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A Proposed Design of Logistics Information Systems Database to Enhance the Effectiveness of Supply Chain Manager Decisions

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Abstract:

Logistics is the field of study to focus on the: Design, Control, and Implementation of flow and storage of goods and services and any other related information from the point of origin to the point of consumption. Logistic Information Systems have been introduced to this field in order to make this flow more efficient with an aim to satisfy the requirements of its existing and prospective customer. The College of International Transport and Logistics (CITL) is the professional body for everyone in the fields of logistics, supply chain management, international transport and related industries in Egypt. The Portsaid branch is responsible for covering previous activities in the northeast and east regions of Egypt and Sinai This paper presents the results of a research work aiming at building a Logistics Information System based on the experience acquired in The College of International Transport and Logistics (CITL), Arab Academy for Science, Technology and Maritime Transport, Port Said Branch, Egypt.

Keywords: Logistics, Elements of Supply Chain, Supply Chain Management, Information Systems, Logistics Information Systems, Computer databases and Database design.

I. INTRODUCTION

Logistics, involve the management and follow-up of several activities such as transformation of natural resources, raw materials, and components of finished products in order to deliver whatever required to the end customer efficiently and effectively. Logistic guarantee that the correct materials will be delivered to the correct location at the correct time with the correct quality and with the most competitive cost. [1]

The terms "supply chain" and "logistics" are often used interchangeably. They are, however, distinct areas, each involving specific processes, duties and responsibilities. The confusion in distinguishing between supply chain and logistics might stem from the fact that logistics are considered by many people to be a subcategory of supply chain management. The main difference between supply chain and logistics is that logistics are merely a specialized part of the entire supply chain process. The supply chain encompasses a bigger picture. Supply chain management is the umbrella that covers all aspects of the sourcing and procurement of goods. Basically, supply chain management forms and manages the business-to-business links that allow for the ultimate sale of goods to consumers. Logistics, basically getting the freight from one place to the other, is a function that falls under the wide umbrella of supply chain management, but is only one part of the entire process. . A supply chain is a system of organizations, people, activities, information, and resources involved in moving a product or service from supplier to customer. In sophisticated supply chain systems, used products may re-enter the supply chain at any point where residual value is recyclable. Supply chains link value chains [3]. In fact, one cannot separate supply chain from the global company strategy [4], and for companies to succeed, they must be able to align supply chain with business strategic plans and objectives [5].

The rationale behind this research was motivated by the results of several studies concluding that getting supply chains in general and logistics in particular right boosts corporate overall company performance [6] and how do supply chain networks affect the resilience of firms to natural disasters, providing the results of several studies in Japan after the great east Japan Earthquake took place [7,8].

The College of International Transport and Logistics (**CITL**) is the professional body for everyone in the fields of logistics, supply chain management, international transport and related industries in Egypt. It is considered an educational center for logistics excellence in the Middle East and North African regions.

The Portsaid branch is responsible for covering previous activities in the northeast and east regions of Egypt and Sinai. It built a Logistics Information Centre aiming at putting theory into application by teaching students how to build information systems serving different logistics activities.

In that process, a logistics information system was built based on the profound experiences of the academy in logistics field. The system addressed two directions; the first one is integrating elements of supply chain in order to gain visibility and control over supply chain activities. The second one is following the flow of goods and services from point of origin to point of consumption. An example of getting products to people is presented in the JSI framework for integrated supply chain management in public health [9].

This paper presents the work completed in the first direction. This system is trying to help supply chain manager to perform his/her tasks, duties and responsibilities effectively, these tasks are:

1. Review or/ and update supply chain practices in accordance with new or changing environmental policies, standards, regulations, or laws.

2. Select transportation routes to maximize profits or to minimize costs by combining shipments or consolidating warehousing and distribution.
3. Diagram supply chain models to help facilitate discussions with customers.
4. Develop material cost forecasts or standard cost lists.
5. Assess appropriate material handling equipment needs and staffing levels to load, unload, move, or store materials.
6. Appraise vendor manufacturing ability through on-site visits, measurements and sharing alternatives .

