

**T.C.**

**YAŞAR UNIVERSITY**

**INSTITUTE OF SOCIAL SCIENCES**

**DEPARTMENT OF BUSINESS ADMINISTRATION**

**MASTER THESIS**

**INFORMATION TECHNOLOGIES AND APPLICATIONS IN LOGISTICS SECTOR**

**Sezai BAHAR**

**Thesis Advisor**

**Prof. Dr. Ömer Baybars TEK**

**İzmir, 2013**



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## YEMİN METNİ

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**ABSTRACT**  
**Master Thesis**

**INFORMATION TECHNOLOGIES AND APPLICATIONS IN LOGISTICS  
SECTOR**

**Sezai BAHAR**

Yaşar University

Institute of Social Sciences

Master of Business Administration

Changes in world trade and information technologies and the fast increase in national and international competition have pushed logistics to change as well. The scope of logistics, which was understood as transporting and shipping in the past, has been developed fast and the range of logistics activities now include order taking, delivery, raw material flow, storing and processing and preparation of customs and transit transfer papers.

Beside increasing competition and changing trade trends, fast improvement in especially informatics provided change in logistics and successful improvements in the sector. Faster, easier and more secure information share brought the advantages such as effective time management, saving in costs and effective management methods in logistic firms. Thanks to technological developments, more use of informatics provides more benefits for logistics as well as other sector. In the first chapter of the study, concept of logistics and logistics sector in general are stated. In the second chapter, information and informatics are analyzed in details. In the third and last chapter, information systems and their application areas are analyzed.

**Key words:** Logistics, Information Systems, Supply Chain Management, Software.

**ÖZET**  
**Yüksek Lisans Tezi**

**LOJİSTİK SEKTÖRÜNDE BİLGİ TEKNOLOJİLERİ VE KULLANIM  
ALANLARI**

**Sezai BAHAR**

Yaşar Üniversitesi  
Sosyal Bilimler Enstitüsü  
İşletme Anabilim Dalı

Dünya ticaretinde ve bilgi teknolojilerinde gerçekleşen değişimler, ulusal ve uluslar arası yaşanan rekabetin hızlı artışı daha birçok sektör üzerinde olduğu gibi lojistik sektörü üzerinde de değişime zorlayıcı bir etki yapmıştır. Geçmişte nakliyecilik, taşımacılık olarak algılanan lojistik faaliyetlerinin kapsamı oldukça hızlı bir şekilde genişlemiş, lojistik faaliyetleri sipariş alımından mal teslimine, hammaddelerin akışı, depolanması ve işlenmesine, gümrük ve transit geçiş evraklarının hazırlanmasına kadar oldukça geniş bir yelpazeye ulaşmıştır.

Artan rekabet ve değişen ticaret eğilimlerinin yanı sıra özellikle bilgi sektöründeki çok hızlı gelişim lojistik anlayışının değişimini ve sektörde elde edilen başarılı gelişimleri sağlamıştır. Bilgi paylaşımının hızlanması, kolaylaşması ve güvenilirliğinin artışı lojistik firmalarında zamanın etkin kullanımı, maliyetlerde tasarruf, etkin yönetim şekilleri gibi birçok olumlu etkiyi de beraberinde getirmiştir. Teknolojik gelişmelerin de etkisiyle kullanımı günden güne artan bilgi sistemleri daha birçok sektörde olduğu gibi lojistik sektöründe de büyük faydalar ve kolaylıklar sağlamaktadır. Çalışmanın birinci bölümünde genel olarak lojistik kavramı ve lojistik sektörü anlatılmıştır. İkinci bölümde ise bilgi ve bilgi teknolojileri ayrıntılı olarak incelenmiştir. Çalışmanın üçüncü ve son bölümünde ise lojistik sektöründe kullanılan bilişim sistemleri ve kullanım alanları incelenmiştir.

**Anahtar Kelimeler:** Lojistik, Bilişim Sistemleri, Tedarik Zinciri Yönetimi, Yazılım.

## CONTENT

### INFORMATION TECHNOLOGIES AND APPLICATIONS IN LOGISTICS SECTOR

YEMİN METNİ .....	i
TUTANAK.....	ii
ABSTRACT .....	iii
ÖZET.....	iv
CONTENT .....	v
ABBREVIATIONS .....	ix
TABLE LIST .....	x
FIGURE LIST .....	xi
INTRODUCTION.....	xii

## CHAPTER ONE

### CONCEPT OF LOGISTICS AND LOGISTICS SECTOR IN GENERAL

1.1. The Definition Scope of Major Logistics Concepts.....	1
1.1.1. Definition and Importance of Logistics .....	1
1.1.2. Historical Improvement of Logistics .....	2
1.1.3. The Aim of Logistics.....	4
1.1.4. The Elements of Logistics .....	4
1.1.5. Management of Logistics .....	5
1.1.5.1 Inventory Management .....	6
1.1.5.2 Transport Management .....	6



1.1.5.3. Store and Warehouse Management .....	7
1.1.5.4 Distribution Management .....	8
1.1.5.5. Custom Clearance.....	8
1.1.5.6. Customer Service and Order Management.....	9
1.1.5.7. Purchase and Supply Management.....	10
1.1.5.8. Supply Chain Management and Performance Assessment .....	10
1.1.5.9. Informatics Management .....	10
1.2 The Logistics Sector .....	11
1.2.1 The Logistics Sector in Turkey .....	11
1.2.2. The Logistics Sector in the World.....	14

## **CHAPTER TWO**

### **BASICS OF INFORMATION AND INFORMATION TECHNOLOGIES**

2.1. The Concept of Information in Logistics .....	17
2.1.1. The Characteristics of Information .....	20
2.1.1.1. Administrative Data and Characteristics .....	20
2.1.1.2. Computational Information and Characteristics .....	21
2.1.1.3. External Information and Characteristics .....	21
2.1.2. Information Production and Transmission .....	22
2.1.3. The Cost of Information .....	22
2.1.4. The Usage of Information .....	23
2.1.5. The Quality of Information .....	23
2.2. Information Technologies.....	25
2.2.1. Information Technology Elements.....	26
2.2.2. Planning the Information Technologies .....	26

<b>2.3. Information Systems in Information Management Process .....</b>	<b>27</b>
<b>2.3.1. Information Systems Elements.....</b>	<b>28</b>
<b>2.3.1.1. Input Units.....</b>	<b>28</b>
<b>2.3.1.2. Central Processor Unit (CPU) .....</b>	<b>28</b>
<b>2.3.1.3. Output Units.....</b>	<b>28</b>
<b>2.3.1.4. Human Resources .....</b>	<b>28</b>
<b>2.3.1.5. Procedures .....</b>	<b>29</b>
<b>2.3.1.6. Software .....</b>	<b>29</b>
<b>2.3.2. Information Systems Applications.....</b>	<b>29</b>
<b>2.3.2.1. Electronic Data Processing Systems.....</b>	<b>31</b>
<b>2.3.2.2. Office Automation Systems.....</b>	<b>31</b>
<b>2.3.2.3. Management Information Systems .....</b>	<b>31</b>
<b>2.3.2.4. Decision Support Systems .....</b>	<b>32</b>
<b>2.3.2.5. Executive Information Systems .....</b>	<b>33</b>
<b>2.3.2.6. Expert Systems.....</b>	<b>33</b>

## **CHAPTER THREE**

### **INFORMATION TECHNOLOGIES AND SOFTWARE APPLICATIONS IN LOGISTICS**

<b>3.1. The Need for Information Technologies in Logistics.....</b>	<b>34</b>
<b>3.2. Historical Development of Logistics Information Systems .....</b>	<b>38</b>
<b>3.3. The Use and Benefits of Software in Logistics .....</b>	<b>39</b>
<b>3.3.1 Electronic Data Interchange (EDI).....</b>	<b>41</b>
<b>3.3.2 Barcode and Radio Frequency Identification (RFID) .....</b>	<b>42</b>
<b>3.3.3 Enterprise Resource Planning (ERP) .....</b>	<b>47</b>

<b>3.3.4. Order Management System (OMS)</b> .....	<b>50</b>
<b>3.3.5. Warehouse Management System (WMS)</b> .....	<b>51</b>
<b>3.3.6. Transportation Management System (TMS)</b> .....	<b>53</b>
<b>3.3.7. Advanced Planning System (APS)</b> .....	<b>58</b>
<b>3.3.8. Vehicle Tracking System (VTS)</b> .....	<b>60</b>
<b>3.3.9. Collaborative Planning/Forecast/Replenishment (CPFR)</b> .....	<b>62</b>
<b>3.3.10. Vendor Management Inventory (VMI)</b> .....	<b>64</b>
<b>3.3.11. Quick Response (QR)</b> .....	<b>68</b>
<b>3.3.12. Efficient Consumer Response (ECR)</b> .....	<b>68</b>
<b>CONCLUSION</b> .....	<b>71</b>
<b>REFERENCES</b> .....	<b>78</b>

## **ABBREVIATIONS**

<b>APS</b>	Advanced Planning System
<b>CPFR</b>	Collaborative Planning/Forecast/Replenishment
<b>DSS</b>	Decision Support Systems
<b>ECR</b>	Efficient Consumer Response
<b>EDI</b>	Electronic Data Interchange
<b>EDPS</b>	Electronic Data Processing Systems
<b>EIS</b>	Executive Information Systems
<b>ERP</b>	Enterprise Resource Planning
<b>IT</b>	Information Technology
<b>MIS</b>	Management Information Systems
<b>OAS</b>	Office Automation Systems
<b>OMS</b>	Order Management System
<b>QR</b>	Quick Response
<b>RFID</b>	Barcode and Radio Frequency Identification System
<b>TMS</b>	Transportation Management System
<b>USA</b>	United States of America
<b>VMI</b>	Vendor Management Inventory
<b>VTS</b>	Vehicle Tracking System
<b>WMS</b>	Warehouse Management System

## TABLE LIST

<b>Table 2.1:</b> Information Systems Applications in the Organizations and Information Use .....	30
<b>Table 3.1:</b> Logistics Information Systems and E-Logistics Application Areas .....	35
<b>Table 3.2:</b> Management information Systems Functions .....	36
<b>Table 3.3:</b> Cost and Benefits of Information Systems to Logistics .....	40
<b>Table 3.4:</b> Tag classification according to EPC Protocol.....	44
<b>Table 3.5:</b> Function and Benefits of TMS .....	55

## FIGURE LIST

<b>Figure 1.1.</b> Management of Logistics.....	5
<b>Figure 1.2.</b> The process of delivery.....	8
<b>Figure 2.1.</b> Data Information.....	19
<b>Figure 2.2.</b> The Flow Diagram of Measuring the Value of Information.....	24
<b>Figure 2.3.</b> The relationship between information systems and management .....	27
<b>Figure 2.4.</b> MIS – Decision making – Implementation Relationship .....	31
<b>Figure 3.1.</b> Three Main Functions of Transportation Management System .....	54
<b>Figure 3.2.</b> Transportation types .....	56
<b>Figure 3.3.</b> Information sharing points in SC with retail activities.....	64
<b>Figure 3.4.</b> Successful ECR Implementation .....	69

## **INTRODUCTION**

In today's business conditions, companies design their products in a different country than the country they provide their sources and they produce them in another country; and then they propose their products to the global market. As a result of requiring services from different sectors in an environment where the producer, retailer and consumers are in different parts of the world, logistic management gains importance. In parallel with a process of transition to information-based economy, logistic companies which need more information should effectively get use of information systems to adapt to new working conditions brought by this new economic system. Information produced in logistics is transferred on the Internet and it will become input to information systems of the company and will be effective in decision making process.

In today's global world, the technological developments brought innovations which make people's lives easier. Especially the information technologies abolished the boundaries between the countries and information from any part of the world, which became easy to reach, was proposed to users. The societies and organizations which fail in following the technological developments today cannot be successful. In market conditions where competition is dense, the companies which cannot be fast and flexible enough or cannot meet the expectations of customers have trouble in keeping market share. Information systems are the systems which are prepared according to work flows, composed of human, hardware, software, data and network sources, which facilitate company activities and help company realize its aims.

Logistics organizations use these information systems. It is inevitable to think a logistic firm without such information systems. Even the smallest transportation companies use such programs anymore. It is impossible especially for international companies to take thousands of products, to organize and deliver to different parts of the world without using information systems by only using human memory. Every process such as taking orders, loading and deciding the route are available at any time with these systems.

To provide reliability which is the fundamental of logistics and to meet increasing customer expectations, logistic firms must be managed simultaneously and be transparent. Their communication with customers and suppliers must be

strong. In each process from storing to delivery, information systems used in logistics increase efficiency of logistic activities and ease supervision, flexibility and decision making.

Supply chain can be defined as the sum of organizations in all processes of products from raw materials to proposing the customers. With this respect, supply chain of a typical product covers various organizations from producer to retailer.

The companies in a supply chain are in communication with each other regularly. This communication is carried out by fairs, sale orders with letters, with sophisticated information technology connecting their data bases. The development of supply chain management needs relations including production and logistics activities between supply chain members. Such coordination requires supply chain integration which foresees decisions related with production, stock and delivery activities of two companies to be taken mutually. Information technology (IT) eases supply chain integration especially when the technologies covering traditional boundaries of companies in the chain are used. Such IT is known as the information system among organizations.

IT based systems organize the flow of the materials, information and finance from supplier to producer, to retailer and last user. IT provides gaining, sharing and organizing regarding key processes of organizations in and out boundaries of the company. IT is an important supplier of the chain and by healing quality and line timings and decreasing coordination costs and process risks, it contributes to company's profit. Thus, IT based supply chain management systems are expected to contribute to both forward and backward chain members in terms of financial performance.

In an electronic environment where information can easily be produced, one of the most important methods of providing competition advantage is information systems. Companies use information systems to organize and control their work flows effectively.

Moreover, for logistic management to become successful depends on how effectively the information technologies are used. For this reason, effective use of information technologies becomes crucial in logistics, as well as other sectors.



In this study, a research was made regarding the use of information technologies in logistics. The purpose of the research was to find answers for questions as below:

1. What are the information technologies used in logistics?
2. What is the purpose of information systems used in logistics?
3. What are the benefits of information systems to the logistic companies?
4. What are the benefits of information systems to the customers of logistic companies?

## **CHAPTER ONE**

### **CONCEPT OF LOGISTICS AND LOGISTICS SECTOR IN GENERAL**

#### **1.1. The Definition Scope of Major Logistics Concepts**

Under this topic, primarily the definition and importance, historical improvement, purposes and elements and Management of logistics are emphasized.

##### **1.1.1. Definition and Importance of Logistics**

In the most general sense, logistics is an operation of consignment, distribution, shipment and storage when necessary (IGD, 2012). Logistics is a process of storing the goods where it is necessary and consists of 9 basic services: transportation, storage, packing, value added services, order management and customer services, inventory management, customs clearance, assurance and inspection/supervision.

Concept of logistics can be defined as keeping a good in the right place, at the right time, in the right amount, in the highest quality, in the safest way and at a relevant cost (Kaynak, 2003). Tek describes logistics as “an important philosophy and instrument to create sensibility in the management and control of time, movement, energy and location in all tangible and intangible transaction relations” (Tek and Karaduman, 2012).

According to another definition, “the word logistics derives from French words; to lodge and quarter”. As per another definition, logistics is; “the transportation of goods and services and even the people to one place from another in an organized way” (Kaya, 2003).

With respect to the definitions of logistics, although it is considered as linked with transportation, because of the needs assessment, market research, customs clearance, obligation of legal regulations, it is defined as a different sector.

