, Annual Conference, Chicago, 2009.

Research Key words: logistics Key Performance Indicators (KPIs), inbound logistics, internal bound logistics, outbound logistics, food processing industry, and logistics chain processes performance.

Research Problem:

According to Saddle Creek Corporation (2014), By far, capacity problems are the most critical. Driver shortage and increasing customer demands in food processing industry also topped the list. While these challenges may not be surprising, they indicate that there is a significant opportunity for companies who are able to offer solutions.

Masood, Farid, (2015), argued that as the available intensive problems all over region's supply chain infrastructure, Middle Eastern states would face unnecessary losses, spoilage, delays, lack of quality logistics, and strategic warehousing. As consequence, of the lack of quality logistics, problems in the food supply chain emerges. Continuing political instability is also putting increased hassle on the region's food processing supply chains, according to Global Agri-Investing. Even in countries not immediately affected, ports and shipments are under increased scrutiny, tighter security, and increasing transit times.

Widening the perspective on a Strategic food security issues, Masood suggests the region's 80-90% food import rate is likely to be sustainable, provided importing countries remain able to maintain high export incomes. Nevertheless, with the vast majority of food imported, the region will still need to maintain some Industrial Logistics Chain Processes itself.

Moreover, the region will face a gigantic challenge to attract remarkable investment for food processing projects as consequence of scale lacking that enlarges logistics time and swells cost.

The research Objectives:

1. Determining the ability of applying various Logistics KPIs in the Egyptian food processing industry logistics chain.
2. Knowing the suitability of performing proposed standard logistics processes in the Egyptian food processing industry.
3. Knowing the KPIs that mostly affect the Egyptian food processing industry logistics processes.
4. Determination and sorting the most important KPIs in the Egyptian food processing industry logistics chain.
5. Setting a common logistics KPI raw model.

6. Measuring the Logistics KPIs model Impact on Logistics chain processes performance in the Egyptian Food Processing Industry.

Hypothesis

1. Standardized logistics processes key performance indicators KPIs are suitable in the Egyptian food processing industry logistics chain.
2. Logistics KPIs improve the Egyptian food processing industry logistics chain.
3. The proposed Logistics key performance indicators KPIs model has a significant Impact on Logistics chain processes performance in the Egyptian Food Processing Industry.
4. The Egyptian Food Processing Industry is not applying all of the international standardized logistics processes key performance indicators KPIs

Introduction:

During the most recent three decades, goods flow has tremendously increased, even though the amount of goods remains at the steady state. Increment in the variability and variety of goods, Just-in-time delivery system, lean six sigma, low load rate, mass customization, specialization and centralization of processed food production systems, globalization and seasonal variations are among the main challenges of logistics system, which may lead to the necessity of developing effective logistics in the sector.

On October 26, 2014, Egypt decided to keep synchronized to the global efforts exerted now a day to cluster the intensive networks of supply chains all over the world. Throughout, launching one of the most important and strategic logistics centers in the region, and it would be established on Domiatte port, with investments up to 15 Billion EGP, aiming to positioning Egypt to be an international pivot and center barter for passing around and storing grains and food processing merchandising. On purpose of saving and providing the national and the entire regional markets with its requirements. Nevertheless, freight forwarding is moving away from its original Structure, built on extensive networks of local branches. To improve efficiency and service, the food processing industry in Egypt is evolving toward more centralized networks, with large platforms and hubs at the national and regional levels. Despite consolidation, this new model hasn’t been fully adopted yet.

In reality, many players in Egypt still operate extensive local networks as a center of their gravity where they originally based. Moreover, August 2015, Egypt inaugurated the building of an extra waterway alongside the existing Suez Canal. This very ambitious project is set to cost around EGP60 billion (USD8.4 billion), and is, according to the Suez Canal Authority, estimated to more than double revenues from USD5 to USD13 billion annually by 2023. On August 6, 2015, it is acknowledged all over the world that Egypt nominated to be one of the most prominent logistical center of gravity to the whole world throughout the historical opening of the new Suez Canal. Egypt accessed large key markets through various multilateral and bilateral trade agreements with African countries; mainly the Common Market for Eastern and Southern Africa (COMESA), which secures benefits to Egyptian-based producers and re-exporters supplying these markets. Sales Potentials Are Rising with a growing population of more than 80 million, Egypt represents one of the largest consumer markets. Global food processing suppliers consider the Egyptian market of significant importance, as witnessed by the arrival of dozens of global food processing brands and the sharp expansion of retail food processing sales in the past two years. Although the Egyptian food processing sector is considered one of the oldest sectors in the economy, yet the consumption still exceeds the processed food production, indicating that the market is still unsaturated, with great opportunities to absorb unmet demand.

Effective logistics chains are a critical success factor for both manufacturers and retailers (Brimer, 1995; Tarantilis et al., 2004). Effective logistics chains encompass delivering the right processed food, in the right quantity, in the right condition, to the right place, at the right time, for the right cost (Aghazadeh, 2004) and it has a positive impact on the success of the partners in the supply chain (Brimer, 1995) .

Food processing logistics chain is a significant component within the entire logistics system. The food-processing sector plays a significant role in economy being one of the main contributors to the GNP of many countries, particularly in developing countries. According to the New Zealand (IFAB) 2014 food processing Review, the research is a comprehensive overview of the Food Processing Industry Logistics Chains in Egypt from dairy and processed food over beverage companies, as well as the latest industry news.

According to the federation of Egyptian industries January 2015 Egyptian food processing companies and strengthening, the image of the Egyptian food processing industry domestically and globally includes more than 2420 industrial institutions. “the Support for Environmental Assessment and Management Project”, (SEAM) that implemented by the Egyptian Environmental Affairs Agency (EEAA), focused in its review 2014 on food processing sector that occupies 20% of the distribution of production value by sector. According to the International Trade Exhibition for Food and Beverages May 2015, Cairo International Convention and Exhibition Center (CICC), Egypt’s ideal location grants it distinct access to key regional markets.

Literature review:

1. Logistics Phases, Areas and Processes:

A. In-bound logistics includes:

- The first phase On-farm: In-fields transportation, harvest collection, processing in the fields, temporary storage, fertilizers and seeds distribution. The second phase transporting agricultural processed foods from fields to homesteads, transport of agricultural executed from homesteads to fields and vice-versa, transport of seeds and fertilizers to the fields, and transportation of finished processed foods to and from different plots etc .
- The second phase Off-farm transportation, transport of agricultural processed foods including animals to local markets, transportation to grinding mills, transport of industrial processed foods (commercial fertilizers, implements, seeds, etc). From markets to homesteads, transportation to health centers and schools, religion centers, and transportation to towns and bigger market.

According to Selim, (2009), The Egyptian perishable processed foods sector, mainly the fruit, vegetables, and dairy sector, is constrained by a transportation and storage system that is very damaging to processed food quality. It has estimated that up to 40 percent of total production of highly perishable processed foods are damaged or lost in transit and handling .

According to industry sources, estimates of agricultural; raw material losses run as high as 60 percent. This is the result of poor packaging, lack of cold chain facilities, rough transport, and multiple labor handling.