Elements of supply chain will be presented in section two. Section three presents some previous work. The implemented supply chain model is presented in section four. In section five, the implementation of visibility in the database design will be discussed. Section six, discusses the implementation of control over the supply chain activities in the database design. Section seven, is the paper conclusion and future work.

II. ELEMENTS OF SUPPLY CHAIN

Fig.1, presents model a typical relationship between different elements of the chain. The problem with that model is, it is both sequential and cyclic. Accordingly, a supply chain manager, when at any point in that chain, s/he can only see what is happening in the next and the previous boxes. In this model, supply chain managers lose visibility accordingly, they lose control.

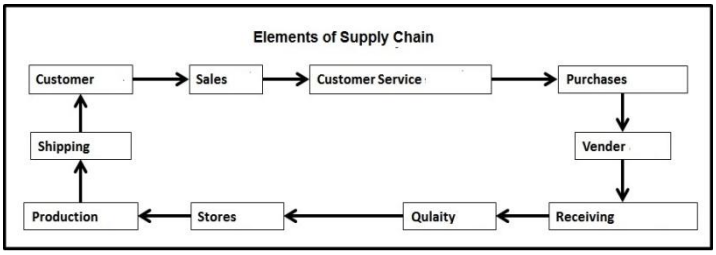

Fig.1

III. PREVIOUS WORKS

This section describes a supply chain model that has been used in the development and implemented of logistics information system in the academy, the college is teaching logistics information system application as one of its courses,the college decides to give its student the opportunity to participate in establishing a model of supply chain system to gain feasibility and control . As supply chains involve several activities including sourcing, procurement, conversion of both goods and services, several models proposed by several companies and research groups are in the market [10].

A development of a simultaneous design for supply chain process for the optimization of the product design and supply chain configuration problem is presented in [11]. A model that is measuring the influence of relational competencies on supply chain resilience: a relational view is discussed in [12].

In [13], an imperative study for global corporation supply chain is presented, the model was introduced as a socially responsible supply chain model.

When the Egyptian market was studied, it was fund that supply chains in general and in Egypt in particular require the coordination and collaboration with suppliers, intermediaries, third-party service providers, and most importantly customers. From that prospective, the proposed system incorporates the planning and management of all of the previous activities in the implemented supply chain management model.

IV. THE IMPLEMENTED SUPPLY CHAIN MODEL

This paper presents a database design for the kernel of an implemented Logistics Information System (LIS). This database will allow the LIS to integrate supply and demand management within and across companies. The LIS will allow the process of integrating function with primary responsibility and linking major business functions and business processes within and across companies into a cohesive and high-performing business model. It offers visibility and control.

The presented system includes all elements of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, finance and information technology.

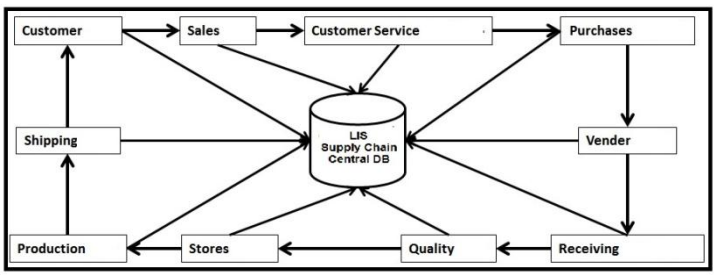

Fig.2

V. THE IMPLEMENTATION OF VISIBILITY IN THE DATABASE DESIGN

The salient characteristic of the database design of this system is offering both visibility and control. Accordingly, when situated in any location, supply chain manager and any location in the supply chain can see each other's data. The design went through every activity in the system as explained below.

The proposed database will act as the heart of the system. It allows the integration of different supply chain activities in one place. Accordingly, a supply chain manager will have the ability to see all components od the supply chain and all the activities going on withing this supply chain. This visibility will give a supply chain manager a full control over different activities.

5.1 Customer – Sales Relationship

Customer sales relationship is the first relationship in the system; customers`needs are the starting point in the modern model of the supply chain and customers also are the ending point that end the chain. The model looks as presented in Fig.3.