Until recently, the concept of logistics is called with a variety of names including the listed items below. (Douglas et al., 1998 from Tek and Karaduman 2012):

- Business Logistics
- Channel Management
- Distribution
- Industrial Logistics
- Logistics Management
- Material Management
- Physical Distribution
- Quick Response Systems
- Supply Management
- Supply Chain Management

It is stated that logistics is a pioneer in the development of countries and Ernst states that throughout the world, % 25 of every 1 dollar that produced is spent on its logistic actions. Together with the fact that it is hard to compute the size of the sector since it includes a variety of actions, it is estimated that the world logistic market reached 5 trillion dollars in 2006, formed a 6-trillion-dollar market in 2009 and would reach a 10-12 trillion-dollar capacity in 2015 (MUSIAD, 2010). Considering its magnitude in the world, the importance of the logistics is understood better.

### **1.1.2. Historical Improvement of Logistics**

Until 1950's, the concept of logistics was unknown and logistic activities were being carried on under separate sections. Usually goals of these sections were conflicting with each other and it made it difficult to act mutually. Besides the economic developments in the world in 1950's and 1960's, the development of marketing approach brought forward the concept of logistics (Orhan, 2003). In 1970's, the fundamentals of current perception of logistics were founded. During 1800's, the first years of industrial revolution, companies' focus point was the cost of the products to their business. In 1900's the focus point began to shift from the production to sale because of the increased demands to the products. Until today,

since the business sector saw the logistics as an extra cost along with the costs such as sale, marketing, and production costs, they haven't given due importance to logistic until recently (Baki, 2004).

The concept of logistics, which emerged in military first, was used to transport the goods necessary for armies to the intended locations throughout the World War II. Following that; the understanding of logistics, which led an off-peak period until 1954's, began to gain importance with the changes in line with the technological and economic needs. After the Industrial Revolution, the increase in the capacity of the goods as a result of mass production in USA caused companies to need logistic activities much more. Companies that initially focused on physical distribution or purchasing, started to give a chance to logistics to take part in both areas (Bowersox, 1978).

In 1970's, it became crucial to reach to the energy comfortably for the first time after the World War II, (Bowersox, 1978). Since this date, today's concept of logistics was formed gradually and logistics was implemented better with less cost day by day. It was realized that company activities which were handled separately as physical supply and physical distribution, were consisted of activities like shipment, stock follow-up, packing, and storage. Until the mid-1970's, while the companies had long production lives and high stock level etc., a customer-oriented organizational structure could not be constructed and coordination among functions could not be realized at a sufficient level (Orhan, 2003). In this period again, logistic actions were faced with the demand to make the energy productivity more beneficial because of the transportation and storage activities between extensive energy consumers. At the beginning of 1980's, there was a rapid development in logistic activities; binding rules became less in the transportation and with the data processing technologies, communication became crucially important (Baki, 2004). In 1990's, the importance of logistics function in business management was understood even more. Rapid increase in costs caused to traditional distribution techniques become very expensive and directors realized that techniques must be controlled better. Especially in the market of fresh fruits and vegetables, because of the storing the goods without deterioration and increased demand in these goods, different storing techniques were started to develop. Product delivery time assigned by the supplier was reshaped according to the demands of customers or merchants.

### **1.1.3. The Aim of Logistics**

The aim of logistic activities is to synchronize the shipment, packing and storing of the goods; that is, the function of materials management. In another words, the aim of logistics is to provide an easy transportation of the goods in the storage of in the manufacturing process to the customer with a low cost (Kaya, 2003).

Companies should establish the logistic system and its supervision. For an effective logistic success it is essential to fulfill the elements listed as minimum deviation, holding minimum stock, combining the goods in highest level, quality control in a good standard, support the product life period (Gökkaya, 2001).

In logistics, shipment is one of the crucial costs. The aim of logistics is to provide customer satisfaction by carrying out effective logistic actions in the organization with a minimum cost and by maximizing the productivity (Timur, 1988).

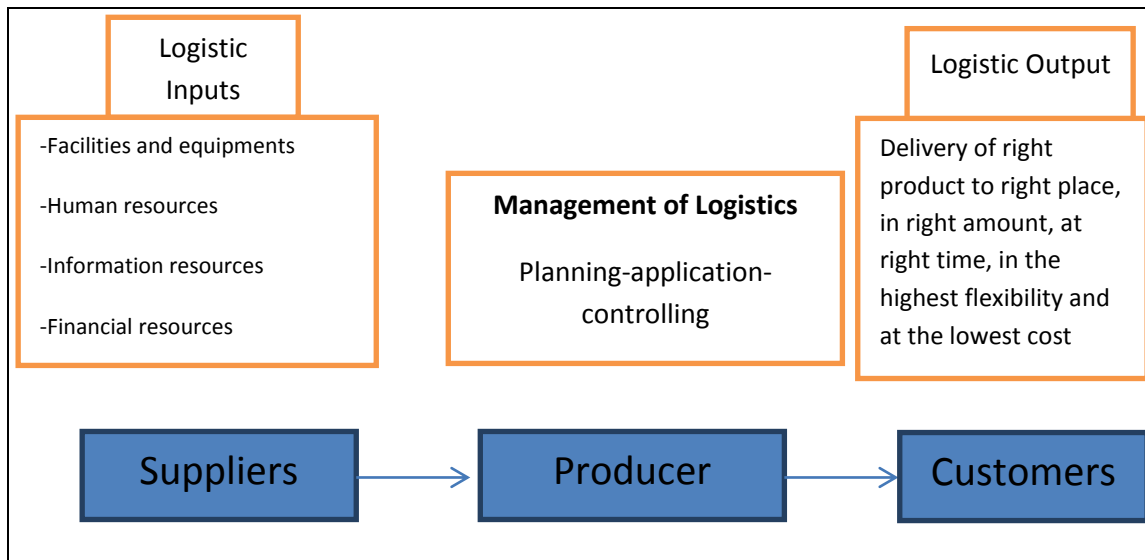
### **1.1.4. The Elements of Logistics**

The elements of logistics show difference among sectors. These differences change according to period and sector. The elements of logistics change in time. The reason is that the needs of logistics also change. As a matter of fact, in every logistic application, there are some elements that can be seen continuously. The basic thing is project management activities. In these activities research, design and production processes are crucially important. Besides procurement activities and transportation activities are also very important. In addition to this, providing quality assurance, quality control, safety standards trial tests are in the quality activities. Apart from that, documentation, codification, packaging, shipping, store, shipment, distribution, delivery and taking over activities are in the last operation activities. But these activities mean nothing unless they are supported by operating support activities like system, equipment, catalogue, procurement and control management. Also, maintenance, renovation, modernization activities must be added. Besides health management occupy a crucial place in logistic management. Construction and estate activities also occupy a crucial place in logistic management. While carrying on the logistic activities, it is a must to protect the environment and regain the wastes. Of course applying these applications, it should be used information technology products data base (Keskin, 2006).

### 1.1.5. Management of Logistics

Logistic Management is, to provide the needs of the customers, managing all supply chain activities which include effective and productive planning, application and controlling of forth and back flows of products, services and related information between manufacturing and consuming points.

**Figure 1.1. Management of Logistics**



(Adigüzel, 2005)

Apart from the production, every activity takes part in the supply chain can be defined as Logistic Activities. Logistic Activities;

- Inventory Management
- Transport Management
- Store and Warehouse Management
- Distribution Management
- Packing and Handling Management
- Customs clearance

### **1.1.5.1 Inventory Management**

Inventory decisions, which are one of the directly effective decisions in success of the logistics management, provide an important support for the logistic activities. A faulty inventory management may cause customer dissatisfaction (Bowersox, 2002). A stock inventory that is held right is an important part of inventory management not only with its traceability and accessibility, but also collecting the date records and files strategic reports. Because of this, planning inventory is a crucial process. Inventory management from the point of Logistic company; stock systems of stock management activities about goods or equipment in the customers' location done by the supplier (Ghiani, 2004).

With the researches, it is found that the inventory cost values are between %14 and %50, and %25 in average. For this reason, having enough product inventories is important to meet the needs of production and customers. Having raw material, material and products not only occupies space, but also causes the capital money which can be used in other places abide inventory (Tek and Karaduman 2012).

### **1.1.5.2 Transport Management**

Transportation is the heart of logistics. That is why the role of transportation is very important. Transport has a crucial importance in distribution of the products from the sources to production places and from production places to market places. Two out of three amounts that spent on all the logistic activities are transportation costs (Ballou, 1987).

Transport consumes environment sources including –in case the products is not processed- financial sources consisting of time, drivers, vehicles, equipment, lost and damaged products and the most part of consumption of oil and gas in economy. Transport consumes other environment sources including air and noise pollution (Langford, 1995).

Product storage is less noticeable part of the transportation. The products are already stored while they are in the vehicle. Although the vehicles are used as storage in the center or in the place of destination, it is more expensive than the other option.

However, for the products to be sent to a different location in a short period of time, when the expenses of unloading, storage and reloading costs of the products that are compared, it might be decided to keep them in the vehicle (Langford, 1995).

Transport is done in six different ways. Land transportation, railway transportation, airway transportation and -considering the country's geographical position- seaway, river way and pipelines that used liquid cargo transportation are utilized. In determination of transport methods, cost, pace, reliability, traceability, flexibility is very important (Çancı, Erdal, 2003).

### **1.1.5.3. Store and Warehouse Management**

Stores are the waypoints that play a strategic role in implementing all the activity series till the distribution of raw material process of the products to production area, then the consumption centers. Storing the goods and products that have to be moved in specific centers increases the productivity and efficiency of logistic activities. Warehouse is expressed as the places in which amount, quality and features of the products and goods is analyzed and value-analysis is done, protection in appropriate conditions is carried out, constituted in airside and noted in the Customs Law no. 4458 and Customs Regulation (Çancı, Erdal, 2003).

It must be emphasized on some points such as coding in the warehouse management, fractionizing the storage volumes and determining according to the coordination, fractionizing according to frequency of usage of goods, placing the frequently used goods in the way that shorten the transportation length, quality of ground, easy mobility of the vehicles, fire, security, using simple but effective register systems (Çancı, Erdal, 2003).

Basic work in warehouse management starts with entry of goods in the store and unloading ends with storing the goods physically, receiving orders, packing and combining the goods.



#### 1.1.5.4 Distribution Management

After taking and storing the products, it is time to planning the delivery. After loading the stocks with checking, it is billed the delivered goods to receivers while delivering. Outcomes of deliveries provide feedbacks with reporting.

**Figure 1.2 the process of delivery**



(Çancı, Erdal, 2003)

The productivity of delivery depends on success of delivery management. The success of management depends on; setting the orders of customers beforehand, the ability of responding desires of customers using information technologies.

#### 1.1.5.5. Custom Clearance

Custom clearance has a crucial and sophisticated place in logistic activities in terms of bureaucratic procedures. Logistic companies provide completion of procedure in accordance with regulations in import-export, transit clearance and hand in the documents that asked by the consignee countries to customers or representatives in foreign countries (Çancı, Erdal, 2003).

From the view of logistic company, customs clearance procedure starts with giving away customs declaration to management of customs offices and arrival of vehicles or goods to customs area. Customs clearance, in conjunction with the process of export and import, includes preparing the declaration, document needed in entry and exit, handing in these documents to management of customs and then transfer them to relevant services putting on necessary procedure, doing the necessary examination and getting permission for getting inside or out of the country (Çancı, Erdal, 2003).

The success of customs clearance can be possible with expediting the procedures in customs stations, usage of information technologies for convenience in control.

#### **1.1.5.6. Customer Service and Order Management**

Customer services can be grouped according to their place and roles in the selling process as; before, at the moment of, and after the sale. The actions before the operation are consisted of activities such as written statement of customer service policy, customer's taking; seeing; understanding and acceptance of this written statement, accessibility, organization structure and system flexibility. The activities at the moment of selling are the timing of order cycle, stock availability, order coverage ratio, status of the orders, order information, fastened deliveries, load transfer, up-to-datedness of the orders, appropriateness of the orders and product substitute. After-sale activities are the availability of spare parts, chasing up with the customer calls, tracking the products, customer complaints and temporary product substitute (Tek and Karaduman, 2012).

Order management is categorized in the organizations generally such as order planning, order transmission, order processing, order collecting and connecting and order deliveries. Order planning is done to balance the work load and to put the orders in a more organized way. Order transfer is the time period between the customers' giving the order and getting it. Order transmission is generally done via telephone or the Internet today. Order processing period includes the activities such as checking the correctness and fullness of the order information, checking the customer's payment status by credit department, entering the order into the system, charging the salesman, record of the operation by the accountancy department, choosing the nearest warehouse and transportation unit's realization of delivery service. Order collecting and connecting is a process beginning with giving the direction of gathering the material related with the order. In this period, it is checked whether the order is in the storage or not, the solidness of the customer's credit status, and if the product is not in the stock, it is checked whether it is in the production process or not. Order delivery is the last circle of the product cycle and it includes the transportation process till the product reaches the customer (Tek and Karaduman, 2012).

### **1.1.5.7. Purchase and Supply Management**

The purpose of the supply management is to provide the needed material, tools and service uninterruptedly for the organization, to minimize the inventory investment, to increase the quality, to find qualified suppliers and to develop them, to provide standardized among the purchased products, to provide the needed materials at the possible lowest costs, to create co-operative and harmonized work relations with the other functions of the operation and to provide purchase needs with the lowest management costs (Tek and Karaduman, 2012).

### **1.1.5.8. Supply Chain Management and Performance Assessment**

In many organizations, logistics cannot be managed as a unified system. Even in the organizations which accept the unified logistics management, the necessary data cannot be provided. The correct measuring and control of the logistics costs increase the cash flow and productivity. However, performance measuring should not be limited only by costs. Other key performance indicators which are frequently used in the logistics are the reliability of the supplier, storing process, cycle time, inventory correctness, transportation period, inventory level, supply period and inventory activity (Tek and Karaduman, 2012).

### **1.1.5.9. Informatics Management**

It includes the storing the data in the necessary places to provide the share among the elements of the system; to process these data at defined levels; to transfer them to required elements. Informatics management is necessary in any type and size of organizations. In the current economic order of the advanced technology, the organizations have realized that first corporate information is developed in their own structures. Later on, in addition to the old management systems, they realized the importance of the management of this newly established corporate information. This brings out the importance of information management (Tek and Karaduman, 2012).

## **1.2 The Logistics Sector**

The status of logistic sector in Turkey and in the world is analyzed through this chapter of this study.

### **1.2.1 The Logistics Sector in Turkey**

The logistics sector means a lot for Turkish economy. The cause of this importance is; the decisions which are made about this sector effects directly the country's trade. On the other hand logistic sector is the most rapidly growing sector from the angle of growing potential and creating job power among the leading sectors. In addition to this logistic sector's importance is increasing day by day because Turkey has a strategic location between the Asia, Europe and Africa continents. In Turkey logistics is the second sector which has potential after tourism in the area of service. Logistics sector, which has a great share in the country's economy in terms of goods and service cost, is one of the most important elements which determine competition. Logistics inner capacity's effect on country's economy's general course is undeniable and indisputable. It is in the way of increase in the demand to logistics when the economy is recovered or decrease in the demand to logistics when the economy is experiencing dullness (Birdoğan, 2004).

