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A Proposed Logistics Information System for Implementing an Integrated Products Tracking System

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Abstract:

Supplier relationship management and customer relationship management are two of the most important issues for every company. Between the two, lays a sequence of activities including distribution, manufacturing, warehousing, inventory and retail. Between this chain of activities, products might get delayed, misplaces or even lost. This paper presents a suggested logistics information system that is capable of tracking products where ever they are, GIS concepts and delay forecasting model have been integrated in the system. This will offer both companies and supply chain vision and control over the flow of products from supplier to consumer.

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

I. INTRODUCTION

Managing product flow across several organizations from suppliers to consumers is a challenging task. Usually, company`s competitive edge is achieved when a company can manage that process in the most efficient way [1]. Supply chain network economics: dynamics of prices, flows, and profits is a deciding factor in the supply chain's success [3]. This involves managing vendor and customer relationship, receiving timely information about all aspects of a product transaction [6] [4].

In previous work by the authors [5], a proposed design of logistics information systems database to enhance the effectiveness of supply chain manager decisions was presented. In that work, the results of a research work aiming at building a Logistics Information System based on the experiences acquired in The College of International Transport and Logistics (**CITL**), Arab Academy for Science, Technology and Maritime Transport, Port Said Branch, Egypt was presented.

Several supply chain management tools were presented in [6] [7]. This research presents a system designed to offer companies a tool helping them to have products and services to be delivered to customers to satisfy their needs and simultaneously achieving companies` objectives. It will make companies able to manage the efficient flow of products which will lead to having the correct materials, to arrive at the correct location, at the correct time, with the correct quantity, and with the most competitive cost. Section two presents the proposed conceptual model, section three discusses the proposed system database design, section four achieved implementation and functionalities, section five is the conclusion and section six is the future work.

II. CONCEPTUAL MODEL

Companies to succeed, they need to have close control over the efficient flow and storage of goods and services and any other information from the point of origin to the point of consumption with an aim to satisfy the requirements of its existing and prospective customer [8]. Figure 1 shows the elements of the flow of products and the interactions along them.

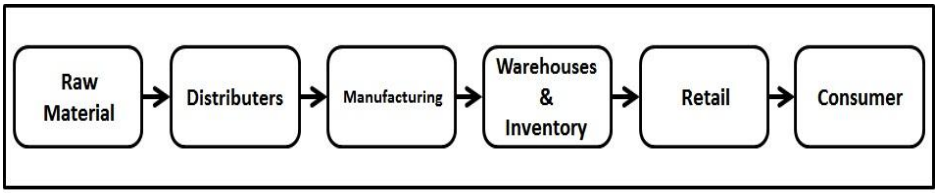

Fig.1

Many researchers proposed the integration process of all supply chain activities. In [9], a guide to supply chain management, the main objective of this work is to show how getting it right boosts corporate performance. An integrated supply chain system was presented in [10], it presents how the system managed getting products to customers, it discusses the role of the JSI framework for integrated supply chain management in public health. This research presents an integrated supply chain system to allow a better management of the chain by any supply chain manager. The proposed system will allow the integration of information, transportation, inventory, warehousing, material handling, packaging

and security. In order to do that, figure 2 functionalities were implemented, because implementing the presented relationships, will offer visibility and control over all the required activities.