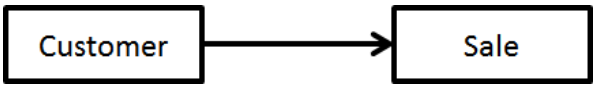

Fig.3

In real life there is no direct relationship between Customer and Sales, but the relationship is established through products. In the system this relationship is implemented as presented in Fig.4.

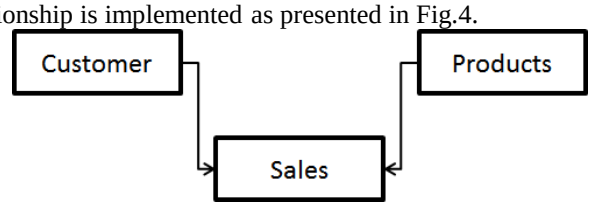

Fig.4

This relationship allows:

- Customers to see Sales and Vice versa.
  - Customer goes to sales.
- Customers to see Products through Sales.
  - Customer goes to sales get product number.
  - Go to products using product-number.
- Products to see Sales and Vice versa.
  - Products go to sales.
- Products to see Customers through Sales.
  - Products go to sales get Customer number.
  - Go to Customer using Customer -number.

5.2 Customer – Sales – Customer Service Relationship

Customer-Sales- Customer Service relationship is the second relationship in our system, it looks as presented in Fig.5

Fig.5

This relationship is represented in the database as presented in Fig.6.

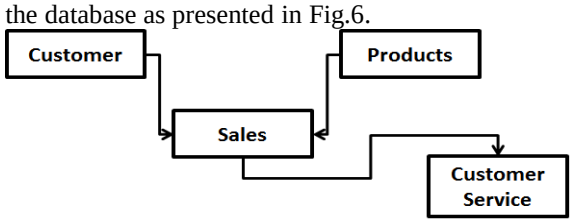

Fig.6

In addition to what is achieved in the previous section, this relationship allows the following capabilities:

- Customers to see Customer Service and Vice versa.
- Products to see Customer Service and Vice versa.
- Sales to see Customer Service and Vice versa.

5.3 Establishing Salespersons Relationship

In real life, sales persons complete sales, accordingly, Salespersons relationship is established in the DB through Sales. This relationship is presented in Fig.7.

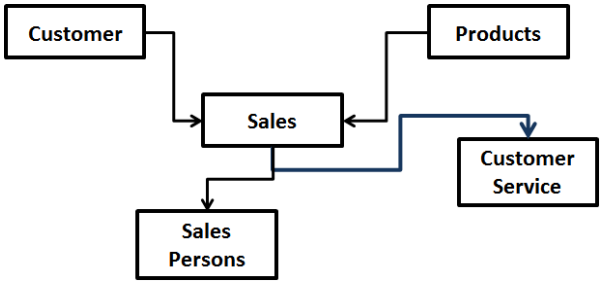

Fig.7

This relationship allows Customers, Products, Customer-Service and Salespersons to see each others through sales.

- Customers through Sales to see Salesperson and vice versa.
- Products through Sales to see Salesperson and vice versa.
- Customers-Service through Sales to see Salesperson and vice versa.

5.4 Establishing Receiving Relationship

In real life, Receiving is connected to Sale of a Product, accordingly, Receiving relationship is established in the DB through Sales which can see the products. This relationship is presented in Fig.8.

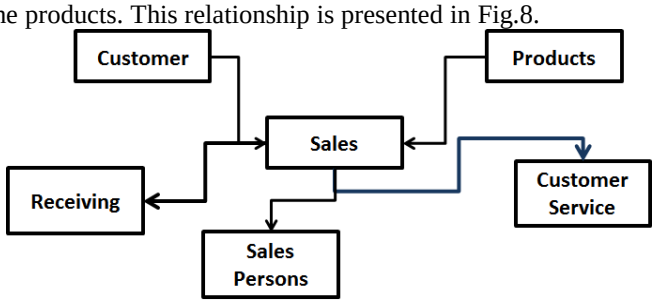

Fig.8

This relationship allows Customers, Products, Salespersons and Receiving to see each other's data through sales.