The regional evaluation of logistics is determined according to the physical, geographical and institutional background. Those kinds of evaluations illuminate the investments and arrangements which are required for logistics to break through. To break through in the area of logistics in Turkey some kinds of plans can be followed and these plans will give information about information sector, banking and insurance sectors. Some of these strategies are (Çancı and Erdal 2003; Erdal, 2005);

- We may list the necessary strategies to be followed related with transportation area: Connection of the companies in proper areas to national railway transportation network, giving importance to station management and orienting, promoting and easing the country's transportation to the railways. Logistic areas (sea way, rail way and air way stations) should be made according

to the bulky vehicles are serving with great speed and fertility and which enables special logistics companies or some public corporations like customs can work. The distribution of goods and services throughout the country should be provided by planning with the logistic viewpoint of development priority regions. Fleet renewal enterprises of transportation vehicles should be promoted in the frame of investment incentive legislation. Combination of union types proper to all transportation types should be formed and combined and transit transportation opportunities should be increased. Costs should be at the minimum level, and speed, safety and flexibility should be at the forefront. Besides, combined and transit transportation lines must be determined. With this way, money and time savings should be done. By expanding the practices such as e-taxation, e-organization, e-contract, e-signature and e-declaration quickly; the operations must be quick. By supporting the electronic trade, a quick flow of products and services in the country should be provided. Besides, necessary automation works at the customs unions should be carried out quickly. Integration between transportation and logistics companies will be only with this way.

- Necessary strategies should be applied for informatics and communication sectors. Work fluency should be provided by increasing the vehicle transporter and document traceability. By using electronic communication and telecommunication with the public bodies, bureaucratic processes should be avoided. The documents such as authorization or vehicle documents should be taken easily on the computer environment.

- New strategies should be applied in industry areas and estates. The main transportation roads from organized industry areas and small industry areas should be supported and necessary investments should be done about these. Communication between logistics centers and organized industry areas must be provided and structuring and fluency at work should be realized by making planning and coordination perfect.

- By developing strategies about internal and external trade, transit trade should be eased. Besides, necessary measurements should be taken to prevent vehicles on the transportation route from coming back empty. Necessary producing and consuming balance must be provided in the country and thus,

productivity in logistics must be tried to be developed. The trade with neighbor countries should be refreshed, there should be a support to make those countries liberal, and there should be a support to those countries under construction works. Common corporations should be orientated to those and logistics integrations should be provided. The logistics activities should be provided to spread to Anatolia. Public associations and organizations logistics activities should be orientated to companies for external resource usage. Building warehouses and establishing in abroad will be an advantage to have goods in stock continuously. The improvement of logistics sector not only affected Turkish enterprises competition power positively but also it also contributed to the solution of employment problem. The geographical location of Turkey is one of the elements that provide it a leading role and competition superiority. With the solution of problems that exists, the sector's contribution on Turkish economy will be immensely big and Turkish logistic companies will hold their places in the world.

The aim of the sector is to make Turkey the candidate of logistics center of 3 continents until 2012. It is guessed that Turkish logistics sector which can move above economic performance, creates positive value and importing service, will supply 46 billion dollars as value added. The logistics companies in the other countries are interested in Turkey because the growing speed of this sector is high (Çancı and Erdal, 2003; Erdal 2005).

One of the sectors which show a great improvement in Turkey is logistics sector. Logistics sector, in Europe has annually % 7-10, in North America %15, in Asia and Turkey % 20 improvements. In Turkey the rate in gross national product is %1.5 but in USA it is %12. Turkey with its geographical position, dynamic youth population, the importance given to logistics, and with the investments has the power to become the center in logistics sector in world markets (Orhan, 2003).

In the last 5 years, logistics sector became a discussed topic. With the integration of logistics services and the boost of corporations which functions in different kinds of transport areas, the construction of transportation establishment's as a logistics service supplier became a current issue. It can be seen that there are much more local firms than service suppliers. That's why there

are lots of players in the market; and this caused the competition's increase (Aktaş and Ülengin, 2003).

### **1.2.2. The Logistics Sector in the World**

Under the head of the logistics sector in the world, USA, European Nations and China are examined from the point of their place in logistics sector.

The term logistics firstly used in USA at the beginning of 1970s as a military term. USA has protected itself in the logistics market but in the last years the stability can be seen in its improvement. The decrease of USA dollar in the year 2007 is shown as the cause of it (Engell, 2008).

According to a research which was done in 21st Century, it was concluded that logistics will be one of the three sectors which will show more improvement than the other sectors. With the result of the research, logistics will take the entire world to its effect with globalism (Yıldıztekin, 2002).

With its population which is approximately 300 million and with its 14 trillion dollars gross national product, USA is the most important countries of the world. It is in the first place with its capacity of import and export in the world trade and it is shown as the trade's giant.

At the same time, having the biggest economy in the world USA has an important place in logistics. According to USA's 2007 data, logistics got %13 share from the cake in the gross national product which shows us how important this country from the angle of logistics. When we look at USA transportation we can see how its aviation has improved. Also we can see that railway is given a great importance and the areas link together with railway networks. Country is built upon the places which are ultimately important as logistics centers. In logistics sector, the investments which will increase the quality of service, speed and elasticity are done (Gülen, 2011).

It can be seen that the logistics firms in USA fall behind the corporations in European countries. In the past USA companies didn't get the expected profit from the investments that they made in Europe. Today they have still doubts about

whether invest their money or not in Europe. On the contrary, as a result of the European firms' merger and take over actions to penetrate USA market, the USA customers' expectations started to increase. Consequently, there is a prediction that USA firms will get into other markets (Turkey Logistic Sector Research, 2002).

Logistic sector is one of the sectors which is improving in USA .With the growing of %15 annually it has gross national products' %12. USA's logistic expenditures are approximately as 1 trillion dollars, and it is thought that the sector will improve in the future (Beşli, 2004).

The commercial organizations such as NAFTA, WIPO, WTO, and APEC provide convenience in transportation of goods which has great role in the sector's improvement (www.igeme.org.tr DATE: 13.08.2007).

Even though logistic activities are carried on by the organizations of the companies in USA, American companies are still the leader of its sectors. If we take examples of the most successful and leading companies of USA, UPS (United Parcel Service) and Expeditors can be ranked as the leading ones (www.logistics.com 01.03.2007).

Now enterprises are working to outweigh their rivals by giving importance to main business issues. Enterprises prefer external resource usage for the logistic activities that requires expertise. This issue especially affected the services that the public utilities give in EU. In the light of these developments, the firms that give logistic services achieve a significant competition advantage. It forced the companies to diversify the fields of activities and offer their customers better services (Gürdal, 2006).

According to the data of 2010, 495 million people live in 27 member countries of EU. EU's gross domestic product is about 11 trillion dollars and there are 500 million consumers mass. The European logistic market has a great place in world's logistic market with the growing of %8 and reached to 700 billion Euros (Gülen, 2011).

Thanks to the logistic politics, there is a possibility to do the customs procedure with standard applications of imported goods no matter where you are



in Europe. In addition to this, with the construction of railway network, long way transportation is made a lot easier (Bookbinder and Tan, 2003).

The most important logistic sites of EU are: France, Germany, and the countries of Benelux: Belgium, Holland, and Luxemburg.

These countries are in the western part of Europe. EU has recently started to move to the Eastern part of Europe.

Although Eastern Europe countries have made a progress on the logistic sites, they couldn't improve their logistics performance as the countries of Western Europe did. In Eastern Europe it can be seen that there is a great improvement in land transportation but the railway transportation still remains to be the most commonly used way of transporting goods (Gülen, 2011).

Considering another country of the Far East, China, having dealt the problems with the West, it turned to the West with the economic improvements and consequently it is no longer seen as the country which produces cheap goods, and also it started to take lots of interest from international firms.

Today China became the commercial center with its 1.330.141.295 population and 8.789 trillion dollar gross domestic product.

The inflation rate in China is approximately %2 and in the last 10 years it showed an increase at the rate of %8 annually ([www.asiatradehub.com](http://www.asiatradehub.com)).

For centuries being a 'Free Zone' Hong Kong has been considered the center of international finance and trade in Asia. Consequently, Hong Kong is one of the popular centers of international transportation.

## **CHAPTER TWO**

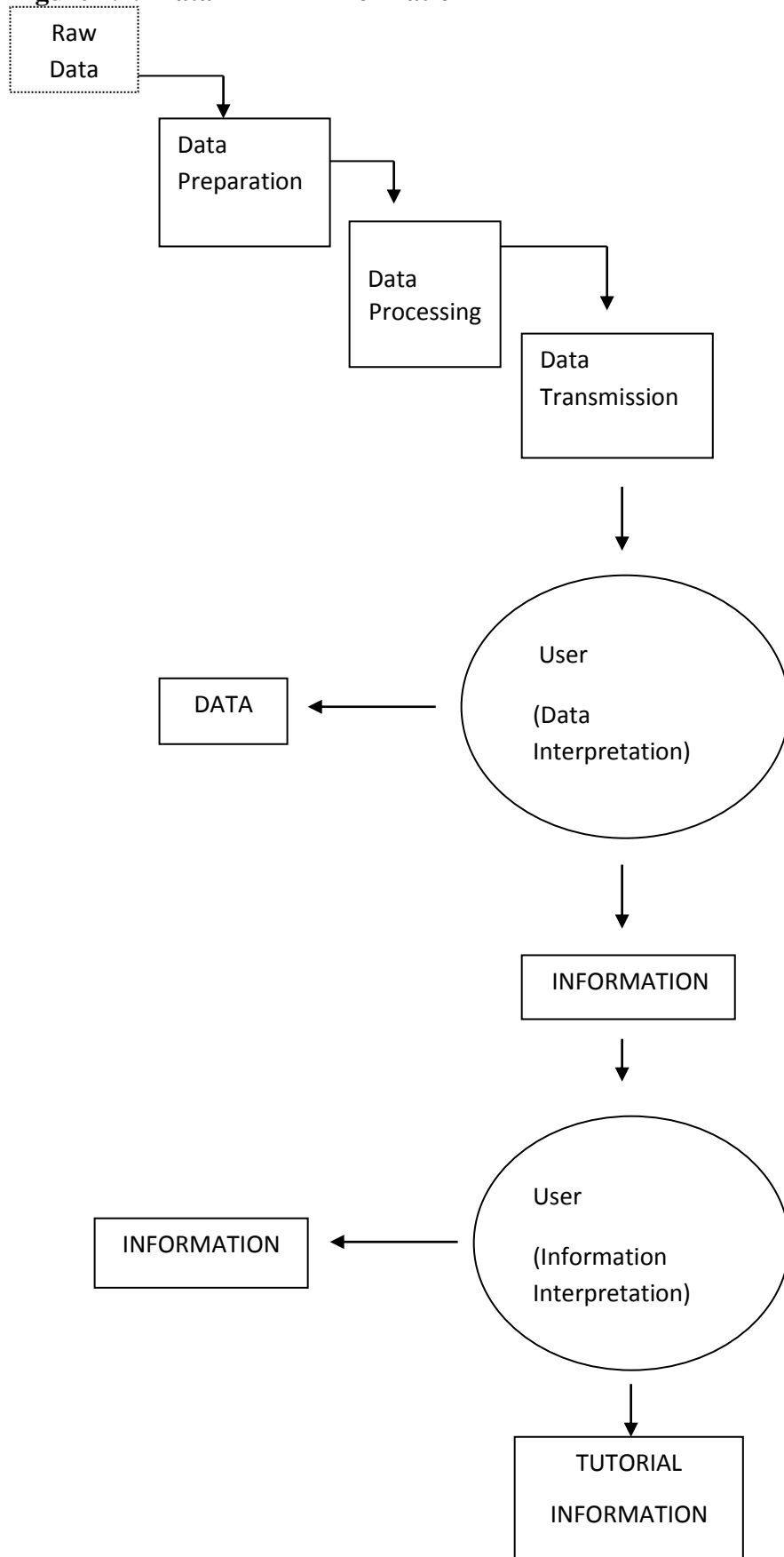
### **BASICS OF INFORMATION AND INFORMATION TECHNOLOGIES**

#### **2.1. The Concept of Information in Logistics**

The concept of information can be explained by subjecting data-information-tutorial information. The reason for this is to confuse these concepts with each other and in fact the information is multi-dimensional. Mentioned concepts occur in different steps/phases within the process (Bensghir, 1996). The data is the initial material for process. These are the things like symbols, numbers, letters, images or observations that cannot be defined. Every kind of symbol, number, letter, image and supervision that has a certain value and a meaning is a data. For instance; the letters and numbers which were written in the way that TRN2335-9599 are data because they don't have any meaning. However; the definitions which were written in the way that Serial no: TRN2335-9599 is a data due to contain meaning and certainty. Making the right decision is significant to manage the organizations efficiently. The vital spot of decision making mechanism is information and information system. In that case, for the concept of information; it can be said that it is the processed information for the purpose of decision-making. Making decision on information depends on having some characteristics such as accuracy, relevance, wholeness, accessibility, clarity, reliability, and cost-effectiveness (the benefit which is acquired from information is higher than its cost), (Yozgat, 1998). In the literature the concept of tutorial information is used in addition to data and information concepts. Tutorial information is the knowledge which guides its user. Someone who has this kind of information can obtain some results even s/he doesn't know what to do about this information. For instance, you can't learn anything from the map on the paper.

Computerizing the same map is directing its user for reaching the destination, and by revealing the shortest distance, information turns into tutorial information (Demircan, 1997). The concept of information basically comes from the Latin word “information”. It has communication or formation meanings (Öğüt, 2001). Generally; information is a logical product which is obtained as a result of consideration, observation, experiment, research, and reasoning (Larousse, 1992). In order to make decision valuable data can be sold and purchased, and gain the meaning by being processed. To sum up, information is a data that is gathered, organized, interpreted, transferred to relevant department due to get effective decision with a certain method, transformed into meaningful and valuable aspect by being carried over to processing time, and effecting the decisions and actions (Barnatt, 1994).

**Figure 2.1. Data → Information**



(Ögüt, 2001)

### **2.1.1. The Characteristics of Information**

Arbak argued that information has two significant characteristics. The first one is the data which is the basic material of information has no meaning by itself, yet it becomes meaningful after processing (Arbak, 1995).

Today information becomes an output which is constantly produced, increased, conveyed with communication path, divisible, shared and substituted with production elements. The complex situation of relations between organizations and individuals reduce the reliability of information production and transmitting to the receiver. In order to increase the reliability of the information administrative audit methods are recommended (Güredin, 1994).

#### **2.1.1.1. Administrative Data and Characteristics**

Administrative data involves the elements and observations relating to operations. In other words, in order to achieve the determined goals it is the circumstance which was become meaningful by processing data for the managers. The most important resource of administrative data is experiences. Nevertheless, it is also utilized from embodiments, schedule, framework and model. Information needs of managers vary according to their positions. As the top managers need unplanned information in the long term lower management are in need of predictable and detailed information (Öğüt, 2001).

#### **Characteristics of Administrative Data**

- To serve a useful purpose.
- To be related to the responsibility of manager.
- To comprise the detail according to the needs of top management.
- To be up-to-date.
- To have acceptable level of accuracy.

- To have right timing.
- To have reasonable cost level.
- To be comprehensible.
- Not to contain any unnecessary repetitions.

### **2.1.1.2. Computational Information and Characteristics**

The most crucial source of organizations in the information age is the information which is produced by information systems. Due to the fact that computational information is acquired by using information technologies and information systems with scientific methods, it is away from the individual approaches and it shows objective attribution.

#### **Characteristics:**

- Accuracy or Inaccuracy: Information might be true or not. The person who gets the wrong information will be the same level with the exact information.
- Innovation: Information can be new and significant for the person who obtains.
- Increase in the amount of information: Information can straighten existing data or add new ones.
- Verification: The information which has been obtained recently can confirm existing information (Öğüt, 2001).