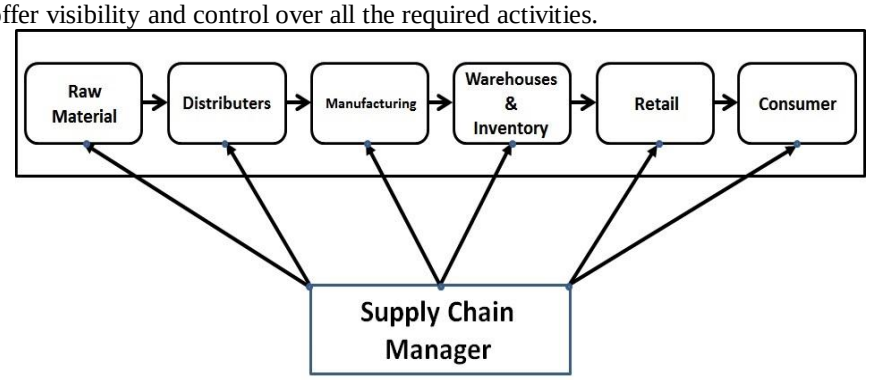

Fig.2

The flow of products and services, is always associated with the flow of money and other financial resources. Each of which is associated with a continuous flow of information they allow the success of the organization. The flow of products and services, money and information is presented in figure 3.

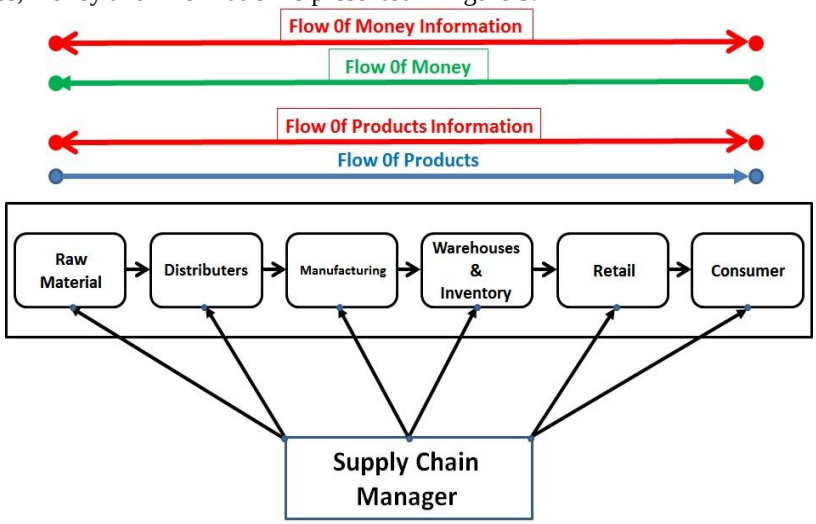

Fig.3

As presented in figure 3, products movement flows from supplier to consumer alongside with its relevant information. Money moves in the opposite direction from customers to suppliers as customers are the source of all money in the system. In order to manage that, it requires to track information in all directions and make it available to the supply chain management. When information is current and accurate, it offers better tools for the supplation chain manager visibility, which leads to a better grip on the supply chain control. The proposed model looks as presented in figure 4.