The impact of this on firms in the food processing industry is inconsistent supply and poor quality inputs. The impact on consumers is higher retail prices and lower quality than would be the case with proper post-harvest handling. In case of lacking of processed food delivery system coordination (In-bound logistics), farmers are reluctant to transport on their own either as head loading or using pack animals either to short or long distance markets. Moreover, the unavailability of the required transportation mechanics has negative consequences on quantity of finished processed foods could be transported, putting into account Spoilage, wastages, and losing market opportunities with the internal-stream. On the other hand, Transportation time increases the lead-time for replenishing the internal stream and the down-stream requirements considering the core competencies (the right time, quantity, quality, cost and place).

These constraints may result in reducing processed food production and marketing opportunities for farmers, and consequently shortage of processed food for consumers. The reduction of spoilage and damages that could improve the marketing value of the produce may necessitate the availability of adequate processing, packaging and storage facilities and management for each varieties of produce (Gebresenbet and Oodally, 2005).

All KPIs described in table (2) coming below, measures the fulfilment of the mutual agreements made between the in-bound of the up-stream and the internal bound of the internal stream. Inbound logistics KPIs are applicable on the different transportation mechanics or tools involved in the tiers levels of supply in the in-bound logistics of the up-stream supply chain. All KPIs should be broken down, e.g. per transportation container, Original equipment manufacturer (OEM), Material Suppliers, flow, market, transport mode in order to identify improvement areas .The general assumption is that a good result in inbound logistics KPIs means an efficient logistics chain that reduces the total cost, even if the inbound logistics KPIs as such are not measuring the cost.

Table (2): Inbound KPIs:

No.	Indicator	Main Criteria	Purpose
1	**Arrival Precision**	Time: Carrier arrives within agreed time window	To secure the receiving/loading process
2	**Pick up discrepancy Alert**	Alert: Carrier / LSP alerts (addresses pick up discrepancies)	To address emergency actions and thereby minimize processed food production disturbances
3	**No. of incidents**	Security: Carrier / LSP handles goods properly	To ensure that the goods are properly handled and thereby minimize processed food production disturbances
4	**Late delivery Alert**	Alert: Carrier alerts (addresses late delivery)	To address emergency actions and thereby minimize processed food production disturbances
5	**Filling rate in transport equipment**	Efficiency: Transport equipment is efficiently used	To measure the efficiency in loading and thereby reduce the cost and environmental impact
6	**Stock accuracy**	Security: LSP handles goods properly	Total stock units discrepancy in inventory (e.g. cells, part number) in relation to total stock units estimated

Source: Odette Pan-European collaboration and services platform working for the entire automotive network. September 2007.

B. Internal-bound logistics includes:

Lambert and Pohlen, (2001), debated that the articles majority about supply chain metrics are in actuality about internal logistics performance measures that have an internal focus and do not capture how the firms drive value or profitability in supply chain. When measuring internal logistic through the in-stream supply chain performance, some metrics seem to be measured more often in comparison to the others. In this context, Chan, (2003), explained that the profits of food processing companies directly affected by the cost of its internal operations, and added that it is the most significant direct kind of measurement. Keebler and Plank, (2009), discussed that effectiveness and cost measures are captured more often measured while processed food productivity and utilization indicators are measured much less often in the companies. As stated by Chia, Goh and Hum, (2009), that the most prominent three indicators that are commonly measured are financial in nature (profit before tax, gross revenue, cost reduction), and for non-financial indicators, on-time delivery, customer satisfaction, service quality, and employee turnover are measured more. Moreover, they noted that the least measured indicators seem to be the number of suggestions implemented per employee, market share and new services implemented.

In accordance with Asadi, (2012), who concluded that Internal logistic is a part of supply chain so its performance cannot be measured apart from the supply chain, what will contribute to the improvement of logistic and supply chain performance as a whole, and to be more precise the internal logistics is synchronized with the in-stream supply chain.

According to Keebler and Plank, (2009), the key players for the internal logistics measurement are upper management support and resource availability in the in-stream supply chain, on the other hand the major barriers are resource availability in (IT) function, availability of information in general and the perception of the accuracy of the information.

Ran, (2009), argued that traditional logistics generally refers to activities after processed foods manufactured, such as packaging, transport, loading, unloading and warehousing, etc. Moreover, modern logistics stated the integrated logistics management concept and implementation. Specifically, the meaning to extent and combine the social logistics and internal logistics, the supply logistics from the beginning, after the processed food logistics, re-entering the sales logistics, at the same time, go through the packaging, handling, transportation, storage, processing, distribution and deliver to consumers, and finally have recycling logistics. In addition, the DHL, (2015) defined that Logistics is complex and simply everywhere and added that modern logistics involves planning, creating and monitoring flows of goods and information.
To my point of view, it is important to discover that the modern logistics should be the means of concurrent processed food production and Operation of the entire food processing manufacturing process. Moreover, to information flow and activity related services. Thus, logistics is the processed food flow within manufacturers, through materials procurement and physical distribution of these two functional activities, respectively to both supplier and customer orientation of the longitudinal extension of the structure of the internal logistics chain throughout the in-stream supply chain system.

C. Out-bound Logistics:

Outbound logistics processes, binds the supply chain downstream together, it is the end of the logistics chain and comprise activities required collection, storage and physical distribution of the final processed foods to customers (Hitt et al., 2007). Moreover, a wide range of processed food produced that in need to be stored, packed, and transported to the customer.

According to Lysons and Farrington (2003), outbound logistics activities requires moving the processed food from operations to the end user and include finished goods warehousing, order processing and picking, packing, shipping, transporting and maintenance of a distribution network. In addition, Outbound logistics is one of the primary activities of the value chain others being inbound logistics, operations, marketing and sales and service.

Sainudeen, and others, (2013), believed that various entities in the outbound logistic system includes: parking area where trucks wait for the registration of their arrival, entrance gates, exit gates, check-up zones, sales offices where sales invoices are given to the trucks, packing, and loading of processed food in ballets onto trucks and wagons through equipment directly from storage area, and docking platform.

The goal of these activities is to offer the customer a level of value that exceeds the cost of the activities, thereby resulting in a profit margin. The success of outbound logistics entails a balance of total outbound logistics costs and customer service levels. Profit can be attained through On-Time In-Full (OTIF), while costs can be minimized through efficient outbound logistics operations, Delivered In-Full, On-Time, (DIFOT) for customer serves, both of them are considered measurements of delivery performance in a supply chain. Some consider it superior to other delivery performance indicators, such as shipped-on-time (SOT) and on-time performance (OTP), because it looks at deliveries from the point of view of the customer. It measures how often the customer gets what they want at the time they want it. (Rushton et al., 2006).

The basic goal of outbound logistics is to process the processed foods issued and delivered from the finished processed food warehouse as follows:

- Standard outbound deliveries: Processed foods delivery to customers based on sales or service orders.
- Return to supplier deliveries: The return of damaged or unwanted processed foods to suppliers based on inbound delivery.
- Internal company stock transfers: Transfer of stocks between various locations of the same company based on stock transfer order.
- External company stock transfers: Transfer of stock between two companies that belong to the same holding company based on sales orders.

Outbound logistics constitutes a number of logistics tradeoffs that need to be managed to provide increased service and reduced costs. Of essence to outbound logistics is that it must be efficient and cost effective whilst providing an acceptable service to the customer. The Chartered Institute of Logistics and Transport as cited in Rushton, Croucher, and Baker, (2006), who suggested that, to achieve an efficient and cost effective logistics pipeline, resources should be positioned at the right time, at the right cost, in the right place, and in the right quality, with the right quantity, and with the right price.