### **2.1.1.3. External Information and Characteristics**

External information is the data which is likely to affect the organization regarding to the threats and the opportunities consisted outside the organization in accordance with the social, economic, juridical, cultural, technological, and international conditions and developments. External information should include the following elements:

- The market share of rival organizations
- New market opportunities

- National economic growth rate and organizational growth rate
- Market situation of human resources
- Potential political risks
- Technological advances and the effects of the organization
- Trend in the general level of costs
- Changes in the global economy
- Legal regulation (Öğüt, 2001)

### **2.1.2. Information Production and Transmission**

The aim of every organization is to produce information which is a very difficult job. Information which has a significant influence on the capacity and efficiency of the organization is the reason of innovations and a prior condition of technological production. Information production and transmission are clarified with ‘‘information theory’’. This theory handles the production and the transmission of information at three levels. These are technical, relevance, and efficiency levels. Technical level represents the correct transmission methods of information. Relevance level represents which symbols will be used in order to give the desired meaning. Efficiency level represents in which standards the messages will be sent to affect the people (Bensghir, 1996).

### **2.1.3. The Cost of Information**

There is a cost in obtaining, using, and managing the information. Developed countries devote their one fifth of gross national product to information production and transmission. This rate is %12 in USA’s telecommunication and IT sectors. These sectors are growing faster than other sectors. This development emphasizes the importance of the cost of information which is very crucial for organizations. However, it is difficult to determine the cost of information which is an abstract concept. For this reason, in order to make a substantial cost analysis it can be said that there is no need to have any substantial source (O’Brien, 1993).

#### **2.1.4. The Usage of Information**

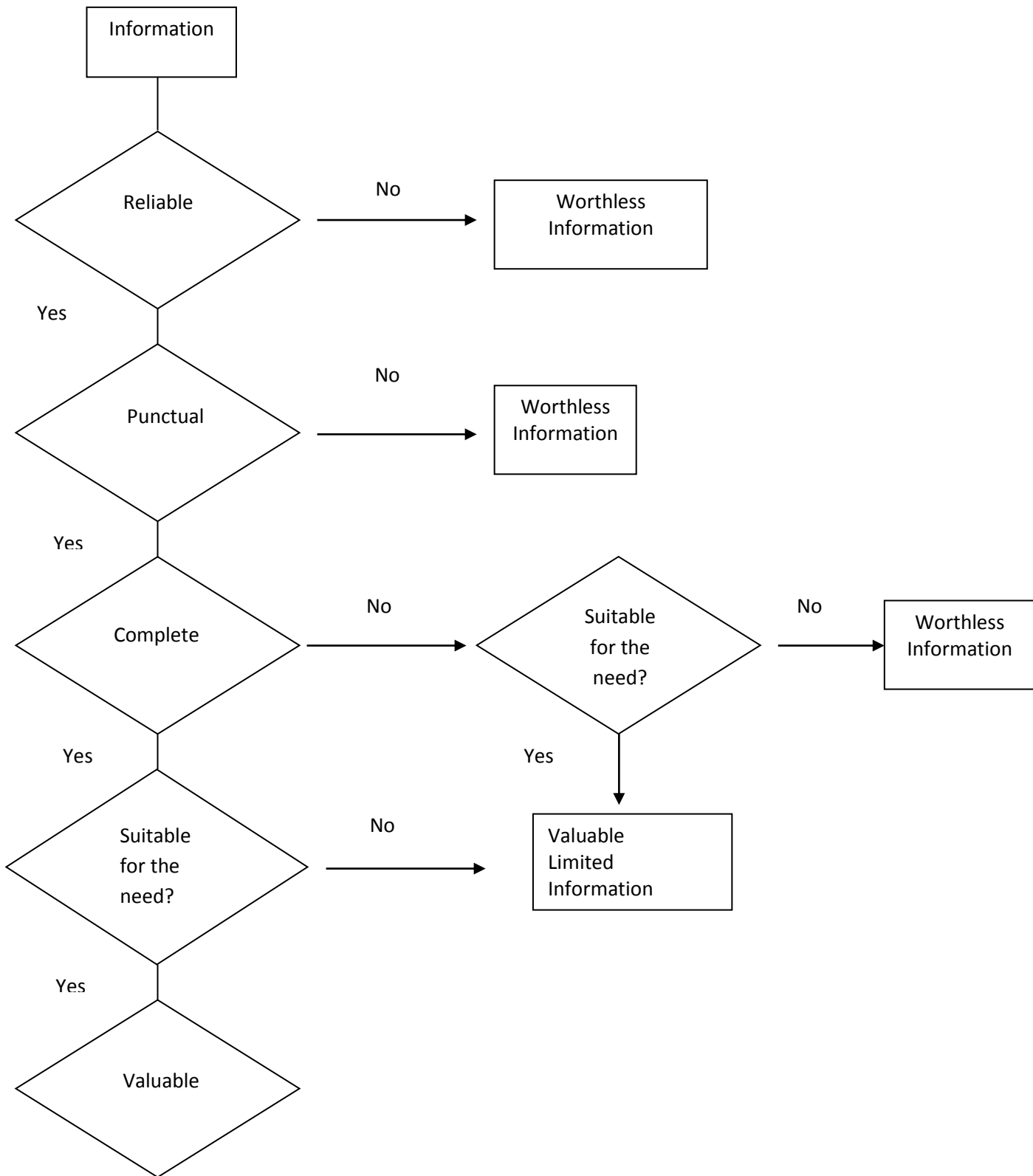
The basic purpose of using information is to provide support for decision-making process. Capital, technology, natural resources and traditional production elements of labor force in order of priority became of secondary importance. These resources can be obtained easily when the sufficient information is provided. The productivity of information depends on the integration with a task.

#### **2.1.5. The Quality of Information**

If the basic purpose of using information is to support the decision-making function, the value of the information will depend on the value of the decision. It is a realistic approach to define the value of the information according to the expected results. The qualifications which define the value of information can be considered as timeliness, propriety, completeness, economy, conformity etc. (Long, 1989).



**Figure 2.2. The Flow Diagram of Measuring the Value of Information**



(Öğüt, 2001)

Error is the important and effective element about the value or the quality of information. If the error is not detected in time it is very difficult to fix it. The reasons of incorrect information:

- To gather incomplete or incorrect information
- Errors which are made in information processing
- Not to process the data or to lose the information
- To obtain the information from the wrong source
- Data processing errors
- Distortion of information intentionally

## **2.2. Information Technologies**

Information technologies provide a technology based structure for coordination and control in the organizations. The relationship between IT and organizational researches proceed from a simple point. IT enables us to manage endless information instead of physical objects. Thus, IT can be used in the coordination and the control of affairs and decision-making processes. It is more flexible, versatile, useful and effective mechanism than many other traditional coordination methods. In other words, the potential effect of IT on the organizations has the importance of being the heart of organizational existence.

IT provides the methods and tools to get the power and to strengthen the current power positions without losing their efficiency. IT means' promotion of the possibilities to use information in and out of the organization started to extend the centrifugal organization structures. The information transparency gained in this way helps to increase the centrifugal power in terms of decision making. The organizations get help from IT to be effective while they establish relations with complicated environments. IT guarantees the immediate response to the flexibility and innovation of the environment, external elements and their demands (Masino, 1999).

Information society is an active society which is free from passivity and which knows how to get use of information technologies prevalently. With these specialties, information society organizations are shaped with IT. IT, which is consisted of computer hardware, software and communication systems, constructs the human life dynamics today. It has entered into the daily life as a tool used in social, economic, legal, political and cultural activities.

### **2.2.1. Information Technology Elements**

IT includes the calculation and communication technologies about the microelectronics which carry out the acquiring, processing, storage and distribution of data with sounds, pictures, texts or numeric data (Bensghir, 1996). In this context, primarily the computers and input-output equipment which support those, fax, micro graphic, telecommunication, document filling and preparation machines and print machines are the elements of IT. IT is developing fast in line with the development of communication technologies such as laser, fiber optic and sound scanners.

### **2.2.2. Planning the Information Technologies**

IT has an important role in the determining of the success or failure in the world organizations. To make the role of IT effective is only possible with a comprehensive information technology strategic planning. Planning shows what is within possibility, how to reach success and how to coordinate the struggles. Strategic planning is, on the other hand, the process of decision making about sourcing and its application to realize the organizational goals. Strategic planning must be long term focused and should take the external elements into consideration. On this scope, there are six basic rules about the information technologies strategic planning:

Primarily, the focus must be on the work and the subjects to be achieved.

IT investment opportunities and alternatives should be evaluated rationally.

The risk must be defined and preparations must be done for risk management.

Unnecessary technological changes must be avoided.

It should be thought rewardingly.

Total participation and determination of every organizational unit and personnel related with IT should be provided (Öğüt, 2001).

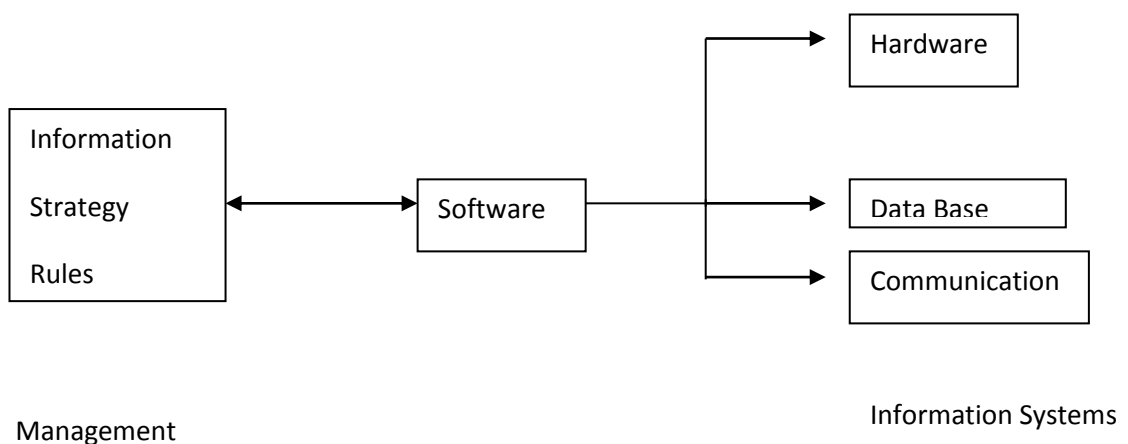
### 2.3. Information Systems in Information Management Process

Information systems are the processes composed of computers, procedures and human resources which carry out the information gathering, processing and transferring functions in the organizations. When talking about information systems, computers, telecommunication and organizational automation technologies should be considered altogether. Information systems can also be defined as the set of rules defining which data to be collected and how to process them.

Information systems are crucially important for organizational success. In information systems, human and technology work together. A new information system should be understood as a harmony of technology and humans rather than a superficial hardware – software change (Demircan, 1997).

From information era's viewpoint, information system is a computer based system which uses information technologies to turn data sources into information products. At this era, IS is used at a strategic level.

**Figure 2.3. The relationship between information systems and management**



(Demircan, 1997)

While the aim of information is to reduce possible future uncertainties, the aim of IS, in the most general sense, is to provide the necessary information in the process

of decision making. Information systems can provide the information about performing the purposes such as organizational effectiveness and qualified service delivery, in the required form and specialty. To perform this contribution depends on harmonizing the strategic purposes, activities, needs and sources of the organization with the information systems. At this point, the importance of management of IS is seen.

### **2.3.1. Information Systems Elements**

In this part, the elements of information systems; input units, central process unit, output units, human resources, procedures and software are emphasized.

#### **2.3.1.1. Input units**

Data, the basic input of the information systems, are transferred to the system via input units. Hardware such as optical readers and discs are used as the input units.

#### **2.3.1.2. Central Processor Unit (CPU)**

These are the hardware equipment which carry out the controlling, processing and storage of the data. Computers can be given as examples of these.

#### **2.3.1.3. Output Units**

It is impossible for information systems to work without input and output units. The information turned into output by being transformed in central processing unit is submitted to the service of relevant with output unit. Micro films, printers and scanners can be given as an example of output units.

#### **2.3.1.4. Human Resources**

These are the individuals who carry out the necessary works from designing to application and who are in systems analyst, systems engineer, system scanner, programmer and designer as IS personnel in organizations.

### **2.3.1.5. Procedures**

These are the operating and user instructions which provide the cooperation between the personnel, input and output systems and the central processing unit in IS. The variables and parameters related with procedure are important for the use and management of IS.

### **2.3.1.6. Software**

This is the set of programs which define the method and duties of IS and which supports the hardware. Software is the set of programs and commands which carry out the mission of controlling the activities of output and central processing units to realize the expectations from IS (Öğüt, 2001).

## **2.3.2. Information Systems Applications**

Information systems are used for the purpose of process the data produced by organizations and used in organizational processes and they serve as sources for variety of information products for internal or external use. It is suggested that IS should organize around the results but not the tasks. In the information era, it is seen that many organizations get use of information systems more and more to enhance the quality, decrease the cost and save time. IS types seen in application are; electronic data processing systems, office automation systems, management information systems, decision support systems, executive information systems and expert systems.

**Table 2.1. Information Systems Applications in the Organizations and Information Use**

Information Systems	Information Use
Electronic Data Systems	Routine data related with organization activities
Office Automation Systems	Digital data for the operational level
Management information Systems	Information for planning control and decision making at general management level
Decision Support Systems	Intra-organizational and extra organizational graphical information for executives
Executive Information Systems	Analytic information with interactive support
Expert Systems	Top information with artificial intelligence support including expertise suggestions on specific topics

(Öğüt, 2001)

### 2.3.2.1. Electronic Data Processing Systems

EDPS are the information systems provide routine data about organizational activities to be processed. The data which can be listed as sales and purchases are compiled, processed, classified and put into service via EDPS. Customer programs of the banks, reservation operations of the hotels, and payroll programs can be listed as examples of EDPS.

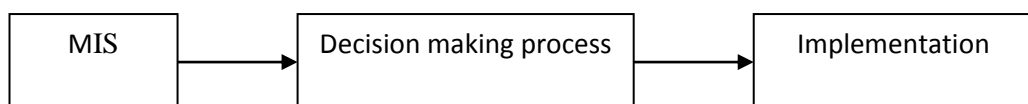
### 2.3.2.2. Office Automation Systems

OAS are used to make routine decisions which supervise organizational processes like automatic stock, order and manufacturing control decisions. Its basic purpose is to reduce employees' workload related with paperwork and to computerize the organizational works. OAS are the systems which comply, process, store and deliver data in electronic office communication form. Today, for the purpose of increasing the activity and service quality levels of the organizations, OAS technologies such as word and tele-conference are used for in-office communication.

### 2.3.2.3. Management Information Systems

MIS are integrated person-machine systems which provide to administer the information contributing to the decision making processes economically and correctly, in an optimal time frame. Decision making is to process the information. Thus, the manager will review, analyze, evaluate the data or information and then will make a decision. However, this depends on necessary data's and information's reaching to him. MIS are to provide this. In other words, a side of decision making process is implementation and other side is MIS.

**Figure 2.4. MIS – Decision making – Implementation Relationship**



(Malatya, 2013)



Since MIS give importance to the administrative dimension of information technologies used in organizations and since they adapt system approach in information system implementations, they are evaluated as a vital element in enhancing the organizational activity and service quality. MIS, which are traditional quick methods to transfer sales, inventory, manufacturing and information to the decision makers, can be enlarged till they are integrated with all organization units. Management support system concept is also used to reflect the role of MIS in decision making processes of the executives. MIS, which are developed for organizations, should adapt to environmental conditions. In the process of adaptation, the focus should be on success by information systems, feedback, evaluation and data regulations.

#### **2.3.2.4. Decision Support Systems**

DSS is the information system which provides interactive and actual support to decision making process. It provides software packages such as statistical analyzes graphic and model supports, data base and report creating techniques for the last user administrators. It is claimed that DSS are the developed versions of the EDPS and OAS. DSS define a more interactive process than EDPS and OAS. Different from MIS, DSS provide individual / machine interaction and contribute to synergetic decision making process which is a source of qualified decisions. DSS contribute with its advanced analyze models. It emphasizes that computers are the supporting tools in decision making and that they should not be considered as the sophisticated machines which make decisions themselves.