- Customers through Sales to see Receiving and vice versa.
- Products through Sales to see Receiving and vice versa.
- Salesperson through Sales to see Receiving and vice versa.
- Sales to see Receiving and vice versa.

5.5 Establishing Purchase Relationship

In real life, Purchase is connected to Receiving and manufacturing, supply chain manager should see all purchasing alternatives to decide shipping means and modes,transportation decisions, purchasing locations and so on. As Receiving is connected to the Sale of a Product, Receiving will be able to see products through Receiving which can see Sales which can see every other part of the system. In the DB design, Purchase is connected to Receiving. This relationship is presented in Fig.9.

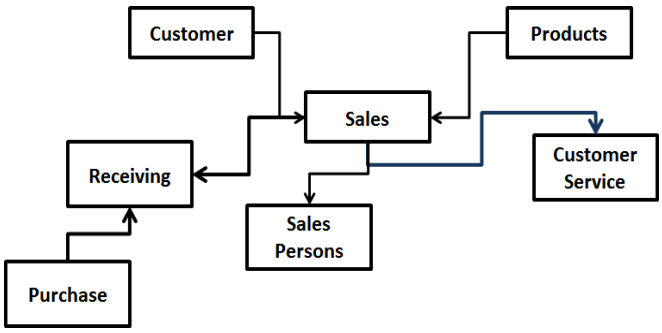

Fig.9

This relationship allows Customers, Products, Sales, Customer-Service, Salespersons, Receiving and Purchase to see each other's data through sales.

5.6 Establishing Quality Relationship

Quality in this system is connected to Sales, traditionally, quality is connected to products, in this system, high- quality goods will satisfy customer and increase sales . As Sales are connected to every other activity of the systems, once quality is connected to sales, the system can measure and establish quality for every other element in the system. This relationship is presented in Fig.10.

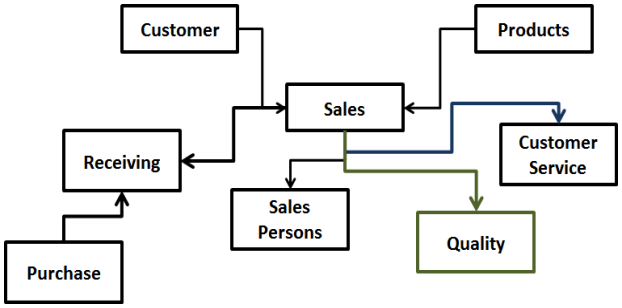

Fig.10

5.7 Establishing Inventory Relationship

Inventory in this system is connected to Products which is connected to Sales – to assess inventory levels- which take it to be seen by every other activity of the systems like purchasing , receiving and manufacturing , this relationship is presented in Fig.11.

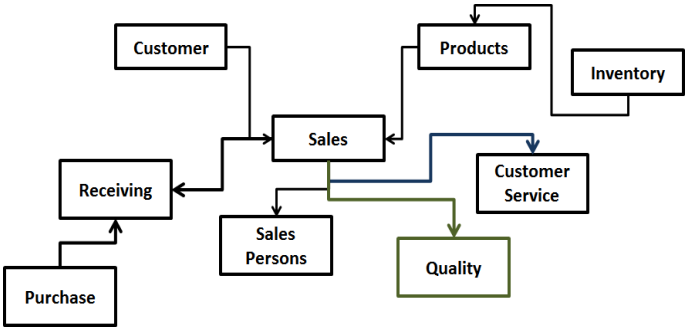

Fig.11

5.8 Establishing Manufacturing Relationship

Manufacturing in this system is connected to Sales. As Sales are connected to every other activity of the systems, once manufacturing is connected to sales, the system can and establish a relationship between Manufacturing and every other activity in the system. This relationship is presented in Fig.12.