According to Jayaraman, and Luo, (2007), Companies that do not recognize the importance of an effective reverse logistics strategy as part of their value chain risk damaging customer relations and may seriously jeopardize their brand image and reputation. A good reverse logistics program can be a differentiator and provides means of gaining market advantage. In our perspective, a redefined value chain should be a part of the overall business strategy for manufacturers or retailers who handle product returns. Some companies have reverse flows on the outbound side of their logistics systems. This is true of companies producing durable processed foods that the customer may return for trade-in, for repairs, or for salvage and disposal.

Companies that deal with returnable containers also fit this model. Increased concern with the environment will require more companies to develop reverse logistics systems to dispose of packaging materials on used processed foods. According to Linton and Jayaraman, (2005). Retailers, for instance, can use reverse logistics as a strategic variable by keeping consumer products fresh and appealing. Reverse logistics is defined as "*the process of planning, implementing, and controlling the efficient flow of materials, in- process inventory, finished goods, and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal*" (Rogers and Tibben-Lembke, 2001). Moreover, Jayaraman, and Luo, (2007), argued that typical reverse logistics activities would be the processes a firm uses to handle used, damaged, or outdated products from the end-customer or the reseller.

2. Logistics Indicators Components Measures:

a. Logistics performance

As a part of the food processing supply chain performance, Chow, Heaver and Henriksson, (1994), defined logistics performance as the extent to which goals such as cost-efficiency, profitability, social responsibility, on-time delivery, sales growth, Job security and working conditions, customer satisfaction, keeping promises, flexibility, Inputs fair prices, decreased losses and damages and Processed food availability. According to Chen and Paulraj, (2004), measuring logistics chain performance can facilitate a greater understanding of the supply chain, positively influence actors' behavior, and improve its overall performance. As per the performance measures of logistic supply chain, there are various definitions and key performance indicators (KPIs), hence, the focus of this study is on the entire logistic indicators, a brief overview of both supply chain and logistic needed to narrow the stream of literatures in this context. The supply chain consists of different levels, e.g. supplier, manufacturing, distributing, and end-consumers, as if it is a network of food processing companies that influence each other as argued by (F. T. S. Chan, 2003).

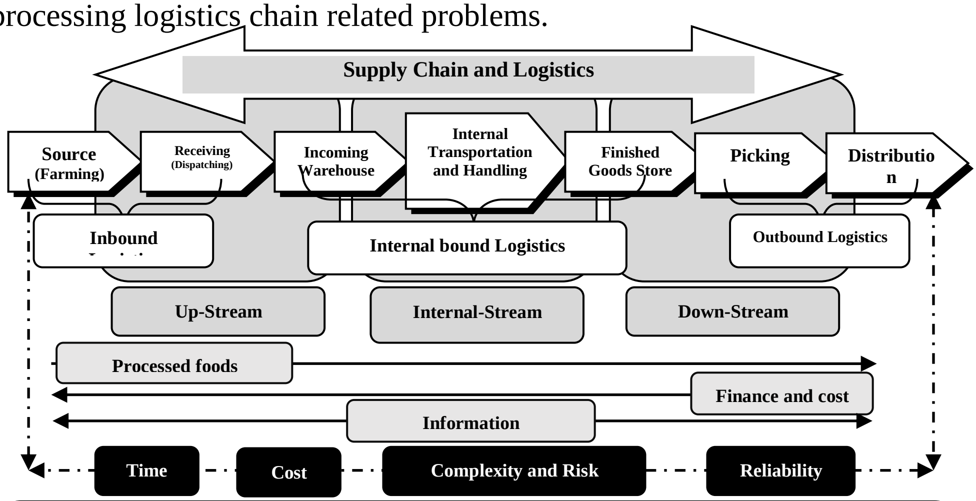
Logistic is that part of the supply chain process that plans, implements and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customer requirements, as quoted by (D. M. Lambert and T. L. Pohlen, 2001), from (The Council of Logistic Management 1998).

In fact, the existing literature faces some difficulties in defining and collating logistics key performance indicators:

- Firms' focus on traditional financial measures (gross revenue, profit before tax, and cost reduction) despite the need to provide a balanced approach to performance measurement (A. Chia, M. Goh and S. H. Hum, 2009).
- The complexity of supply chain metrics and disagreement over an appropriate categorization (C. Shepherd and H. Günter, Measuring supply chain performance, 2006).
- Lack of a balanced approach to integrate financial and non-financial measures, lack of a system thinking; viewing supply chain as a whole entity and the loss of the supply chain context, and Absence of an approach for developing and designing supply chain performance measures (F. T. S. Chan, 2003).

b. Logistics services in developed vs. developing countries

Lately, Food processing Logistics chain have been dramatically put under development, as more efficacy management system is required for the food processing supply chain phases, planning, physical collection of primary produce from fields and homesteads, processing and storage through various chain phases, handling, packaging, and distribution of final processed food. In the food processing supply chain, many stakeholders such as farmers, vendors/agents, wholesalers, rustic retailers and suppliers and transportation is involved. At all phases, information flow and processed food production management is essential to maintain the food processing quality throughout the chain (see Figure 1). The flow of input resources from farms to consumers' needed to be identified and described in detail and the restrictions in each phase needs to be identified to develop appropriate model of KPIs as some solutions for food processing logistics chain related problems.



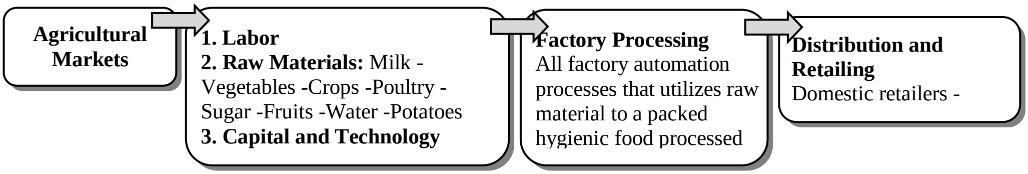
Logistics Indicators Components Measu… Supply Chain Pl… Logistics chain Phases

Source: The researcher based on:

- World Bank, Global Logistics Indicators Survey, 2005.
- Logistics along the entire logistics chain, DHL Logbook - in cooperation with Technical University Darmstadt.

According to (selim, 2009), who argued that factor inputs include agricultural raw materials, labor, and capital and technology. Since food, processing is highly dependent on availability of agriculture raw materials, the structure and performance of agriculture markets greatly affects the performance of the food processing industry.

The entire supply chain however is very broad, starting with production of processed foods raw materials, inclusion of other factor inputs such as labor, factory processing, and finally ending up with a retailing phase, which could be domestic retailing or distribution for international exports, see figure (2).



- **Source: Tarek H. Selim, (2009), "The Egyptian Food Processing Industry: Formalization versus Informalization within the Nation's Food Security Policy", American University in Cairo, General Industry Studies, Annual conference, checago.**
- **Fig.2. The Food Processing logistics Chain.**

Noting the major implications of packaging facilities lack may be one of the restrictions in the logistics chain internal bound from small farmers during the movement from subsistence to commercial farming. Significant post-harvest losses occur when especially vulnerable and defected crops and fruits brought to mechanical damage (gebresenbet and Bosona, 2012). For that reason, packing management has to be took into account in the development of food processing logistic chain.