The primary task of development stages of DSS and computer related technologies is not to take place of administrators and make decisions but to provide necessary data to the administrators in time. DSS is used with a set of organizations and it is claimed that this use will expand more in the future (Öğüt, 2001).

### **2.3.2.5. Executive Information Systems**

EIS are the information systems which provide the necessary and critical information for executives of organization in a proper time period, in the required form, in or out of organization. EIS are developed to create strategic support the decisions in non-structural form of executives via advanced graphic and communication technologies.

### **2.3.2.6. Expert Systems**

ES, one of the top base information systems, which include the use of artificial intelligence techniques, are the information systems which provide advisory support to users in some specific expertise areas. In other words, this is the use of artificial intelligence techniques to suggest solutions for practical problems; or to give computers some human behavior.

The expected benefits of expert systems are;

- The need for experts who ask for high salaries is reduced or the productivity of the experts increases.
- The expert information is stored, re-applied and distributed.
- They increase the consistency and degree of accuracy wherever they are used.
- When it is compared with experts who have special knowledge, ES can provide more qualified documentation in terms of rationality.
- It contributes to the decision making process as a foresight.
- It is also used as an educative tool for inexperienced employees.

## **CHAPTER THREE**

### **INFORMATION TECHNOLOGIES AND SOFTWARE APPLICATIONS IN LOGISTICS**

#### **3.1. The Need for Information Technologies in Logistics**

The use of informatics in logistics increases day by day. The elements, such as the increase in the speed of integration and goods traffic in global trade, the enlargement in trade volume with the product variability and change in demands, and managing a full time watch of the product about when, what time and where it is, are prominent in the use of logistics informatics systems (Çancı and Erdal, 2003).

The application areas of basic logistics information systems are the “e” base applications in businesses producing logistic service, “e” based applications in businesses like virtual shops and the producers getting logistic service, and “e” based applications in public administrations.

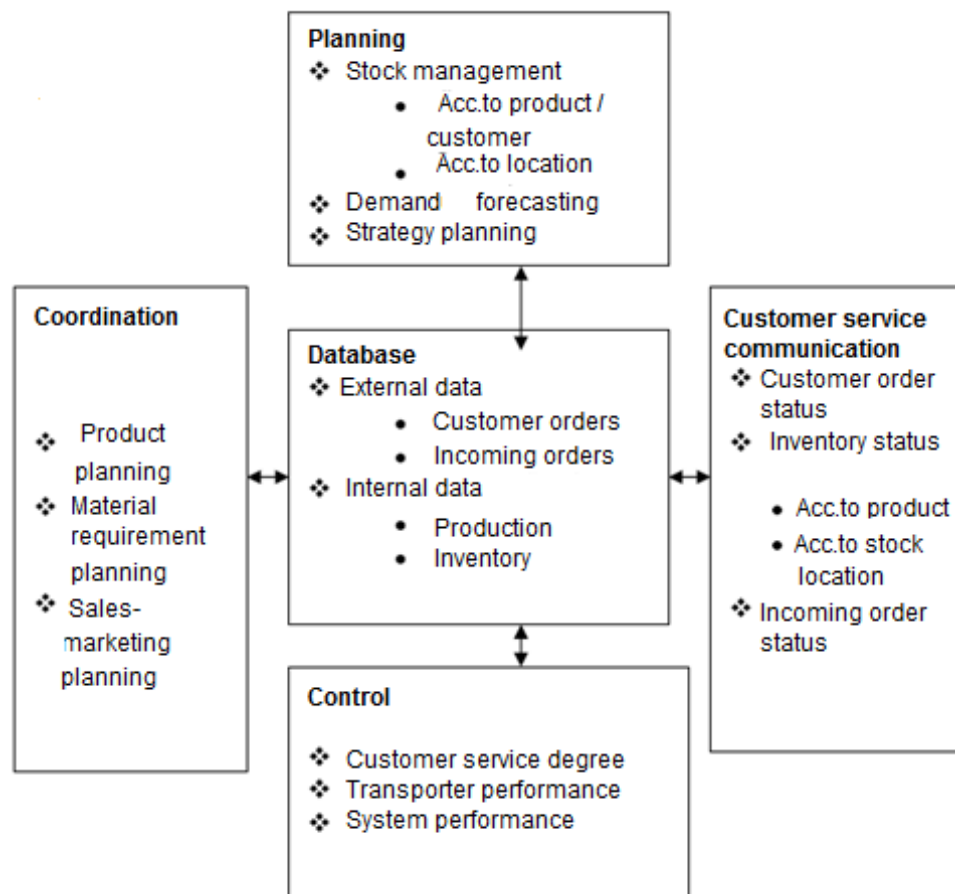
**Table 3.1: Logistics Information Systems and E-Logistics Application Areas**

<b>E-LOGISTICS APPLICATIONS</b>		
<b>PRIVATE SECTOR Logistics Sector</b>	<b>PRIVATE SECTOR</b> <b>I. Automotive, Textile, Electronic etc.</b> <b>II. Virtual Shop</b>	<b>PUBLIC MANAGEMENT Public Institution and Agencies</b>
<b>Information Technologies</b>	<b>Information Technologies</b>	<b>E-State Applications</b>
<b>Logistics information systems</b>  -Business information systems  -Transportation organization  -Route planning  -Product, vehicle, driver tracking systems -Store information systems  -Customs operations - Customer relations etc.	<b>E-Business</b>  - Business information systems  -MIS, EIS, DSS, IS, etc.  -Supply, produce, distribution operations  -E-Trade -B2C and B2B  -Intranet, extranet, internet etc.	<b>Transportation background, system and processes:</b>  -Highway -Airway -Seaway  -Railway  -Tubing  -Customs  -Telecommunication

(Erdal, 2005)

Logistics Information Systems are defined as the comprehensive systems which provide logistics companies to store customer, order and inventory information in and out of the company, and to use them when necessary; to make stock planning, demand foresights and strategy plans regarding the customer and supplier, to support any kind of work flow coordination and to control the customer service degree and the performance of the transporters and system during and after all these activities (Christopher, 1998). Logistic information systems are the systems where the information about planning, coordination, control and customer service contact is collected in a single data base; and where each sub system is related with each other via the data base.

**Table 3.2: Management Information Systems Functions**



(Christopher, 1998)

Information systems, which are used in logistic sector, are consisting of software modules. This software, in terms of management necessities, generally could be privatized and its modules host below (Erdal and Saygılı, 2007):

- Business information systems
- Land route goods transportation
- Fleet management
- Transportation organization
- Route planning
- Goods, Vehicle and driver chasing information systems
- Airway goods transportation
- Sea route transportation
- Railway good transportation
- Depot and bond operation
- Clients relations management
- Customs operations
- Foreign trade process
- Varies of special transportation
  - Project base transportation
  - Container transportation
  - Cargo transportation
  - Automobiles, textiles transportation etc.

Software information, which has modules above, within business and other functional areas as market, accountancy, finance and human resource is working as connected and actively with sourcing sections.

### **3.2. Historical Development of Logistics Information Systems**

Logistics Information Systems has been a very important study area of logistics activities for 25 years (Stephen, 2003). Logistics Information Systems is defined as information systems providing related and real time information (Comyn-Wattiau and Akoka, 1996). Logistics Information Systems ensure that acquisition, storage, processing, transmission and associating data in between different levels of logistic at structural model and all logistic activities at the same time. Logistics information systems are expressed as a set of logical and physical structures. Physical structures describe systems occurring with regard to the existence of products like computers, bar code readers, communication tools, software, and tools that provide control, whereas logical structures consist of principles of the system like algorithms, rules, important working principles, methods, technologies, procedures, laws and guidelines (Ginters, 2002).

23 countries come together under the leadership of the United States of America to sign the General Treaty of Tariffs in 1974. As a result of this, Logistics Information System got more importance. According to this agreement, tariffs were regulated, and trade began to increase all around the world. With the increase in the volume of world trade, firms were faced with the problem of determining from which factory the goods requested and in which way they should send the goods. After this problem, companies had to try to create the logistics information systems. The problems with the shipment of goods were resolved thanks to mathematical models in time, and the resolution time reduced due to the development of computer technologies. However, the recent development of communication technologies, especially the Internet, has resulted in the creation of several small demand points. While there were one or a few demand and supply points in the past, the importance of Logistic Information Systems has increased in today's world due to the increase in the number of demand and supply points.

### **3.3. The Use and Benefits of Software in Logistics**

There are various benefits of using information systems by logistics. In terms of transport and management, they help to make an efficient and productive management functions. Simultaneous and true information flow and keeping documents in electronic environment are the basic benefits.

Using information systems provide security for vehicles, objects and drivers as well. Safe drive of the driver with the vehicle, decreasing accident numbers, fast first aid in emergencies are the primary benefits of the system.

Information systems provide crucial downs in period and costs of the drives. True route planning minimizes the delays and provides less traffic bills and more control upon working and resting hours of the driver.

Logistic organizations using information systems provide faster and stronger operational management to their customers and have more qualified workers. They also increase the flexibility of the vehicles.

Thanks to these systems, operational costs of the vehicles are decreased and they provide benefits in areas such as vehicle use optimization and periodical protection maintenance processes.

Information systems keep and store each sent and received information. This prevents misunderstandings and provides fast and safe transfer of the data (Erdal and Saygılı, 2007).



**Table 3.3: Cost and Benefits of Information Systems to Logistics**

<b>COST</b>	<b>BENEFIT</b>
Amortization Cost	Route times prevented empty routing
Annual enterprise cost	Prevented route km.
Annual benefit cost	* Undone transport operations * Done transport operations
Corporate cost	Better loading elements
Maintenance – Repair Cost	More profitable fleet operations
Communication Cost; * Subscription and Use Cost	Strong communication and preventing misunderstanding
Educational Cost	* Less communication times * Profitable time use
Annual Total Costs	Annual Total Benefits

(Erdal and Saygılı, 2007)

To provide the benefits listed above, logistic firms are using software such as Electronic Data Interchange (EDI), Barcode and Radio Frequency Identification System (RFID), Enterprise Resource Planning (ERP), Order Management System (OMS), Warehouse Management System (WMS), Transportation Management System (TMS), Advanced Planning System (APS), Vehicle Tracking System (VTS), Collaborative Planning/Forecast/Replenishment (CPFR), Vendor

Management Inventory (VMI), Quick Response (QR) and Efficient Consumer Response (ECR). These software, application scopes and benefits are stated below.

### **3.3.1 Electronic Data Interchange (EDI)**

Electronic Data Interchange (EDI) is a revolutionary working tool. EDI provides the true interchange of all work information such as invoice, order, catalogue, price list, etc. The dictionary meaning of EDI is; interchange of data among organizational units in standardized ways which can be processed by computers. Thus, electronic documents can be transferred from one computer to another without typing on keyboard. Companies use templates defined before while doing interchanges of standardized business forms with EDI. For example, a gross market can carry on all its order, transport and payment activities on electronically by using EDI. Within this system, each document is once transferred to magnetic medium by its creator and it is distributed magnetically to all required departments till the last unit. Each department, without re-typing and repeating anything, takes the data valid for itself, processes the changes it does electronically and carries out its operations based on this data electronically. This whole process is named as EDI (İlhan, 2002).

EDI is a technology which provides trade operations to be carried out through communication network among computers (Eom and Kwon, 2005). It was begun to be used in 1960s in North America and was spread to transportation industry in 1970s and to automotive, retailing and distribution sectors. Although it is used in many industry branches, EDI is mostly used in automotive industry. EDI provides standard operational information to be transferred from a computer to another (Sanders, 2007).

Organizations can carry out their operations without writing on paper, filing or repetition of the information with EDI. Besides, pre-defined templates are used while interchanging standardized business forms with EDI (Ertaş, 2000). The benefits resulting from usage and adaptation of EDI increase the financial performance and competition strength of the companies (Dresner, 2001). Together with this, with the use of EDI technologies, the ambiguity of

information share among supply chain members is decreased and the transportation performance of suppliers and the supply chain system performance are highly increased (Gunesekaran and Ngai, 2004).

Established organizations trust EDI in their operations of taking and accepting orders through supply chain. So the organizations develop more contributing and continuous relations with their partners. For example, Chrysler, by re-organizing its relations with the suppliers, saved an amount of 1.7 million dollars annually with decrease in manufacturing costs and quick product circle (Son et al., 2005). As a result, recently big retailers are struggling to make their suppliers adapt EDI. For example, Wall-Mart, the biggest retailer of the world, started the electronic operations of taking and accepting data with their suppliers in August 2002. This system makes the data share and communication in selling points easier by providing faster, cheaper and more reliable information for trade partners besides cost saving (Eom and Lee, 2005).

A research was carried out by Hill and Scudder (2002) to review the use of EDI between organizations including suppliers and customers of food sector. The result of the search showed that the companies saw EDI as a tool to develop efficiency more than as a tool easing the integration of supply chain. Latest researches show that the growth rate ranges between 50 – 60% annually with EDI implementations while traditional service growth rate is between 5 – 8% and the costs are reduced by saving 220 million dollars per year (Huang et al., 2008).

### **3.3.2 Barcode and Radio Frequency Identification (RFID)**

Radio Frequency Identification System is a very promising technology recently. In RFID system designs, the purpose is to create and collect information without human effect. Its application increases across the world day by day. RFID is the technology of defining objects and humans with radio frequencies. The RF tag can be put on various types of objects (product, human, tool, etc.). Each label has an identity code for security reasons which are defined by the manufacturing company and which cannot be changed. (RFID Advertorial, 2006. Koç System RFID Applications, İstanbul).

RFID is the general name of the technology working with radio frequencies which provides the movements' of the objects with tags to be tracked. The products can be tracked from manufacturing to distribution through all their life time with RFID.

With this new technological background, data collecting and service distribution can be carried out without human interference; and the fault rate is decreased and service speed and quality is increased. Tags can either be mounted on the products directly or on palettes or packages, or can be used in various operations for logistics.

A RFID system is composed of the followings:

- RF Tag
- Antenna
- Reader/Printer
- General Programming Hardware (<http://www.coolavenues.com>).

Communication is carried out between the reader and the antenna on the tag. The tag is perceived by the reader when it is in the communication field of the reader. The perceived tag sends data of its identity code and other recorded data with RF signals to the reader (<http://www.coolavenues.com>).

RF Tag: RF tags are the devices, composed of chip and antenna, where the product information is stored. Memory shows differences depending on the reading interval and reading/printing capacity. RF tags can carry various information from product serial number to product history.

RF tags are classified into three categories according to their energy source; active, passive and semi-passive. Active tags get use of an integrated energy source to communicate and to operate while passive tags get this energy from the reader they get into the communication area. Passive tags, since they get the energy necessary for the chip from the reader, need to be in a distance of 4-5

meters. The battery in semi-passive tags to operate the chip can operate in lower signal levels (till 100m) (RFID Advertorial, 2006. Koç System RFID Applications, İstanbul).

**Table 3.4: Tag classification according to EPC Protocol**

<b>EPC Class</b>	<b>Definition</b>	<b>Function</b>	<b>Description</b>
0	Read only	Passive tags	Data written in tag manufacturing process and can be read again and again.
1	Written once and read only	Passive tags	Data is written by producer or user and can be read again and again.
2	Read / Write	Passive tags	User can write and read the data again and again.
3	Read / Write	Semi-passive tags	Can be equipped with sensors to read parametric details such as temperature and pressure.
4	Read / Write	Active tags	Can be equipped with sensors to connect with the reader and work like RF transmitter.