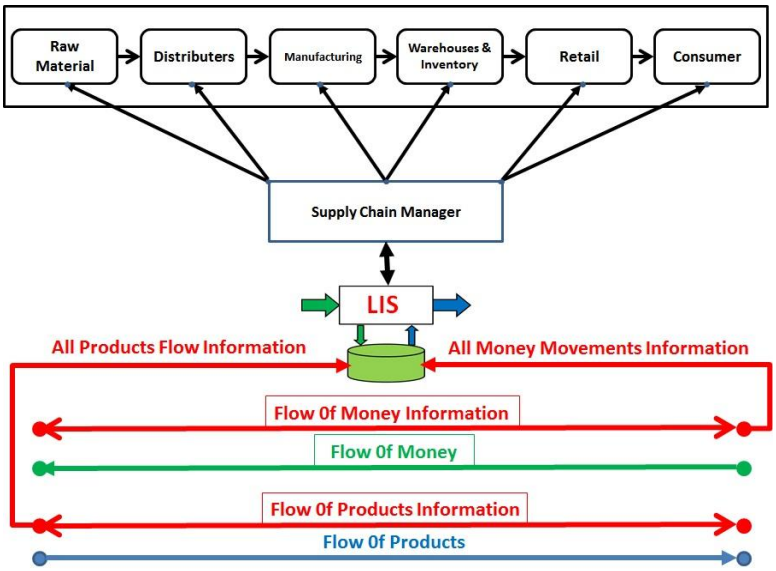

Fig.4

As presented in figure 4, as products move from one activity to the next, its relevant information is recorded in the database of the LIS system, as supply chain manager has access to the database, the manager will be able to see all products and their movement information. The manager can will be able to see the delays and where they are, the causes of the delays and different ways of dealing with them even before they happen.That will help supply chain manager to make effective decisions, meanwhile he/she can take corrective and preventive actions, which lead to enhance the overall performance.

III. IMPLEMENTATION OF INTEGRATED PRODUCTS FLOW MODEL

Integrated product flow tracking system will allow supply chain managers to see the flow of products through shipments database and track money in the chain throw financial transations which are recorded in the system database also. This way, the system will be able to issue timely alarms regarding the delays in products movements and problems of relevant financial issues. From that sense, the database design that was presented in previous work by the authors where a proposed design of logistics information systems, database to enhance the effectiveness of supply chain manager decisions were presented [5], will be repeated for every one of the above activities, that database model is presented in figure 5.

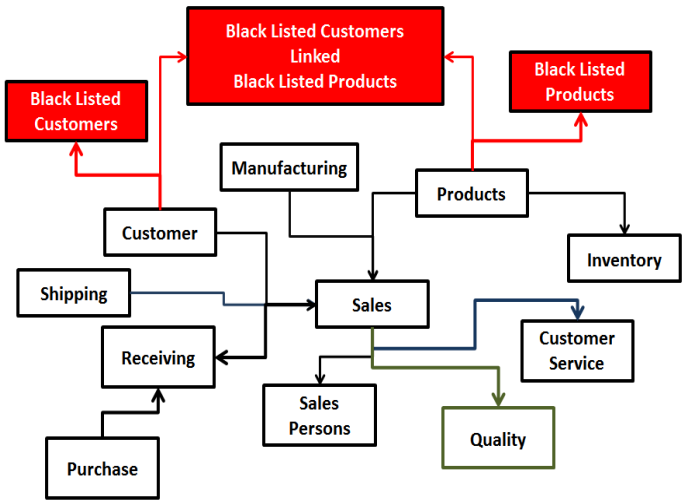

Fig.5

In figure 6 the design of the LIS that is tracking, supply chain products and its relevant financial transaction movements is presented in figure 6.

Fig.6

IV. TABLES, DEFINITIONS AND FUNCTIONALITIES

The presented system depends on a database that consists of fifteen table, each one of the is responsible for a different functionality in the system. Those tables are the following tables:

4.1 Raw Materials Table.
4.2 Suppliers Tables. Suppliers information is stored in three tables, those tables are the following tables:
- 4.2.1 Supplier.
- 4.2.2 Supplies destination.
- 4.2.3 Supplier Warehousing.

4.3. Distribution Tables.
- 4.3.1 The Design of Shipment Table.
- 4.3.2 The Design of Transportation Table.
- 4.3.3 The Design of Ships Table.

4.4 Manufacturer Table.
4.5 Warehousing Table.
4.6 Inventory Table.
4.7 Retailers Table.
4.8 Purchase Orders Table.

4.9 Products Table.
4.10 Relationships binding table.
The definitions of those tables and their functionalities are as follows:

4.1 The Design of Raw Materials Table:

The design of the raw materials table is as presented in figure 7. This table contains all information relevant to raw materials moving through the system. It tells whether a special treatment is needed or handle with care required. Supply chain managers will have access to this table to know how to deal with a specific type of raw material to prevent its damage.

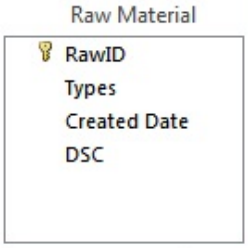

Fig.7

4.2 The Design of Suppliers Tables:

The design of the suppliers tables is as presented in figure 8. Suppliers activities are represented in three tables, those tables are the following:

4.2.1 Supplier Table:

- Contains suppliers basic data.