The development of smallholder agriculture as an in-bound logistics through the food processing supply chain up-stream in developing countries is very sensitive to transport strategies. According to Gebresenbet and Oodally, (2005), many isolated farmers have little opportunity as their potential marketing activities hindered by insufficient transport facilities. The rustic transport plans must address the needs of people, as much as possible at the household level. Such planned transport system enables smallholders make the movement from subsistence to small farming businesses, what enables them to harvest and market crops, Moreover, facilitating roads infrastructure (that includes feeder roads, tracks, and paths), storage, transport and communication services increases mobility and encourages processed food manufacturing.

3. Logistics key performance (KPIs) assessment framework

a. Indicators of time

None of the studies cited above takes explicit account of transport time as distinct from cost. Hummels (2001) is among the first to do so, using cost (by mode of transport) and shipping time for each bilateral trade flow, he estimates the implicit value of time saved in shipping time. He estimates that each day in shipping time reduces the probability of trade by 1 percent (for all goods) and 1.5 percent (for manufactured goods). Hausman, and others (2005).

Logistics inefficiencies harm the competitiveness of private firms through their effects on both cost and time. The costs relate not only to the direct costs of transporting products; goods in transit incur indirect costs such as inventory holding costs (Hausman, 2004). The longer the transit time, the higher are the costs. Hummels, (2001), found that shippers are willing to pay a premium for faster delivery.

Other indirect costs are incurred when delivery times and reliability are uncompetitive, severely affecting a country's position in highly competitive international markets demanding just-in-time delivery. Product value often declines with time while in transit. For perishable products, spoilage or wastage may increase with transit time. Products with time-sensitive information, such as newspapers, decline sharply in value as that information becomes obsolete. Seasonal and fashion apparel has similar time sensitivity. These costs can also reflect lost opportunities, as when critical inputs cannot reach manufacturing plants in time or perishable commodities cannot reach markets in time—or when production plants must hold higher-than-optimal levels of raw material inventories to cover for logistics delays.

The purpose of this paper is to examine the effect of logistics cost and time on bilateral trade patterns. The paper uses a supply chain framework to examine the time and cost of importing and exporting a typical 20-foot FCL container with medium-value products for 80 economies. It also includes, for the first time, a more complex dimension of time—certainty in time of delivery. Reliable delivery of goods within narrow time windows, with minimal uncertainty, may be even more important than average delivery time to a firm's ability to compete in just-in-time regimes.

The data set, compiled by the World Bank in 2005, contains detailed country-level data on the time and cost of moving a typical 20-foot FCL container from the port of entry to a firm in the most populous or commercially active city in the country—or to the port of exit from a firm in that city.

The use of a disaggregated supply chain framework makes it possible to measure time and cost for such activities as trade document processing, approvals needed for import or export transactions, customs clearance, technical clearances, inland transport, terminal handling, and container security measures. In addition, the data illuminate underlying policy and institutional issues that affect time and cost along the supply chain, such as the percentage of containers inspected, the number of agencies with the power to inspect goods, and whether risk-based criteria are applied for inspections.

Hummels, (2001), found that each additional day of transit time for a country's trade would reduce the probability of the United States sourcing from that country by 1–1.5 percentage points. He argues that transport time influences the volume of trade for two reasons:

- Because goods that are in transit constitute inventory for the buyer or the seller (depending on where the buyer takes ownership), longer transport time translates into higher inventory carrying costs (Hausman, 2004).
- Goods awaiting inspection or intermodal transfer may also incur warehousing costs. The value of some goods depreciates with time after their shipment from the point of origin.

Reliability and consistency in delivery time are also critical. In addition to the average time for delivery of a product, what matters in global value chains is the reliable delivery of goods within narrow time windows, with minimal uncertainty in time. This is true for consumer goods as well as for intermediate goods in global value chains that thrive on just-in-time inventories. Similarly, highly efficient retail chains source consumer products such as apparel globally and demand guaranteed deliveries within very narrow time windows. Since apparel orders may be placed weeks or even months in advance, timeliness becomes critical. The supply chain will incur a cost if the goods arrive either early or late. If they arrive early, the shipper may have to pay to warehouse them until the purchaser takes delivery. If they arrive late, the purchaser may refuse to take delivery, which means markdowns or outright returns. The World Bank, Global Logistics Indicators Survey, 2005. Has recommended the Indicators of complexity and risk factors as follows:

- *Total time for trade-related procedures (average and maximum)*
- *Customs inspection clearance time (average and maximum)*
- *Technical control clearance time (average and maximum)*
- *Time for trade document procedures (average and maximum)*
- *Inland transport time*

- *Additional time due to Container Security Initiative*
- *Vessel turnaround time (average)*
- *Time to resolve customs appeals (average and maximum)*
- *Vessel waiting time to obtain berth*

b. Indicators of cost

According to, Wittmann, Hans, (2010), It is obviously accepted now a days that any competitive network of global logistics is the backbone of international trade and supply chains. Many countries have not benefitted from this. The World Bank Reported on the topic of trade logistics competitiveness that "*Improving logistics performance has become an important development policy objective in recent years because logistics have a major impact on economic activity*." Furthermore, "*The importance of efficient logistics for trade and growth is now widely acknowledged. Analysis based on the 2007 logistics performance indicators (LPI) or similar information has shown that better logistics performance is strongly associated with trade expansion, export diversification, ability to attract foreign direct investments, and economic growth*".

As the logistics costs increase, the costs of processed foods in the marketplace increase, placing an added unbearable burden on the consumer and having distractive effects on the competitiveness of food processing companies, moreover maintenance and repair costs increase in logistics has a negative implications transportation operating costs for transport operators. Bad road conditions results also damage to transported cargo. Consequently, the price of processed food increases – the increased transportation costs are absorbed either by the seller or, by us, the consumer. The researcher perceived three ways to overcome increased processed food prices, Improved packaging of transported processed foods. This will increase the total packaging costs of the manufacturer, resulting in costs increase to the consumer. Table (3) summarizes some of the relevant logistics activities.

Table (3) Logistics activities (cost objects) and their performance indicators

	Logistics activities	Performance indicators
1	**Procurement**	No. of orders - time of order
2	**Distribution**	No. of deliveries - time of delivery
3	**Transportation**	• Transport distance (vehicle kilometer) • transport performance (ton kilometer)
4	**Internal transportation**	No. of movements - time of movements
5	**Inventory**	Inventory no. of items - lead time
6	**Disposition**	No. of operations - operation time

Source: Bokor, Zoltar, (2010)

Logistics costs effective control within processed food companies and the rationalization of logistics activities are missing according to Bokor, Z., (2010). A possible solution may be the introduction of ABC, as it is applicable to allocate indirect costs such as logistics costs. ABC can also be combined with the economic value added (EVA) method, which enables the inclusion of capital costs as presented by Ye, X., (2011).