(EPC Global Standards & Technology, 2000)

**RF Tags Cost:** Some data should be clarified for the costs of RFID tags. These are the amount of tags to be used, the amount of information to be stored in tag memory and information about surface/cover where the tag is put on (such as putting on a plastic surface or sticking to a package tag).

**Antenna:** The hardware which provides the reader to communicate with the tag. The reader distributes the energy it produces to further distances more equally with circular diffusion. In many cases, since the tag reading shots are very

low, the use of antenna is very important (RFID Advertorial, 2006. Koç System RFID Applications, İstanbul).

Reader: RFID reader is a hardware which sends out signals from the antenna via RF. RF tag replies back to these signals and the reader re-reads this answer. Thanks to this, the information exchange between the reader and the tag is carried out. Readers are in three groups in general. Stable readers are established on a certain place and they are the readers from which the RF tags pass through and communicate. Portable ones can create mobile communication with the RF tags. Mounted readers are put into mobile vehicles and they read the tags in their coverage zones (RFID Advertorial, 2006. Koç System RFID Applications, İstanbul).

The selection of the readers is critical for a RFID system setup. Proper reader can carry out the necessary functions based on implementation, can adapt to environmental conditions and can be adaptable to country's frequency norms. The selection criteria for readers are listed below:

- Requirements of the operation
- Frequency range
- Reading/writing interval
- Functionality of the tag
- Standards (EPC/ISO)

General Programming Hardware: They are the key structures which play role in interface data collection and in turning them into understandable information in RFID solutions. They are used for collecting data from the readers, filtering, creating an understandable whole integrated with other software. The organizations should pick up a proper interface with a benefit costing analysis according to their requirements for the RFID technologies to be built (RFID Advertorial, 2006. Koç System RFID Applications, İstanbul).

The expectations from RFID systems interfaces are listed below:

1. The system must recognize any reader and can take necessary information from the reader.
2. The system can be used in determining the number of products, calculating the in/out percentages of the corridors/shelves in the storages etc.
3. The system must provide getting meaningful information by filtering the data.
4. The system can turn the information to proper data formats.
5. System must be capable of replying to data questioning processes.
6. System must be at a level of communicating with the software such as ERP systems which support decision making processes.
7. It must be capable of communicating with a web interface to provide the information from tag reader to be tracked on web.
8. System must be modifiable and capable of recognizing various product code specifications.

Sun Java RFID solution can be given as an example to these interfaces. The processes carried out by Sun Java System RFID solution are listed below.

- It can get store and process EPC data from one or more reader.
- By filtering, it can delete the unnecessary values.
- It can transfer the data periodically to ERP systems.
- It can provide tracking for critical situations such as low stock levels

(<http://www.w3.org>).

Printer: They can be stable or portable as readers are. These hardware systems are used in reading the information in RF tags and writing the new ones. By being connected to desktops, laptops and mobile computers with cables or wireless, it prevents the need to buy a new mobile device. Mobile RFID printers make it easy to read the tags on surfaces hard to reach or dangerous. Except these printers, there are also printers, thanks to a special program uploaded to normal barcode printers, which write the information on paper to the chip in the RF tag and which prints the tags (RFID Advertorial, 2006. Koç System RFID Applications, İstanbul).

### **3.3.3 Enterprise Resource Planning (ERP)**

ERP is the result of the 1990s' customer focused marketing strategies. It is a standard software package which automates all the work and information flow processes from the proposal submission to delivery process and even to providing the customer satisfaction and commitment, by depending on a technological background and by compounding them within the bounds of opportunity of this background. It provides measurable outputs and “primarily supports the management of the source distribution” (Su and Yang, 2010) and “which is designed to integrate the in-value chain of the company” (Moller, 2005). After 1990s, the functions of the companies which want to reach customers and suppliers more easily and faster, such as supply, manufacturing, storing and distribution were begun to be located not in a single area but in different places of the country; or even the world. Moreover, the companies began to distribute a part of the products or services they produced in their scope to their suppliers in the frame of certain agreements (outsourcing). So, the work and information flow processes became more enlarged and complicated. These processes must work integrated to provide true product (with quality and price accepted by the customer) – service to the customers. The larger and more complicated an organization becomes, the more necessary the information flow integration is (Chang et.al., 2008).

With MRP II, that is created by adding capacity installation to MRP, planning and analyses of capacity, quality and maintenance (equipment). However, MRP II is not efficient in whole integration of all sources of the organization (beside others; human resources and finance etc.) because with new competition



conditions, it is necessary to follow costs, quality, productivity of the equipment and workforce in each facility and in each process separately and as a whole and it is also necessary to provide a proper – fast – in time work – information flow through all process. ERP is a business software package which provides the use of company sources efficiently and productively (Boersma and Kingma, 2005) for the companies seeking ways to develop administrative control upon complicated work processes, to increase efficiency and productivity and to decrease the costs of products and processes (Boersma and Kingma, 2005) with the integration of work processes and information flow in a single package (Mzoughi et al., 2008).

ERP is a method for efficient planning and controlling of all sources related with taking and preparing orders, delivery and calculation in a manufacturing, distribution or service company (Moller, 2005). The logic behind ERP is to collect as many functions as possible under a single roof to provide the information share and communication among different departments (Tarantilis et al., 2008).

ERP Applications integrate the information technologies and work processes in and out of the limits of the company within a package. The primary function of ERP is to decrease the costs and to plan and integrate the sources including sales, distribution, manufacturing and performance (Chang et al., 2008).

ERP software package includes integrated modules which are used by different units and which provide getting single and consistent results in the process of reporting (Taşçı, 2006; Yegül, 2003; Moller, 2005);

- Material requirements planning: The module provides materials and semi-finished products to be ready at needed time - in any desired location - right cost - which makes the desired quantities, warehouses - manufacturing centers - outsourced providers on the basis of inventory reports, etc. (Plastics - semi-finished products at the level of quantities and costs) are to be taken (using the advantages of barcode systems today).

- Manufacturing Resource Planning: The module enables Inventory - Workforce - Equipment (machinery, equipment, etc.) at the level of production facilities, the trio plan - monitoring - provides management, capacity - labor –

bench reports, why stop bench reports, planned - actual time (efficiency) receipt of reports of this through these analyzes, reports, analyzes, and proper arrangements (adjusting customer practicing, the labor shift, disabling the procurement of equipment, etc.).

- Maintenance Management: The module provides tracking of first stages of the equipment used (machinery, tools, etc.) needs timely supply of spare parts, maintenance of the way that does not disrupt the planning of production, and use of molds used in the duration of their lives, the device that allows traceability of the calibration.

- Customer Relations Management: The module provides reporting and analysis of ensuring customer satisfaction and loyalty given to the customers' requests quickly and accurately, until the first meeting, the provision of services and keep records of all the processes.

- Human Resource Management: Sufficient to meet the labor needs of the existing workforce motivation - education - ensuring the development, personnel management, career planning, employee suggestion practices, prizes, and allow follow-up, wages (payroll) the execution of such processes, which keep records to be analyzed and reported by the module.

- Quality Management: Module enables, on the basis of customer - Product – bench, the operation procedures and instructions to be entered, Plastics - semi-finished products and production quality criteria considered to be entered at each stage, enabling the monitoring.

- Finance and Accounting Management: Billing, checks, promissory notes, and follow-up of inputs, risk analysis, and the remaining dating on today, banks automation, budget management, legal, accounting for receiving are the outputs of the module.

- Supply Chain Management: Evaluation of bids, purchase orders, applications, price lists. When and where will it be produced, which parts will be supplied from where and when?

- System Management: Installation, authorization, interface - menu - settings, reports, etc. The system's modular structure allows the module to walk off without a hitch. - E-Applications (New generation ERPs (ERP II)): a web-based work developed over the internet customer (B2C - sales to end-users or companies on the internet - marketing tools (catalogues, order taking, collection, etc.) present), suppliers (B2B - companies on the internet offer, procurement, presentation) relationships.

ERP Applications initially accounting, order, distribution, shop floor control functions integrated into the systems that combine functions such as material requirements planning. Then, the demand forecasts, storage, capacity requirements planning, and logistics are added these functions. In recent years, addable – removable – re-addable modules such as developed project management, human resources management, customer relationship management, information management made ERP more functional. It was possible the development of solutions and methodologies of web-services and the necessity of having got rid of all of the users of ERP (Tarantilis et al., 2008).

#### **3.3.4. Order Management System (OMS)**

Logistics information system is the base of ordering process. Depending on the interaction between marketing, sales order management to complete the cycle in question. In other words, order management is customer service quality indicator. Orders in order to provide the desired level of service planning, receipt, transfer, processing, preparation and sending of information during the inventory and documentation must be complete.

Order at any time, ready to be taken towards the desired location for the desired amount and order management systems are used. Gains provided by these systems can be listed as follows:

Ø Increase the degree of customer satisfaction,

Ø Customer reduced error rates,

Ø Acquire business flexibility,

- Ø Order tracking control is achieved,
- Ø Shorter cycle times,
- Ø The effect of variability order is minimized.

Order management systems and also the goods cannot be delivered, pending orders, running out of stock, order fulfillment rates, customer satisfaction, sales losses can be measured easily (Yıldıztekin,2002).

### **3.3.5. Warehouse Management System (WMS)**

WMS; warehouse and distribution centers, inventory, equipment, management of labor resources as a whole, provides storage and logistics processes. In-house production, purchasing, logistics planning, order management and sales channels, which allow for managing operations to meet the demand WMS, used in conjunction with barcode and RF communication technologies maximize the efficiency of storage and distribution logistics may quite easily lead (Selco Systems Engineering & Logistics Consulting, <http://ww.selco.com>).

WMS includes all storage activities:

- Ø Receiving: Warehouse planning, listing of sizes and weights, quality sampling.
- Ø Placement: The best stock trading decision-making processes in place, to be applied to the support of all stock types.
- Ø Regeneration: Fixed or order picking warehouse based replenishment.
- Ø Collection: Route optimization, placement.
- Ø Value Added Services: Grouping, labeling, assembling.
- Ø Packing: Correct box / parcel sizes cookies.

Ø Cross-Shipment: Planning, labeling and sorting.

Ø Separation: Various types (ordering, vehicle or geographic area) allocation.

Ø Shipping: Route control arrangements, documentation, shipping information transmission.

Ø Management: Warehouse work force planning, performance measurement, production plan, modeling (for the classification of new products or fixes), invoicing, pallet management, custom reporting.

Ø Inventory Count: Full inventory and perpetual inventory.

Warehouse management systems, a repository for all product orders and receiving, handling and storage operations and the information are recorded every detail of interest. In addition, from the WMS, warehouse inventory databases during the stay at the location are recorded clearly (WMS, <http://www.dhl.com.tr/publish/tr/tr/services/logistics/it.high.html>).

By using WMS, these benefits are gained (Conceil Assistance Technique Logistique, Systemes D'informations Logistique, [http://www.catlogistique.com/systemes\\_d'informations\\_logistique.htm](http://www.catlogistique.com/systemes_d'informations_logistique.htm)):

Ø Warehouse entry and exit times to optimize operations and reduce the number of transactions,

Ø Using the best stocks on the move or stationary application and provides the new arrangements,

Ø Optimizes resource utilization and reduced labor costs,

Ø Adds clarity and accuracy of the warehouse inventory,

Ø Collecting reduces preparation times,

Ø Productivity increases,

- Ø Storage provides easy access to information,
- Ø Provides a competitive advantage,
- Ø Distribution center allows more efficient use of space,
- Ø Improved order fulfillment,
- Ø Supply chain costs are reduced.

The most important advantage of this system is quick and degradation characteristics of the goods in addition to provide accurate information to the presence of the ability to control.

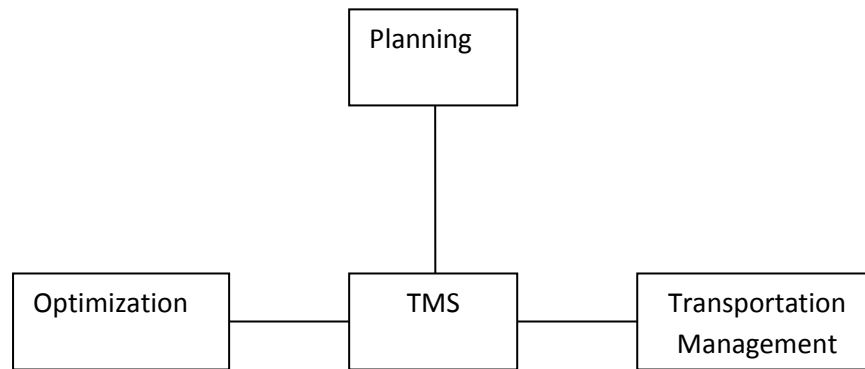
### **3.3.6. Transportation Management System (TMS)**

When the working process of TMS is analyzed, it is seen that it is used in the stage after WMS. In general, it includes functions like creating transport (round) for orders which will come to the storage or those which are already in the storage, planning, and monitoring, and it is used by transport agents and transporters.

There is a single database at TMS just like all other systems (Petri and Szekely, 2005).

It is possible to analyze TMS with three main functions (Figure 3.1).

**Figure 3.1: Three Main Functions of Transportation Management System**



(Petri and Szekely, 2005).

**Planning:** It is the stage in which the decision of which vehicles will be assigned until the stage of delivery of orders to the buyer, whether the vehicle should stop by a distribution center, which products can be transported in the same vehicle etc. is made, and it is the stage in which planning is organized based on this decision. Users have high level of experience, and they use the system as a tool.

**Optimization:** Two important optimizations are used. One of them is route optimization, and the other is vehicle optimization. Optimization programs which are created dedicatedly are generally used to do these operations. The important thing here is to make sure that TMS and these programs can work in an integrated program.

**Transportation Management:** Management stage is introduced a stage that comes after planning and optimization stages in the working process. At this stage, the last stages of transportation process such as monitoring instruments, performance reporting and the stages in which senior management is informed are made and displayed.

If TMS is integrated with the other systems, it becomes more successful, and more effective reports are obtained (Petri and Szekely, 2005) (Table 3.4).

**Table 3.5: Function and Benefits of TMS**

<b>Function</b>	<b>Benefit</b>
Optimization of Storage	Process development, savings, more work with less source
Operation Transportation Control	Creating, labeling round, printing and monitoring document
Control of Transportation Work: Load Planning	Low Costs: Developed reporting and planning system
Optimization of Route	Better Planning: Managing seasonal float of the operation and shortages
Real Time Information	Easy Reporting and Analysis: By providing real time information about stock

(Moralas, 2012).

Transportation activities ensure the link between production, storage and consumption.