4.2.2 Supplies Distination Table:

- Contains suppliers- products destinations. This table is partially used in tracking product and determining whether the product is moved to the right place and at the right time or not..

4.2.3 Supplier Warehousing Table.

- Contains suppliers warehousing and inventory data. It guarantees that the right amount of products is available. One of the advantages of this table is having GIS information that helps the tracking process of products from suppliers to their destinations

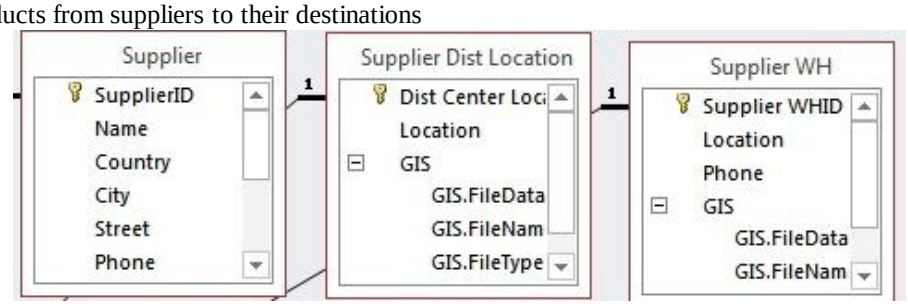

Fig.8

4.3 The Design of Distributions Table.

Distribution tables allow overall control over products` distribution across the chain. Distribution table in addition to having products to be distributed data link, it has detonation link and GIS information relevant to a product movement. This table offers supply chain manager enough information to track shipment movement all over the supply chain movement. Distribution table is presented in figure 9.

Fig.9

In order to do this distribution table is connected to several other tables, those tables are:
4.3.1 Shipment Table.
4.3.2 Transportation Table.
4.3.3 Ships Table.

4.3.1 The Design of Shipment Table.

The main function of this table is to track a shipment based on its shipment data. Shipment subsystem can connect to both Transportation Table and Ships Table. Shipment Table is presented in figure 10.

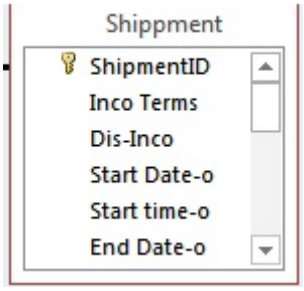

Fig.10

4.3.2 The Design of Transportation Table.

The main function of this table is to let distribution centers and in turn the supply chain manager knows the exact situation of products in regards to transportation. This allows supply chain managers to have a better grip on shipment tracking based on its transportation data. Transportation Table is presented in figure 11.

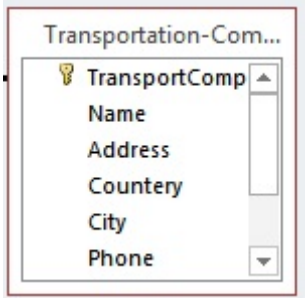

Fig.11

4.3.3 The Design of Ships Table.

This table is very similar to Transportation table. It should let distribution centers and in turn the supply chain manager the know the exact situation of products in regard to ships. This allows supply chain managers to have a better grip on shipment tracking based on its ships data. Ships were separated into a separate table or tables because it represents the majority of products` movement in the chain. Ships Table is presented in figure 12.

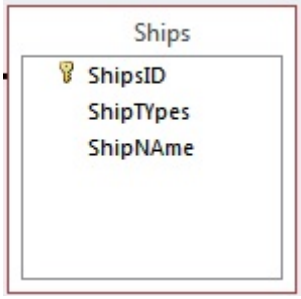

Fig.12

4.4 The Design of Manufacturer Table.

Manufacturer table contains that data described manufacturers. It is connected to both distribution tables, inventory tables and warehousing. Those connections let both manufacturers and supply chain managers know the exact locations of products coming from distributors or going to retailers. Manufacturer table is presented in fig.13.