ABC is an appropriate technique in computing the costs in processed food productive systems according to a make-to-order principle. An extensive ABC model for evaluating the change in the processed food supply system established with a detailed activity and cost driver analysis for company-intern storage systems. ABC is the most suitable methodology in allocating the costs of indirect activities, such as storing and materials handling, which do not directly add value to the manufacturing of the processed food, as claimed by Satoglu, S. I., and others, (2012)

ABC is applied for assessing inventory costs, which controls inventory operations, according to Berling, P., (2008). A customized costing system for order management in processed food companies using ABC and activity-based management (ABM) has been developed and integrated as a decision support system, as argued by Khataie, A. H., and others, (2011), putting into account the world bank, global logistics indicators, 2005 as follows:

- *Total cost for trade-related procedures*
- *Port- and terminal-related charges*
- *Total cost for trade document procedures*
- *Border control costs*
- *Inland transport cost*
- *Additional cost due to Container Security Initiative*
- *Waiting time at border crossings (average and maximum)*
- *Inland freight cost (through transit country)*

Modern processed food systems using material requirement planning (MRP) or just in time (JIT) supply techniques are evaluated by processed food cost calculation based on ABC. It has been proved that the push and the pull supply systems can be compared with each other effectively through using improved logistics costing as discussed by Özbayrak, M., and others, (2004).

c. Indicators of complexity and risk factors

The key function of the studies briefly presented above is to assess country-specific conditions as well as their competitive status, with assessments being carried out without reference to industries, companies or goods (Matthes 2005, pp. 78-9). Comparing country rankings using logistical criteria paints a more complex picture and suggests that the divergent results of country assessments are explained by the different data sources and calculation procedures used (Berndt, Fantapié Altobelli and Sander 2010, p. 119). The selected criteria and publications aim to assess and compare factors relevant to the country in order to identify the potential for optimization. However, this selective and isolated approach stands in sharp contrast to efforts in the field of logistics that aim to capture the process-orientated, holistic interplay of activities. Optimizations limited to individual activities may not be ideally effective because of interdependencies and interfaces (Ihde 2001, p. 246). Over and above our criticism of assessment methods, we also have serious doubts about the way data is collected. One often finds that assessments not only use hard, objective data but also soft, subjective data such as opinions and personal estimates. The World Bank, Global Logistics Indicators Survey, 2005. Has recommended the Indicators of complexity and risk factors as follows:

- Total number of documents per trade transaction
- Number of signatures per trade transaction
- Criteria for customs inspection
- Percentage of containers inspected
- Level of customs inspection
- Speed (inland transport by trucks) (kilometers per day)
- Frequency of vessel calls at port
- Number of agencies that have the power to inspect goods
- Number of times consignments are typically inspected
- Percentage of containers electronically scanned
- Percentage of containers physically inspected
- Damage or pilferage as percentage of value of container

- Shutdown of port due to natural disaster and labor dispute (days)
- Whether the port is a signatory to the Container Security Initiative
- Harmonization of documents with transit country
- Number of transit countries crossed
- Number of borders crossed
- Whether there is free transit access for vehicles across borders

d. Indicators of reliability:

Logistic system reliability defined as its ability to perform supporting task under set of conditions for a specified time interval, without any failures (Nowakowski, Werbińska, 2007), then the reliability of supply process mainly encompasses:

- Delivery reliability which is defined as the probability of in-full delivery being performed without any delay with respect to the customer's specified time;
- Transport reliability which is the probability of fault-free delivery being performed on time;
- Reliability of logistic support infrastructure that includes performance parameters of support personnel and support facilities (support and test equipment and support tools).

Reliability of logistic system defined differently from military and business oriented point of view. According to the glossary published by Defense Systems Management College (OPNAV, 2003), logistics reliability recognizes the effects of occurrences that place a demand on the logistics support structure without regard to the effect on mission or function.

According to the glossary published by Defense Systems Management College (Nowakowski, Werbińska 2007): Logistics reliability is the measure of the ability of an item to operate without placing a demand on the logistics support structure for repair or adjustment. Logistics reliability recognizes the effects of occurrences that place a demand on the logistics support structure without regard to the effect on mission or function.

Similar findings reported by Menon et al, (1998), who list the most important factors relevant for customers in their selection of an LSP, speed and reliability, loss and damage rate and freight rates (tariffs).

According to the findings of McKinnon, Alan, and others, (2008), several papers and reports published since 1998, which shed new light on the links between congestion, reliability and logistical efficiency. This research addresses five themes:

1. Assessments of the impact of congestion / transport disruptions on supply chains.
2. Estimation of the value companies attach to the reliability of freight transport.
3. Analyses of freight transportation operators' perceptions of congestion-mitigation policies.
4. Surveys of company responses to declining freight transport reliability
5. Modelling city logistics systems to minimize the impact of traffic congestion.

Sarmiento et al (2007) provided a general review of the relationship between delivery reliability and the efficiency and performance of different types of manufacturing operation. In a study for the Dutch government, Rand Europe examined the value of reliability (VoR) in freight transport (Hamer et al., 2005). It presented monetary values for a 10% change in reliability on six freight transport modes (road, rail, inland waterway, short / deep sea ship and air cargo). There is little commentary on the derivation of these values. The report also includes a brief summary of an expert discussion on the issue of freight VoR, but acknowledges that there was no consensus nor even a majority position within the expert group'. The only point of agreement was that more research was required!

The focus of the study by Kuipers and Rozemeijer (2006) in the Netherlands was the response of shippers and freight transport operators to worsening traffic congestion. In focus group discussions with these companies, they differentiated measures at the strategic, operational and tactical levels (Table 4).

McKinnon, Alan, and others, (June, 2008), Major sources of delays were the poor reliability of agency drivers, vehicle break-downs and hold-up at previous delivery points on multiple-drop rounds. Cross-docked products spend an average of only 2.5 hours in the DC. The company indicated that inbound delays „very often" caused the late dispatching of outbound vehicles and the failure of inbound produce to be transferred in time onto the scheduled outbound vehicle.

Table (4): Measures taken in response to the declining reliability of road transit times.

	Operational measures	Tactical measures	Strategic measures
Road transport companies	Earlier departure of trucks (and later return) Delivery at an earlier time Use of more trucks Use of back up trucks	Make better agreements with shippers on delivery times Broadening of planning horizon Use of night distribution Use of planning software Use of mobile telephone	Consolidation of transport-networks with other transport companies Strategic cooperation with other transport companies Use of consolidation centers Increase the number of DC"s Move DC"s towards important customer locations Design of new and innovative logistics concepts
Shippers	Relax transport planning Longer opening hours of facilities Assign longer time windows per truck	Make more use of ICT control tools Adapt level of stocks Narrowing of planning horizon Allow night distribution	Increase the size of DC"s to increase the level of flexibility in stock keeping practices Increase the number of DC"s Design of new and innovative logistics concepts