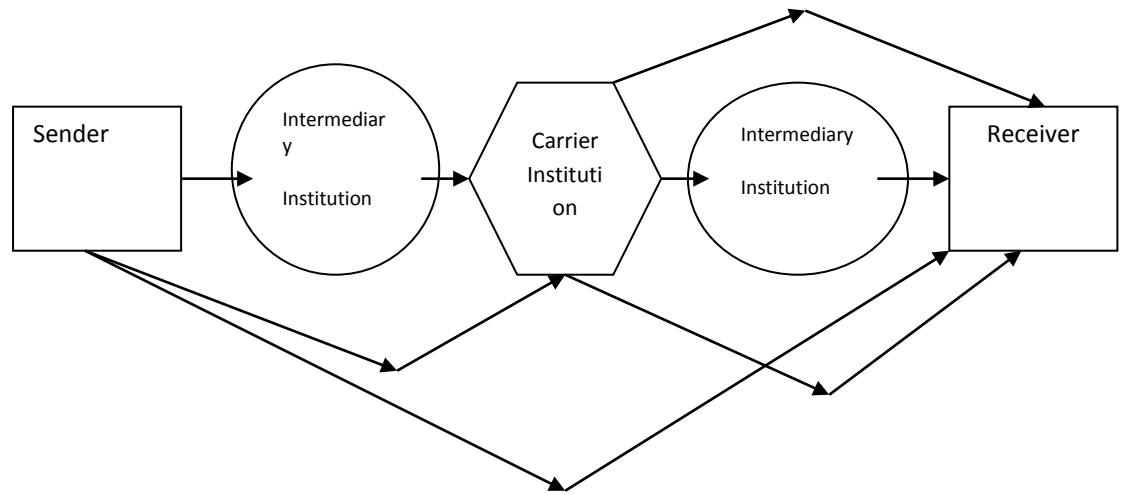
Transportation management helps operation in the following areas:

- Reducing the cost and the time of transit
- Delivery on time
- Low-range in transit time
- Consolidation of different transportation modes
- Minimum number of delay, damage and loss
- Which transportation mode should be used?
- Should own vehicle or third party transportation vehicle be used?
- Which route should be used?

Possible transportation types are shown in Figure 3.2.



**Figure 3.2: Transportation types**



(Kasilingam, 1998).

The following processes are carried out with TMS:

- Planning and optimization
- Carrying out transportation activities

10%-40% reduction in transportation costs that are 30%-60% of all logistics costs of organizations was measured with TMS.

A transportation management method can be used in the following subjects (Chun-Xia et al., 2010):

- Planning and optimization
- Monitoring vehicle in real time
- Loading vehicle, route optimization
- Consolidation of shipment
- Choosing transportation type and shipping agent
- Transportation management

- Controlling service quality
- Transportation costs and making simulation
- Controlling costs, KPI reporting, statistics

Numerous technologies are used in TMS. Some of them can be summarized as follows:

- The Internet technology
- Mobile technology
- GPS technology
- GIS
- RFID
- Barcode

The purpose in transportation management is to increase the level of consumer service with the standard service time and low costs (Tuzkaya and Önüt, 2007).

All management systems can work effectively if integration of them is done. Moreover, several studies reported that integrated work of especially WMS and TMS, working as a whole when necessary contributes to logistics management.

### **3.3.7. Advanced Planning System (APS)**

APS systems have been suggested by different software firms in different times. In addition, most of the well-known APS software programs have a common structure. An APS typically consists of different software modules, and each provides a certain level of planning task.

A summary of the structure of software modules and planning tasks can be as follows:

"Strategic Network Planning" involves all long term parts of planning, especially tasks of the location of factory and the design of the physical distribution structure. Some questions resulted from strategic sales planning can also be considered. Basically, design of supply chain, and basic material flow between the supplier and the customer is determined,

Subsequent tasks of strategic sales planning and medium-term sales planning are supported by the "Demand Planning" module. Most of the APS providers also presented "Meeting the Demand & Saleable Stock" item which includes short-term sales planning.

"Main Planning" coordinates medium-term planning of procurement, production and distribution. Tasks of delivery, capacity, and the medium-term staff planning are considered simultaneously. Furthermore, master production scheduling is also supported.

If there are two separate software modules for production planning and scheduling, the first one determines the size of the party (lot-sizing), and the other one performs machine scheduling and shop control (shop floor). However, only one software module can actually support all of these three tasks. Especially this kind of detailed and short-term planning is related with the organization of production system. Therefore, all bottlenecks certainly should be taken into consideration. If a multi-stage production processes and products exist, these should be set to be configured in an integrated manner. Some software companies created alternative production planning and scheduling modules for certain industries so that they can meet the special requirements.

Short-term "Transportation Planning" was completed with the same software module. An extra "Distribution Planning" sometimes mentions the material flow in detail.

The explosion of the product tree and ordering which has the planning task are usually left to the ERP system. ERPs already traditionally seek to present these operations, and they are already needed as making record (transaction) systems. The explosion of the product tree can be practiced in case of the materials without bottleneck. Alternative suppliers, quantity discounts for materials and components, a purchase planning in case of the lower and upper limits in the amount of supply are still not supported by ERP systems. Some APS providers launch "Purchasing and Material Requirements Planning" module which directly supports the short-term procurement decisions. "Cooperation" module added sometimes helps speed up the traditional interactive procurement process between the producer and the supplier.

APS's modules are dedicated to deterministic planning. Despite that, there is an uncertainty both in the range and out of the range. Some buffers like security storage or security time should be created to take measures to certainties. Buffering against the certainty is a task that includes all supply chain processes, and it cannot be given to only one software module because it depends on the particular industry type and the locations of resolution points (Tempelmeier, 2001).

APS has collaborative interfaces. Cooperation exists in two ways: cooperation with customers and suppliers. From perspective of a single member of the supply chain, cooperation is important at both end points of the supply chain matrix, in other words both sales and supplying sides. The main difference between two types of cooperation is the distinctive structure in case of cooperation with customer and closing structure in case of cooperation with supplier.

One of the main applications of sales cooperation is middle-term cooperative demand planning. Repeating demands are created together. Short-term cooperation can support ATP processes with alternative configurations, additional information at delivery times and costs especially in case of the lack of material.

The aim of the medium-term cooperation in supply is to make a decision about supply plans in the lights of the data produced by the main plan. Mass product

quantities should be separated, and they should be distributed to various suppliers based on their capacities. Abilities of these suppliers also should be enhanced, and they should be used in the next cooperation processes effectively. Therefore, supply plans that avoid shortage of material and delivery schedules can be created.

### **3.3.8. Vehicle Tracking System (VTS)**

With Vehicle Tracking Systems, it is possible to determine mobile devices with location (coordinates) and status (speed, etc.). Graphical and textual information display on the computer screen and the instrument(s) lots of information about associating with each other to make a detailed analysis of the spatial and the database becomes possible. All kinds of land, air and sea vehicle locations around the world, satellites (GPS) watch on digital maps with the help of the "Vehicle Tracking System" provides the user according to the demands of different and flexible applications. Instruments can be followed online via the internet, or to the public of a vehicle's location and status information, VTS device in the vehicle can be saved for later review. Similarly, the shipping fleets, car rental companies, or even vehicles for tourist groups, nature tourism can watch the campers or other objects moving. Monitoring instruments in the field of online geolocation (GPS) and communications (GSM, GPRS) systems and GIS (Geographic Information System) technology offers different solutions for many different purposes and scope (Sezgen and Demirtaşlı, <http://www.trafik.gov.tr/icerik/bildiriler/C4-1.doc>).

Nowadays, GPS systems are installed in vehicles equipped with IT facilities can be followed logistics centers. Modern transportation planning "plan-implement-demanding" of the triangle is formed by common consensus. Claiming to deliver, under which orders have moved to what type of vehicles, as well as which types of transportation, logistics at any time with the password assigned by the company with the possibility of internet orders for the nearest location where you have the opportunity to follow. By coordinating with the logistics company if it so wishes, decided to change the position of the load, the load will take on the position of the decision by making an effective assessment of the cost analysis can be carried out (Keskin, 2006).

The must-have features of new generation Vehicle Tracking Systems are listed below (Uydu Araç Takip, Taşımacılık ve Lojistik Dünyası 2005):

- Ø GPRS-based communication provides low operating costs,
- Ø Provide high positioning accuracy of GPS satellite receiver,
- Ø The system from any location with internet, internet-based software that can access by password-controlled,
- Ø Just move on and stop the vehicle information and related idling outside the contact information is very important in the follow-up,
- Ø Any cost that does not require additional hardware and software-based tool on how to use the drive with shock sensors (sudden departure, such as hard braking and skidding) knowledge generation,
- Ø The driver in the vehicle, as well as follow-up by the system,
- Ø Take a wide variety of reports (which is between the dates specified what kind of driver violations committed by what means), the archive. The route of the vehicle for the past movements, sensor information, and the records of the two-way message etc. high-speed access to detailed information on the map and zoom animation.

Logistics information management software caters for cost optimization carried out at each stage, to 30-50% reduction in stocks of finished projects, materials, transport costs, a reduction of 10-12%, 10-20% reduction in logistics costs, material purchase prices by 5-10% reduction in capacity 5-20% improvement in the use of the order of 5% improvement in the rate of completion, estimated that 20 to 60% improvement in the accuracy of the shelf-life of products was obtained from the results of a 10-20% reduction in stocks.

### **3.3.9. Collaborative Planning/Forecast/Replenishment (CPFR)**

CPFR is the one step further initiative that can solve majority of the problems. Because not only the exchange of information between the trading partners, but also it requires all members of supply chain to jointly develop demand forecasts, production and purchasing plans and inventory replenishments (Aviv, 2002).

CPFR concept was introduced in 1995 with a pilot project called as Collaborative Forecasting and Replenishment (CFAR) implying Wal-Mart, Warner- Lambert (Waller et al., 1999). In this project, a unique CPFR software was used to exchange forecasts derived from the supportive data, such as historical sales, promotion plans on the proprietary Listerine product. All information was transferred to allow convergence on a single forecast. The pilot scheme increased Listerine sales and improved fill rates, as well as a reduction of inventory investment. Another example of CPFR pilots is Sara Lee's Hanes and Wal-Mart stores involving 50 SKUs of underwear supplied to 2,500 Wal-Mart stores (Danese, 2007). As it has developed today, CPFR coordinates the activities of production and purchase planning, demand forecasting and inventory replenishment collaboratively among SC trading partners. Although CPFR is fit to be applied in any industry, the applications have largely focused on food, apparel and general merchandise industries. Other leading companies from different industries, such as Glaxosmithkline, Electrolux Italia, Nestle and Tesco Boeing and Alcoa, Procter and Gamble, Levi Strauss & Co. etc. have been implementing CPFR. Approximately 50 retailing and manufacturing companies operating as the Dynamic Information Sharing Committee under sponsorship of the Voluntary Inter-industry Communications Standards (VICS) are now coordinating further CPFR development (Verity, 1997).

CPFR is based on various programs, especially VMI and CRP which are formed to optimize inventory and replenishment activities in the 1980s and 1990s. Several academics support that CPFR process covers the gap left by previous supply chain management initiatives, such as VMI or CRP. It is pointed out that CPFR captures the operational advantages of all these programs.

Because it requires all members of a SC to jointly develop demand forecast, production plans, purchasing plans and inventory replenishments. The life cycle of products, the duration of retail trends and the nature of the supply chain cost structure are also driving forces behind CPFR.

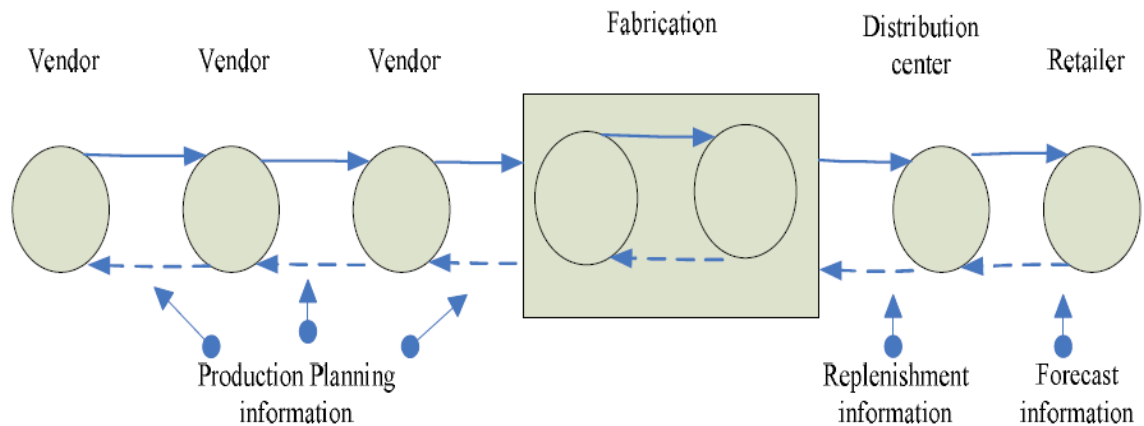
CPFR process is a powerful tool to augment the collaboration from upstream to the vendors/suppliers and downstream to the end customer. It is the partnership programs developed to encourage retailers to share information. It provides standards, protocols, guidelines, etc. contributing to exchange sales and order forecasts on web-based platform between trading partners belonging to the same SC.

CPFR programs concern “collaboration where two or more parties in the SC jointly plan a number of promotional activities and work out synchronized forecasts, on the basis of which the production and replenishment processes are determined” (Larsen et al., 2003).

It is a strategy which seeks through joint planning, joint decision making and the development process to deliver some of the promised benefits of actual SC integration. CPFR is a business strategy between trading partners to collaborate on a single shared vision of forecasted consumer demand at point of sale (POS) level. Both buyer and seller collaborate by correcting, adjusting, proposing prices and quantities to reach an agreement on a unique forecast. By the way, the buyer’s purchases forecast and the seller’s sales forecast concur. Implementing CPFR initiative, firms can get the retail-level demand forecast which is then used to synchronize replenishment and production schedules throughout the entire supply chain. Figure 3.3 represents information sharing points in SC with retail activities (Diederichs, 2009).



**Figure 3.3 Information sharing points in SC with retail activities**



(Diederichs, 2009)

CPFR seeks to reduce the variance between supply and demand by using trading partner data interchange, exception-based management and aims in order to eliminate constraints in fulfilling consumer expectations. It tries to reduce SC costs by promoting greater integration, visibility and cooperation between trading partners (combination of suppliers, manufacturers, distributors or retailers). It leverages the internet and EDI (Electronic Data Interchange) in order to reduce inventories and expenses while improving customer service and satisfaction of customer demand. Another goal of CPFR is exchanging selected internal information on a shared web server to provide reliable, longer term future views of demand in SC. The concept of CPFR is functional in managing collaboration between the manufacturers and the suppliers of raw materials and packaging. These expressions describe the main idea and substance of CPFR.

### **3.3.10. Vendor Management Inventory (VMI)**

VMI is one of partnership initiatives mostly mentioned to increase the efficiency of supply chains consisting of more than one company. The use of VMI has been accepted in many different industries. While it was initially a trial, it has become the preferred way of doing business in today's world (Waller et al., 1999). VMI is one of the successful work models used by Wal-Mart and other several major retailers. Home Depot uses this technique with major suppliers of manufactured products (e.g., Moen, Delta, RIDGID, Paulin) (Tempelmeier, 2006).

VMI, which is one of the tools for improving supplier chain's performance, is obligated to protect inventory levels of manufacturer's dealers. It can access to storage information of manufacturer's dealers, and it is responsible for ordering. Manufacturer gets the electronic data that shows the amount of its dealers' sales and storage from EDI or the Internet. Manufacturer can see every product transported by dealers and real data for sales. Manufacturer is responsible for storage planning and achieving that plan. With VMI, dealers do not order anymore, the manufacturer does ([www.vendormanagedinventory.com/definition.htm](http://www.vendormanagedinventory.com/definition.htm), 12<sup>th</sup> April, 2013).

VMI which is one of the most established practices about resupply reduces the problems such as the bullwhip effect created by order based practice by increasing visibility of inventory. Seller company makes the demand forecast by using data from prior period (weekly movement data belonging to the products of distribution center) and point of sale (POS) and promotion data (the retailer usually gives the information about promotion information a month before the promotion). Vendor realizes the promotion at the last minute thanks to the increase in orders in a classic supply chain in which promotional information is not provided. This can lead to the decrease in the capacity of suppliers and the increase in costs as a result of overtime orientation and use of external sources or the lack of product of retailers. Therefore, telling the promotion calendar and possible volume of orders to the supplier makes profit for two sides (Whipple and Russell, 2007).