Fig.13

4.5 The Design of Warehousing and Inventory Tables.

Warehousing table and Inventory Table contain products situation in regard to both warehousing and inventory. The two tables are connected to every activity in the chain, allowing every activity and supply chain managers to know products situation in regard to their quantities and locations. Warehousing table is presented in figure 14 and Inventory Table is presented in figure 15.

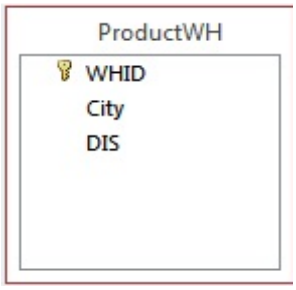

Fig.14

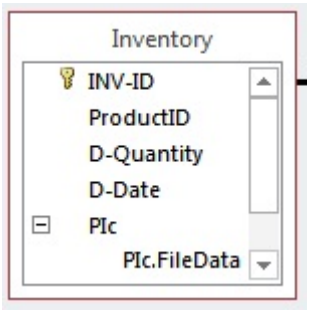

Fig.15

4.6 The Design of Retailers Table.

Retailers are very much interested in receiving products at the right time and at the right place. In order to achieve that, Retailers Table is connected to Manufacturers Tables, Warehousing Tables, Inventory Tables and Products Tables. This table allows both retailers and supply chain managers to know what is the position of products whether they are moving in the supply chain or they are in a retailer warehouse. Retailers Table is presented in figure 16.

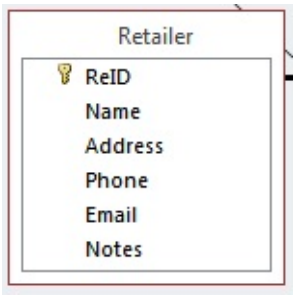

Fig.16

4.7 The Design of Purchasing Order Table.

Purchasing Order table is one of the most important tables in the system. This table keeps track of purchases in the system. The data in this table are used for not only tracking payments but also in marketing analysis and designing marketing strategies. Purchasing Order Table is presented in figure 17.

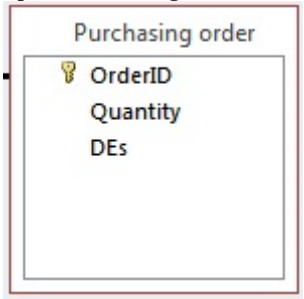

Fig.17

4.7 The Design of Products Table.

This table is connected to every other table in the system as all the system is designed to keep track of it.. Products Table is presented in figure 18.

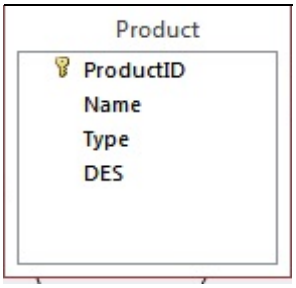

Fig.18

V. IMPLEMENTING OVERALL SYSTEM VISIBILITY

In order to implement an overall system` visibility, a relationship binding table was built. That able connects every table in the system with all the others. That allows all system users to see their relevant product data from the raw materials stage to consumers stage. The relationship table looks as presented in figure 19

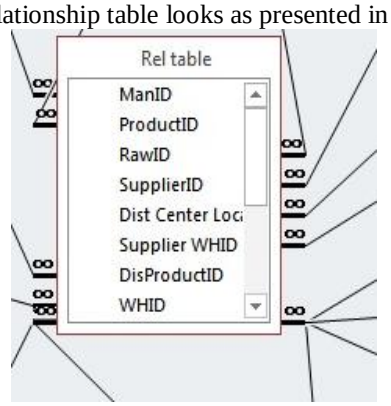

Fig.19

VI. CONCLUSION

This paper presented an integrated LIS to follow and track products through its movement in the supply chain. The system also tracks financial transactions through all the system stages. Shipments, transportation and ships were included to track product location. In that process a GIS subsystem was integrated in this database in order to give the exact location of the product anywhere it is. Warehousing and inventory control systems were encapsulated in the system to locate products and decide whether they are available or not.