Source: Kuipers and Rozemeijer, 2006

Table (5): Logistics Phases, Areas and Processes Model

Logistic	Phase	Area	Type of Service	Process	Withdrawal Amount	Type of Cost	Unit Of Measure	Prices
1	Inbound Logistics	Receiving	Provision of supplied goods in flawless condition for internal storage / processing	• Unloading of pallets with a forklift • Manual inventory of goods • Random / complete control	• Average number of pallets to be unloaded per period • Average number of items to be registered per pallet • Average number of items to be checked per pallet	• Wage costs • Fuel costs • Depreciation • Interest costs • Repair and maintenance costs • Wage costs • Wage costs	Month Litre Year Year Hour Month Month	€ wages / month € / Litre AW / n Interest rate € / assembly hour € wages / month € wages / month
2	Internal Bound Logistics	Incoming warehouse	Storage of types of goods to be provided	• Storage of pallets in a small-aisle warehouse	• Average number of pallets to be stored per period	•Interest costs (on inventories) • Interest costs (on capital tied up in storage facilities) • Depreciation (on storage facilities) • Insurance costs • Energy costs	Year Year Month kWh	Interest rate AW / n € bonus / month € / kWh
3		Internal transport and handling	Transport and provision (positioning) of a defined amount of certain goods from one location to another	• Transport with a forklift • Manual provision of goods	• Average number of pallets to be transported per period • Average number of pallets to be provided per period	• Wage costs • Fuel costs • Depreciation • Interest costs • Repair and maintenance costs • Wage costs	Month Litre Year Year Hour Month	€ wages / month € / Litre AW / n Interest rate €/assembly hour € wages / month
4		Finished goods store	Storage of types of goods to be provided	• Storage of pallets in a small-aisle warehouse	• Average number of pallets to be stored per period	Interest costs (on inventories) • Interest costs (on capital tied up in storage facilities) • Depreciation (on storage facilities) • Insurance costs • Energy costs	Year Year Year Month kWh	Interest rate Interest rate AW / n € bonus / month € / kWh
5	Out Bound Logistics	Picking	In accordance to a contract, provision of a defined amount of certain finished processed foods at a particular time	• Manual composition of finished processed foods • Manual packing and shipment-ready provision	• Average number of finished processed foods to be composed • Average number of finished processed foods to be packed and made ready for shipment	• Wage costs • Wage costs • Packing-material costs	Month Month kg	€ wages / month € wages / month € / vkg
6		Distribution	Finished processed foods delivered to the recipient through the coverage of time and distance	• Transport by truck • Storage of pallets in external warehouse (SGL)	• Average number of pallets to be transported over an average amount of kilometers • Average number of pallets to be stored per period	a. Wage costs b. Fuel costs c. Depreciation d. Interest costs e. Car insurance and taxes f. Repair and maintenance costs g. Interest costs (on inventories) h. Interest costs (on capital tied up in storage facilities) i. Depreciation (on storage facilities) j. Insurance costs k. Energy costs	• Month • Litre • Month • Year • Month • Hour • Year • Year • Year • Month • kWh	• € wages / month • € / Litre • AW / n • Interest rate • € bonus / month • € / assembly hour • Interest rate • Interest rate • AW / n • € bonus / month • € / kWh

Sources:

- World Bank, Global Logistics Indicators Survey, 2005.
- Logistics along the entire logistics chain, DHL Logbook - in cooperation with Technical University Darmstadt.

Table (6): Logistics Indicators Components Measures Model

KPI Indicators	Components			
	Time	Cost	Complexity and risk factor	Reliability
1. Customer service and support	Average order cycle time	Ratio of customer service cost per sale	• Number of agencies that have the power to inspect goods • Total number of documents per trade transaction	DIFOT
2. Purchasing and procurement	Average procurement cycle time	Ratio of procurement cost per sale	• Criteria for customs inspection • Level of customs inspection • Percentage of containers electronically scanned	Supplier In Full and On-Time Rate
3. Information Processing	Average order processing cycle time	Ratio of information processing cost per sale	• Number of times consignments are typically inspected • Frequency of vessel calls at port	Order Accuracy Rate
4. Transportation	Average delivery cycle time	Ratio of transportation cost per sale	• Speed (inland transport by trucks) (kilometres per day)	DIFOT
5.Warehousing and site selection	Average inventory cycle time	Ratio of warehousing cost per sale	• Whether the port is a signatory to the Container Security Initiative	Inventory Accuracy
6. Demand planning and forecasting	Average forecast period	Ratio of forecasting cost per sale	• Unexpected Demand	Forecast Accuracy Rate
7. Inventory management	Average inventory day	Ratio of inventory carrying cost per sale	• Percentage of containers physically inspected	Inventory Out of Stock Rate
8. Handling and packaging	Average material handling and packaging	Ratio of value damaged per sale	• Damage or pilferage as percentage of value of container	Damage Rate
9. Reversed Logistics	Average cycle time for customer return	Ratio of returned goods value per sale	• Damage or pilferage as percentage of value of container • Shutdown of port due to natural disaster and labour dispute (days)	Rate of Return Goods

Source: World Bank, Global Logistics Indicators Survey, 2005.

EMPERICAL STUDY

The questionnaire developed in this paper intended to measure the applicable logistics key performance indicators in the Egyptian food processing industry throughout the World Bank, as the Global Logistics Indicators Survey recommend, and according to the DHL global logistics KPIs. In addition, the current impact of the most applicable logistics KPIs, throughout the current practices of ten Indicators : customer serves and support, complexity and risk factor, purchasing and procurement, Information processing, transportation, warehousing and site selection, demand planning and forecasting, inventory management, handling and packing, and reversed logistics. That examined the research objectives through these ten indicators, and examining its impact on food processing sector Logistics Areas and Processes throughout the current practices of six areas and processes. (SPSS 17) and AMOS 18 are the used Statistical Packages for Social Sciences

1. Reliability Test:

Cronbach's Alpha showed that the values for the key performance ten indicators: customer serves and support, complexity and risk factor, purchasing and procurement, Information processing, transportation, warehousing and site selection, demand planning and forecasting, inventory management, handling and packing, and reversed logistics are (0.753), (0.732), (0.818), (0.821), (0.844), (0.741), (0.858), (0.819), (0.730), and (0.731) respectively, and the overall 0.901 with which are acceptable as Cronbach's test suggested that the percentage should not be less than 0.70. The value of 0.6 considered also acceptable in social sciences.

2. Confirmatory Factor Analysis (CFA):

The confirmatory factor analysis is conducted to test how well the measured variables represent the constructs. Table (2) shows the variables and the two constructs used in the analysis which were initially considered to express logistics KPIs, and its impact on food processing sector Logistics Areas and