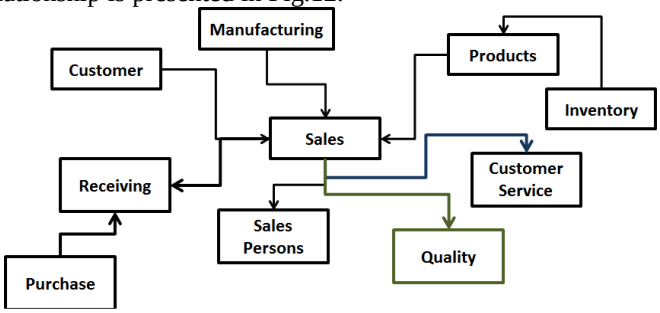

Fig.12

5.9 Establishing Shipping Relationship

Shipping in this system is connected to Sales. Traditionally, shipping is connected to manufacturing or warehousing before connecting them to sales. But it was found from empirical studies that shipping does not start until there is a sale which is directly connected to manufacturing, from that relation supply chain manger can see manufacturing through sales.

On the other hand, the sale is in this system representing a (customer – product relationship). Products are closely tide to inventory (which in this system implies both "Warehousing and Inventory Control") from that relationship, a supply chain manager can access warehousing and inventory from sales information. Finally, Shipping is connected to receiving through sales. This relationship is presented in Fig.13.

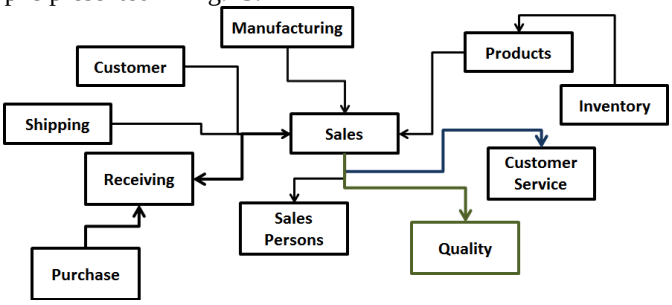

Fig.13

VI. THE IMPLEMENTATION OF CONTROL OVER THE SUPPLY CHAIN ACTIVITIES IN THE DATABASE DESIGN

Control in this system, till now, is by answering three questions, those questions are the following:

- Should we deal to a given customer?
- Should we sell this product?
- Should we sell this product to this customer?

To be able to answer those questions, three Blacklist tables were integrated in the system, those tables are:

- Blacklisted Customers Table – Contains Primary Keys of all customers the organization should not deal with.
- Blacklisted Products Table – Contains Primary Keys of all Products the organization should not sell.
- Blacklisted Customers-Product Table – Contains Primary Keys of all customers that should not have access to a certain product.

The relationships of control are presented in Fig.14.

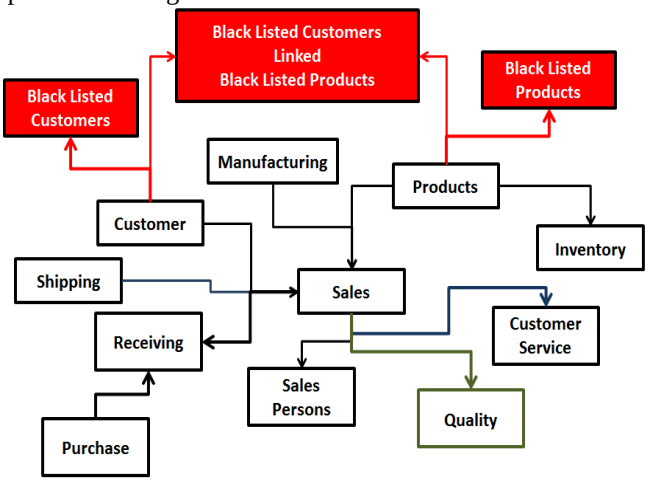

Fig.14

VII. CONCLUSION AND FUTURE WORK

This paper presents a design of a database that integrates the different activities of supply chains. It allows different activities to see each other's information this converts any supply chain from being static supply chain to adaptive supply chain. Additionally, the database includes several tables to apply control over customers and products, but more control will be needed in the future upon organizations request.

This paper represents phase one of the project while phase two puts more emphasis on the flow of products and services.

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