An augmentation of the design of the LIS supply chain tracking system is presented in figure 20. It combines all the presented tables with their functionalities and relationships that allow two features: the first is a holistic visibility for the supply chain managers; and the second, it offers a product flow visibility for whoever interested in a specific activity. That visibility over the activities enables control over the different activities of the supply chain.

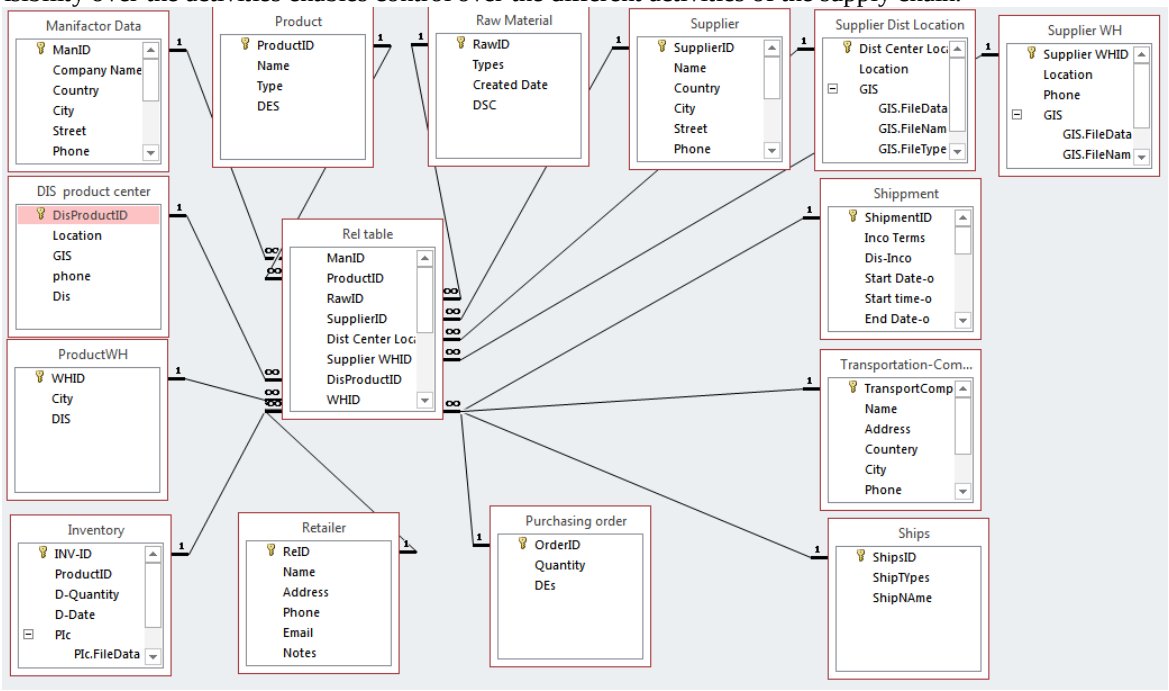

Fig.20

VII. FUTURE WORK

For the completion of this system two stages are needed to be implemented: the first is integrating marketing subsystem within this system and the other is applying artificial intelligence subsystem to select the best route, predict delays and suggests solutions for those delays. What make this possible is the existence of the data that is required to do that.

For marketing subsystem consumers information is recorded, purchase orders are liable to analysis, zone, countries and purchasing patterns are all there. For the AI subsystem, the presented system includes locations, dates and times of products moves. From that information intelligent subsystems can utilize this information to build intelligent supply chain systems.

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