Table (7): Confirmatory Factor Analysis to Measure the model Validity

	Estimate	Se	C.R.	P
1. Customer service and support	1.000			
1.a.Time :Average order cycle time	.789	.135	5.862	***
1.b.Cost: Ratio of customer service cost per sale	1.000			
2. Complexity and risk Factor :	.703	.087	8.127	***
2.a.Number of agencies that have the power to	.874	.097	9.059	***
2.b.Total number of documents per trade	1.000			
2.c.Reliability : DIFOT	.904	.131	6.882	***
3. Purchasing and procurement	.721	.106	6.836	***
3.a. Time : Average procurement cycle time	.761	.099	7.714	***
3.b. Cost: Ratio of procurement cost per sale	.964	.125	7.736	***
3.c. Complexity and risk Factor :	1.090	.122	8.954	***
3.c.1.Number of agencies that have the power to	1.000			
3.c.2.Criteria for customs inspection	.756	.102	7.382	***
3.c.3.Level of customs inspection	1.120	.155	7.242	***
3.c.4.Percentage of containers electronically	.846	.129	6.565	***
3.d. Supplier In Full and On-Time Rate	.989	.124	7.956	***
4.Information Processing	1.000			
4.a. Time : Average order processing cycle time	1.598	.256	6.243	***
4.b. Cost: Ratio of information processing cost	1.000			
4.c. Complexity and risk Factor :	.702	.053	13.23	***
4.c.1.Number of times consignments are	.863	.067	12.84	***
4.c.2.Frequency of vessel calls at port	.535	.083	6.452	***
4.d.Reliability : Order Accuracy Rate	1.000			
5. Transportation	1.253	.131	9.550	***
5.a. Time : Average delivery cycle time	1.096	.144	7.619	***
5.b.Cost : Ratio of transportation cost per sale	.696	.090	7.747	***
5.c.Complexity and risk Factor : Speed (inland	1.178	.134	8.807	***
5.d.Reliability : DIFOT	1.087	.122	8.938	***
6. Warehousing and site selection.	1.000			
6.a.Time : Average forecast period	1.000			
6.b.Cost : Ratio of forecasting cost per sale	1.787	.268	6.660	***
6.c.Complexity and risk Factor : Unexpected	1.274	.197	6.453	***
6.d.Reliability : Forecast Accuracy Rate	1.300	.203	6.402	***
7.Demand planning and forecasting	1.000			
7.a.Time : Average forecast period	1.465	.134	10.94	***
7.b.Cost : Ratio of forecasting cost per sale	1.312	.118	11.15	***
7.c.Complexity and risk Factor : Unexpected	1.345	.127	10.60	***
7.d.Reliability : Forecast Accuracy Rate	1.327	.139	9.562	***
8.Inventory management	1.081	.120	9.039	***
8.a.Time : Average inventory day	1.000			
8.b.Cost : Ratio of inventory carrying cost per	.858	.078	11.00	***
8.c.Complexity and risk Factor : Percentage of	.929	.085	10.90	***
8.d.Reliability : Inventory Out of Stock Rate	1.000			
9.Handling and packaging	1.029	.086	11.90	***
9.a.Time : Average material handling and	1.070	.081	13.27	***
9.b.Cost : Ratio of value damaged per sale	1.000			
9.c.Complexity and risk Factor : Damage or	1.012	.075	13.52	***
9.d.Reliability : Damage Rate	.979	.093	10.56	***
10.Reversed Logistics	1.000			
10.a.Time : Average cycle time for customer	1.065	.082	12.96	***
10.b.Cost : Ratio of returned goods value per	1.000			
10.c.Complexity and risk Factor :	.789	.135	5.862	***
10.c.1.Damage or pilferage as percentage of	1.000			
10.c.2.Shutdown of port due to natural disaster	.703	.087	8.127	***
10.d.Reliability : Rate of Return Goods	.874	.097	9.059	***
y.1.Receiving :	1.000			
y.1.a.Unloading of pallets with a forklift	.904	.131	6.882	***
Y.1.b.Manual inventory of Goods	.721	.106	6.836	***
y.1.c.Random / complete Control	.761	.099	7.714	***
Y.2.Incoming warehouse	.964	.125	7.736	***
y.2.a.Storage of pallets in a small-aisle	1.090	.122	8.954	***
y.3.Internal transport and handling	1.000			
Y.3.a.Transport with a forklift	.756	.102	7.382	***
y.3.b.Manual provision of goods	1.120	.155	7.242	***
y.4.Finished goods store	.846	.129	6.565	***
Y.4.a.Storage of pallets in a small-aisle	.989	.124	7.956	***
y.5.Picking	1.000			
y.5.a.Manual composition of finished processed	1.598	.256	6.243	***
y.5.b.Manual packing and shipment-ready	1.000			
y.6.Distribution	.702	.053	13.23	***
y.6.a.Transport by truck	.863	.067	12.84	***
y.6.b.Storage of pallets in	.535	.083	6.452	***

Processes throughout the current practices. The construct validity is the extent to which a set of measured items actually measures the construct. This has been computed in the (CFA). Variables shown in table (3) were found to be valid, which confirms the acceptance of the first hypothesis,

The Confirmatory Factor Analysis used to measure the validity of the model. All standardized regression weights (factor loading) are greater than 0.5, which means that all measured variables are statistically significant. T-test for all measured variables is significant at a level of significance less than (0.001). All the insignificant measured variables were excluded from the model. Purchasing and procurement, and Handling and packaging, then comes Inventory management, warehousing and site selection respectively are the most latent variables that showed significant relation with the Logistics Areas and Processes throughout the current practices of six areas and processes. In return, it proves that the Standardized logistics processes key performance indicators KPIs are suitable in the Egyptian food processing industry logistics chain.

Moreover, it improves the Egyptian food processing industry logistics chain, as proposed in the first and the second hypothesises.

Table (10): The Goodness of Fit Indices in the SEM

	Estimate
1. Chi-Square	5262.341
2. Degree of Freedom	1084
3. Level of Significance	0.000
4. Root Mean Square Residual (RMR)	0.100
5. Goodness of Fit Index (GFI)	0.408
6. Adjusted Goodness of Fit Index (AGFI)	0.304
7. Normed Fit Index (NFI)	0.431
8. Relative Fit Index (RFI)	0.357
9. Incremental Fit Index (IFI)	0.489
10. Tucker Lewis Index (TLI)	0.412
11. Comparative Fit Index (CFI)	0.480
12. Root Mean Square Residual Approximation	0.204

(RMSEA) ($\leqslant$ 0.10) of percent corrected (RMSEA) by 1-0.204= 80%

a. Measuring the Goodness of Fit of the (CFA) model:

Table (10): The Goodness of Fit Indices in the Confirmatory Factor Analysis the researcher revealed that: All the goodness of fit tests of the model showed significant results or i.e., the majority of indicators are at acceptable limits, or near to the cut-off values, and then the possibility of matching the actual form of the model estimated.

The values of Root Mean Square Residual (RMR) and Root Mean Square Residual Approximation (RMSEA) $\leq$ (0.10) which indicates a close fit of the model in relation to the degrees of freedom. Number of distinct sample moments: 1275, and Number of distinct parameters to be estimated: 191, this means that the Degrees of freedom (1275 - 191):1084. Which determines the ability of applying various Logistics KPIs in the Egyptian food processing industry logistics chain as in the researcher first objective.

Table (11): Reliability and intrinsic validity for research variables:

	Reliability Coefficient	**Intrinsic Variability**
1. Customer service and support	0.753	0.868
2. Complexity and risk Factor :	0.732	0.856
3. Purchasing and procurement	0.818	0.904
4.Information Processing	0.821	0.906
5. Transportation	0.844	0.919
6. Warehousing and site selection.	0.741	0.861
7.Demand planning and forecasting	0.858	0.926
8.Inventory management	0.819	0.905
9.Handling and packaging	0.730	0.854
10.Reversed Logistics	0.731	0.855
Total	0.901	0.949

b. Reliability and intrinsic validity for research variables:

According to Table (11), the researcher found out that reliability coefficient and intrinsic validity, for

Table (12): Descriptive Statistics for Logistics KPI"s

KPIs	Mean	S.D.	C.V.= SD/Mean	Rank
1. Customer service and support				
1.b.Cost: Ratio of customer service cost per	4.2128	0.55110	13.08	4
2. Complexity and risk Factor :				
2.c.Reliability : DIFOT	4.2128	0.52158	12.38	3
3. Purchasing and procurement				
3.d. Supplier In Full and On-Time Rate	3.7832	0.49669	13.13	5
4.Information Processing				
4.d.Reliability : Order Accuracy Rate	3.9238	0.46481	11.85	2
5. Transportation				
5.d.Reliability : DIFOT	4.0585	0.72441	17,85	9
6. Warehousing and site selection.				
6.d.Reliability : Forecast Accuracy Rate	4,0053	0.61781	15.42	8
7.Demand planning and forecasting				
7.d.Reliability : Forecast Accuracy Rate	4.0771	0.59797	14.67	6
8.Inventory management				
8.d.Reliability : Inventory Out of Stock	3.6277	0.76178	21.00	10
9.Handling and packaging				
9.d.Reliability : Damage Rate	4.1303	0.62188	15.06	7
10.Reversed Logistics				
10.d.Reliability : Rate of Return Goods	4.0053	0.44631	11.14	1

research dimensions are (0.901), (0.949) respectively; high-internal consistency based on the average inter-item correlation. The most dimensions with highly Reliability coefficients are, Demand planning and forecasting, Transportation, Information Processing, Inventory management, and Purchasing and procurement with Reliability coefficient (0.858), (0.844), (0.821), (0.819), and (0.818) respectively.

c. Descriptive Statistics for Logistics KPI"s and Logistics Areas an Processes:

According to Descriptive statistics in table (8), it can attain a full determination and sorting the most important KPIs in the Egyptian food processing industry logistics chain, throughout concluding the most five homogeneous variables with the least coefficient of variation are going to be the best in the descriptive statistics for logistics KPIs which are:

Table(13): Descriptive Statistics for Logistics Areas an Processes

	Mean	S.D.	C.V.=SD /Mean	Rank
v.1.Receiving :	4.1879	0.63275	15.11	1
Y.2.Incoming warehouse	3.9362	0.91356	23.21	5
v.3.Internal transport and handling	4.2500	0.66700	15.69	2
v.4.Finished goods store	4.2553	0.70232	16.50	3
v.5.Picking	3.9787	0.76170	19.14	4
v.6.Distribution	3.6755	0.98020	26.67	6

Reversed Logistics Reliability through Rate of Return, Information Processing Reliability through Order Accuracy, Complexity and risk Factor Reliability through DIFOT, Customer service and support through Cost: Ratio of customer service, and Purchasing and procurement through Supplier in Full and On-Time with the least coefficient of variation (11.14%), (11.85%), (12.38%), (13.08%), and (13.13%) respectively.

On the other hand, as shown in table (9), the highest five heterogeneous variables in the Descriptive Statistics for Logistics KPIs are:

Demand planning and forecasting Reliability through Forecast Accuracy, Handling and packaging reliability through Damage Rate, warehousing and site selection Reliability through Forecast Accuracy, Transportation Reliability through DIFOT, and Inventory Management Reliability through Inventory Out of Stock, with coefficient of variation (14.67%), (15.06%), (15.42%), (17.85%), and (21.00%) respectively.

The most three homogeneous variables with the least coefficient of variation are going to be the best in the Descriptive Statistics for Logistics Areas and Processes are: Receiving, Internal transport and handling, .and Finished goods store, with coefficient of variation (15.117%), (15.69%), and (16.50%) respectively.

On the other hand, the highest five heterogeneous variables in the Descriptive Statistics for Logistics Areas and Processes Are Picking, Incoming warehouse, and Distribution with coefficient of variation (19.14%), (23.21%), and (26.67%) respectively. In return, it confirms the acceptance of the third hypothesis that the proposed Logistics key performance indicators KPIs model has a significant Impact on Logistics chain processes performance in the Egyptian Food Processing Industry.

Table (12): Stepwise logistic regression model to determine the impact of the Logistics Key Performance Indicators (KPI) on the Logistics Areas and Processes

No	Independent Variables	Estimated coefficient	Wald test Value	Wald test Sig.	Chi –square test value	Chi –square test Sig.	R^2 (%)	Prob
1	constant	-2.356	29.021	***0.000	28.224	***0.000	39.1	**0.87**
2	Logistics KPI	2.846	13.429	***0.000				**0.95**
3	**Logistics Areas and Processes**	**1.675**	**7.751**	**** 0.005**				**0.85**

* Parameter is significant at the (.05) level ** Parameter is significant at the (.001) level

*** Parameter is significant at the (.001) level

3. The logistic regression model:

Logistic regression is useful for situations in which you want to be able to predict the presence or absence of a characteristic or outcome based on values of a set of pr-edictor variables. It is similar to a linear regression model but is suited to models where the dependent variable is dichotomous. Logistic regression coefficients used to estimate odd ratios for each of the independent variables in the model. Logistic regression is applicable to a broader range of research situations than discriminant analysis. Referring to the Stepwise Multiple Logistic Regression Model previously referred to in table (12), the researcher can conclude the following:

a. **Chi –square test:**

The chi-square statistic is the change in the -2 log- likelihood from the previous step, block, or model. Its statistics are used to determine if the overall model is statistically significant, Like F test in linear regression model, since The value of "chi square test" is (28.224) with significant at the (0.001) level, then the researcher concludes that the overall independent variables statistically significant impact on the dependent variable or the model is fitted to logistic regression. In return, it confirms the acceptance of the third hypothesis that the proposed Logistics key performance indicators KPIs model has a significant Impact on Logistics chain processes performance in the Egyptian Food Processing Industry.

b. **The Classification table :**

The classification table helps you to assess the performance of your model by cross tabulating the observed response categories with the predicted response categories. For each case, the predicted response is the category treated as 1, if that category's predicted probability is greater than the user-specified cutoff. Cells on the diagonal are correct predictions, whereas Cells off the diagonal are incorrect predictions. The percentage of correct number of Agree directions for KPIs is (45.5%), the percentage of correct number of Logistics Areas and Processes is (54.5%), and overall percentage of correct scores is (84 %).

c. **Coefficient of determination:**

The Independent Variables accepted in the model explain (39.1%) from total variation of log odds ratio or logistics model ,i.e., dependent variable, Logistics KPI, the rest percent due to either the random error in the regression model or other Independent Variables excluded from regression model**.** Larger pseudo r-square statistics indicate that more of the variation is explained by the model, to a maximum of 1.

d. **Wald test:**

It would be useful in determining the significant value of each of the individual independent variables coefficient in the logistic regression model. The ratio of B to S.E., squared, equals the Wald statistic. If the Wald statistic is significant (i.e., less than 0.05) then the parameter is useful to the model. The significant independent variables are Purchasing and procurement, and Handling and packaging with significant at less than (0.05), (0.001) level respectively.

e. **Probability event:**

The Probability event of each independent variable is the odds ratio divided by Odds ratio plus one, then the important variables are Purchasing and procurement, and Handling and packaging with probabilities (0.95),(0.85) respectively. Then Inventory management with probabilities (0.84), warehousing and site selection with probability (0.79) respectively. The Egyptian food processing Industry show moderate and low considerations and concern with the other KPIs does the World Bank, as Global Logistics Indicators Survey recommend, and according to the DHL global logistics KPIs.

f. **Logistic Regression model:**

$$P(Y)=\left[1+e^{-\left(-2.356+Purchasing\,\&\,Procurement\,(2.846)+Handling\,\&\,Packing\,(1.675)+(1.621)\,Inventory\_Management+(1.315)\,Warehousing\,\&\,Site\_Selection\right)}\right]^{-1}$$

By substituting the values of independent variables, Purchasing and procurement, Handling and packaging, then comes Inventory management, warehousing and site selection respectively. The Model can then predict the dependent variable: The most applied and common logistics key performance indicators (KPI) by The Egyptian food processing Industry as targeted by the researcher in the third and the fifth objectives. In addition, the model clarifies that The Egyptian Food Processing Industry is not applying all of the international standardized logistics processes key performance indicators (KPIs) as assumed by the researcher in the fourth hypothesis.

1. Knowing the suitability of performing proposed standard logistics processes in the Egyptian food processing industry.

2. Determination and sorting the most important KPIs in the Egyptian food processing industry logistics chain.
3. Measuring the Logistics KPIs model Impact on Logistics chain processes performance in the Egyptian Food Processing Industry.

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