If VMI programs are used between a manufacturing company and its suppliers, common characteristics can be listed as follows (Roberts, 2009):

- The primary responsibility for the provision of targeted stock levels belongs to the suppliers of these parts.
- Program replaces classic processes of purchase orders with a dynamic replenishment process.
- Program delays the time of shipment of the product from suppliers to customers to a time that is close to the time of the use of the part for manufacturing.
- Placing a stock of finished products to a place that is generally close to the production area for a particular client, and keeping this stock at pre-determined levels is one of the tasks.

One of key points to ensure that VMI works is sharing risk. If the goods in the storage are not sold, the supplier generally takes them back. In other cases, the product can exist in the area of buyer but buyer does not have the product until the purchase happens. In other words, buyer has the product and help with purchase in return for a predetermined commission or bonus. VMI is generally applied in this case but this is not an obligation.

The important point here is that owner of VMI and stock does not change. The owners are stable before and during VMI. Therefore, consignee stock and VMI should be compared. Consignee stock is the commercial ware that belongs to the supplier, and it is stocked in the consumer's region. Consumer does not have to pay until he gets the product from consignee stock. Consumer generally can give consignee stock that is not used back to the supplier. Despite the common perception, this regulation can be at the structure of classic supply chain, and it is not synonymous with VMI. The reason for this difference is that the change of the owner of the stock does not change how replenishment orders are given: The same decisions are made based on the same information as in a classic supply chain. That's why; a dynamic benefit is not obtained (Holweg et al., 2005).

The benefits of VMI can be divided into two groups which are those in terms of seller (supplier) company and those in terms of the buyer (retailer) company:

Benefits for seller (supplier) company:

Visible data for the buyers' points of sale makes it easy to estimate.

Promotions can be added to storage plan more easily.

Buyers' order errors that caused return in the past are reduced.

Visibility of the storage levels helps determining priorities.

Supplier can determine the potential needs before ordering the product.

Sellers can control the goods well, and they can communicate in order to employees.

Vendor representatives of a store guarantee exposure of the product in an appropriate way, and they also ensure that store personnel know the properties of the product. At the same time, they help the store to regulate and clean their own product series ([www.vendormanagedinventory.com/benefits.htm](http://www.vendormanagedinventory.com/benefits.htm), 14th April, 2013).

Benefits for buyer (retailer) company:

Occupancy rates from suppliers to end consumer recover

Depleted stock (out of stocks) for a product status becomes less likely to occur

When the responsibility is undertaken by the supplier, the cost for planning and ordering decreases.

Since a lot of official procedures are eliminated, management cost reduces.

The level of service gets better with provision of the right product at the right time

The supplier focuses on presenting better service.

General cost decreases, and sales increase.

The error rate decreases due to the data provided.

Retailers are at less risk, and store staff is more knowledgeable (it builds brand loyalty for both the retailer and the supplier) and the cost of keeping the goods exhibited reduces.

Customers get benefit from well informed store personnel who are in a frequent and sincere relationship with the supplier (seller) agents, when a service or product is needed. Since store personnel have more extensive knowledge about the series of products coming from different suppliers, they can help the customer with choosing the most appropriate product among the products which are in competition with each other, thus, customer satisfaction increases.

### **3.3.11. Quick Response (QR)**

Leading companies in the clothing industry in the United States of America (USA) established "Crafted With Pride in the USA Council" in 1984 due to the increasing competition in textiles & clothing industry. In 1985, Kurt Salmon Associates are assigned to make a supply chain analysis. The results revealed that the time passed from raw materials to the delivery to the customer was 66 weeks for clothing supply chain. 40 weeks of this time were spent in warehouses or during transportation. Long supply chain causes many casualties in the industry due to the lack of funding of stocks in the right time and in the right place. The results gave rise to a quick response (QR) Quick Response strategy.

QR is a cooperation of retailers and suppliers which is supposed to make information sharing possible to give a quick response to the customers. Important changes occurred as the result of the study: UPC code used by grocery industry and a series of standard for Electronic Data Interchange (EDI) between industries was applied in this industry. Retailers started to get point of sale (POS) scanning systems to transmit information to producer and distributor sales companies quickly.

QR maximizes the profitability of the stock by using company's material presence in the time and place, when it is needed, based on data of past sales with data of current point of sale. QR integrates sales information about promotions and discounts with the estimations about distribution plans (Lummus and Vokurka, 1999).

### **3.3.12. Efficient Consumer Response (ECR)**

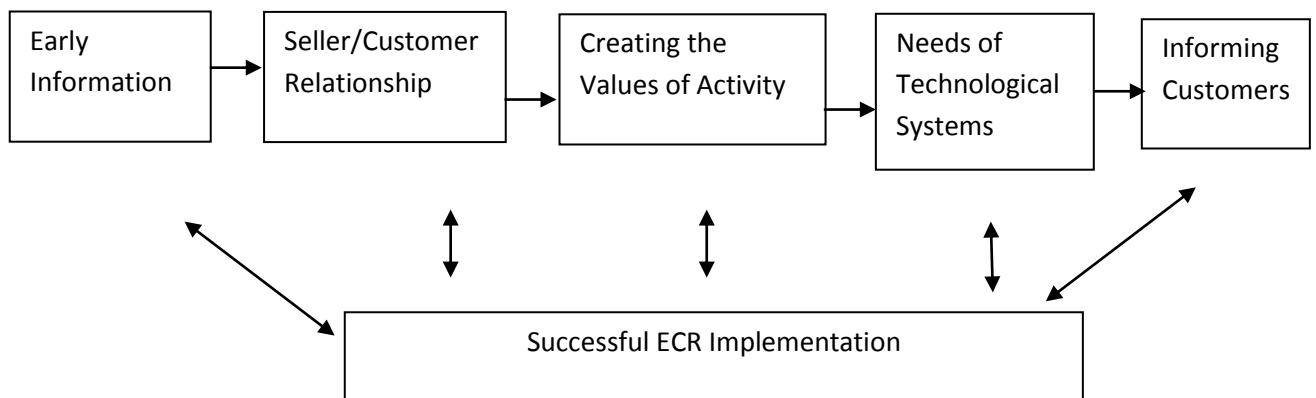
Efficient consumer response or ECR (Efficient Customer Response) refers to a basic, fast, efficient and consumer based system in which all supply chain works together in order to meet the needs of consumers in response for the lowest rate of cost. With ECR system, it is aimed to provide the quick and efficient flow of information within the supply chain a good estimation of future customer needs by the suppliers and distributors. Company has some flexibility in the

production and adapt quickly to the constant changes and developments in the supply chain with the successful implementation of the system.

ECR system is based on three cores (Aydin, 2005).

- Providing customer value,
- The elimination of non-value added costs,
- Maximizing the value and minimize disability in supply chain.

**Figure 3.4: Successful ECR Implementation**



(Hoffman and Mehra, 2000).

Efficient Customer Response (ECR- Efficient Customer Response) is a structure created in order to increase the amount of sales in stores, give a better response to customers' demands by predominantly food stores.

ECR is a system consisting of renewal of products in which information flow is provided in whole supply chain via EDI systems (Fernie and Staines, 2001). An efficient renewal of stock can be achieved with ECR via EDI. Decreased stocks are replaced with new ones, and it is ensured that retail sales and raw materials order of supplier or manufacturer (Harrison et al., 2005).

Necessary applications for adaptation and efficiency of Efficient Customer Response system in chain retailers which can be seen in Figure 3.3 (Hoffman et al., 2000).

- Providing information early
- Creating a good communicative environment for customer and seller
- Creating the value for activities in the supply chain
- Getting the values that technology systems need
- Informing customers.

ECR can be classified in three groups which are category management in retailer organizations, refreshing the product and the provision of technology. First of all, products are divided into groups of categories according to customer demands. These groups vary according to customer requests and needs. It is aimed with this stage to inform customers about products, and it is also aimed to reduce promotion costs. It is aimed to renew the products in categories created in the previous stage which is refreshing the products. New products, promotions and prices may cause the decrease in normal demand. In this case, the third stage which is the provision of technology is needed so that ECR system can reach more accurate data leading to the result. Customer loyalty programs, customer cards, and POS systems are used to do this (Freathy, 2003). These are applied in large chain stores, Use of “Migros Card” in Migros stores can be shown as an example of this.

## CONCLUSION

The organizations, as a whole, can only be successful with the help of a good team and equipment. Manager's carrying on management function successfully also affects the organization success.

Access of information to the manager in right time is very important for management function. Management information systems are computer software programs designed for this purpose. These software programs are supported with various modules depending on organization's activities. Since each organization has different characteristics, information systems are also different as well.

The analysis of the substantial flows in logistics system shows that these flows contain the physical flow of the products as well as the information flow related with these products. In traditional logistics system the information flow related with the product is in the form of document flow. For instance; delivery note which is sent with product, the documents for invoice provision phase, proposal forms etc. Recent advances in computer technology have allowed first to prepare all sorts of the flow documents on computer. Even if this condition accelerates the flow, it is insufficient for the information flow carried on with traditional methods.

With the development of the Internet, it became possible to transfer standard documents from one computer to another. Thus, the information flows in logistics can be done momentarily and this substantially increased the speed - one of the significant elements of logistics. The advantage of these improvements provided not only the increase of speed but also visibility of logistic information on every stage of supply chain.

In today's harsh competition conditions, it is only possible for companies to carry on their existence with proposing services and products in proper quality, in time and cost to their customers. To reach the required quality, to decrease the costs and to move fast are only possible by finding true methods at first and by applying them. Success of this is only possible with installation and application of quality management systems.



Information systems used at every stage of logistics gives information to the administration and regarding personnel. Apart from that, information systems also work integrated for the activities out of operational processes. For example they work in cooperation with the departments such as accountancy, marketing, etc. Numerous and complicated operations in logistics, which is a service sector, make these information systems obligatory. Otherwise, without using such a program, it is impossible to organize operations and activities.

In the supply chain, sharing of the information about products, stock, logistics, etc. between suppliers and retailers, cooperation in planning and ordering increase the competition power of retailers and supply chains.

Large chains have a large organization structure. Thus, with coordination and information share among companies in the supply chain decrease the amount of uncertainty about demand; and it would not be necessary to invest highly upon stocks. Such a structure brings easy planning and decreased costs. Besides, the reliability and cooperation between retailer and supplier brings sharing the risks, decreases blocks between firms and increases flexibility. This will lead to developing new products and less market proposal times; which are advantages against competitive firms. Thanks to this, by meeting customer expectations, customer satisfaction will be provided. When these are evaluated regarding monetary issues, it is foreseen that the cash flows in the chain will be regulated and firms' costs will be decreased and profits increase.

Among the information systems used in logistics, the software programs such as Electronic Data Interchange (EDI), Barcode and Radio Frequency Identification System (RFID), Enterprise Resource Planning (ERP), Order Management System (OMS), Warehouse Management System (WMS), Transportation Management System (TMS), Advanced Planning System (APS), Vehicle Tracking System (VTS), Collaborative Planning/Forecast/Replenishment (CPFR), Vendor Management Inventory (VMI), Quick Response (QR) and Efficient Consumer Response (ECR) are analyzed in this study.

Within this respect, EDI software is the process of work document interchanges between two corporations in an electronic environment with a

standard. With its first application area of logistics in 1960s, EDI is now operated in improving communication and connected computer systems together with e-supply chain management in e-trade and it provides advantages in e-supply chain management and reformation processes. EDI software provides to the organization with benefits such as decreasing future costs even though its starting cost is high; continuous order-taking with registering to the system once; time saving; preventing probable trade loss by cancelling out human errors; decrease in paper use and archive costs; productive operation of human resource; increasing customer loyalty with fast answers to customer demands; shorter order periods; faster cash flow by reforming invoicing and collecting periods; less stock costs with faster information flow; and successful management of all these processes and increasing company profitability.

Barcode in RFID, on the other hand, is the information gathering technology for fast, accurate and easier data input for more economical utilization of the systems. It provides the organization preventing the disorder between similar products; processing the required data very fast; less labor cost; easier integration to computer systems and increasing profitability with usefulness and increased productivity.

The values to be added by RFID are the information about the vehicles carrying the products, when they come, to where they are placed, by whom and to which operation they are carried on, warning mechanism for the products taken out of the store without permission, automatic separation of the packages, decreasing warehouse costs, preventing possible trade loss resulting from human errors, decreasing the employment and time saving.

ERP software is the name of the management systems which provide productive use of sources such as necessary labor for product and service manufacturing; machine and materials. ERP software provide the organization the benefits such as faster supply operations; catching up with standards; less stocks by making supply operation observable; standardizing financial data and making all departments talk the same language; catching up with the standards from ordering to invoicing by managing customer orders well; increase in personnel

productivity by standardizing human resources; and reach a data base where important works are recorded and observed as a whole.

OMS software is the order management systems which are used to provide the ordered products to be ready in the right time, right place and with right amounts accurately. Values to be added by this software are increasing customer satisfaction, accurately leading the customers and decreasing order errors, providing organizations order flexibility, efficient use of order monitoring system, minimizing the order changeability effect and faster ordering and order preparing periods.

WMS software is useful for productive use of stocks, effective management of equipment and labor resources in warehouse and distribution centers and effective management of all storing activities. The values to be added by WMS storing software are as follows;

Goods receiving productivity of the products coming to warehouse

Placing stocks in warehouse in best way

Gathering the prepared orders in the fastest and the most accurate way

Servicing with value added package

Accurate packaging operations

Planning, tagging, separating

Easy order receiving and delivery

Effective and productive management of all warehouse processes

Advanced control mechanism

Continuous, fast and easy stocktaking

Decreasing the supply chain costs

Providing fast and accurate data

TMS software is one of the most important issues of logistics with its benefits such as effective management and improvement of distribution systems; less delivery time and cost; and concurrent sharing of vehicles, loadings, delivery vehicle and time among customers.

TMS software provide less time and cost in delivery, less employment cost, organizing load and vehicle data regarding delivery program and increasing quality of customer services. The large ratio of transport costs in total logistic costs increase the importance of TMS.

APS software is a system consisted of decision support and organization planning. The elements providing APS system to carry on its operations and to develop them are level identification and planning, supply chain monitoring, concurrent source creating and productive source utilization. APS adds up such values to the organization as; less supply time, productive use of stocks, more efficient customer services, more effective planning period, control of supply period management and less supply chain costs.

VTS software is used to monitor the information about vehicles' location and status graphically and in text with mobile tracking technologies and to provide productivity by relating location and data analysis of these vehicles. VTS provides the organization less order time, productive management of reverse returns and less supply chain management costs.

CPFR software is one of the most important software programs which provide the opportunity of integration of both information and communication technologies with supply management and changing traditional working styles.

The main purposes of VMI software are to increase selling and service levels, to increase the usable inventory, to decrease all out inventory in the system, and to make manufacturing or supply program of manufacturer / supplier effective. The advantages of VMI can be listed like improving team work mood in supply chain; being applicable and giving results in short time, reforming the costs and sales, relaxation in internal processes of the supplier, easier predicts for manufacturer / supplier, and decreasing monitoring work load for inventory of customer or consumer.

QR, quick response process, has the aim to response customer needs as fast as possible by sharing information between manufacturer and retailers. With QR, organizations have the chance of predicting the manufacturing and delivery planning; and providing information about promotions and discounts. Besides, QR provides financial gain thanks to less inventory amounts.

ECR is a simple, fast, effective and customer-based system in which all the supply chain work together to provide customer needs with the lowest costs. With ECR system, it is aimed to make fast and effective information flow in supply chain and to predict future customer needs by suppliers and distributors well. With successful application of the system, organizations have flexibility in terms of manufacturing and adapt to continuous changes and developments in supply chain fast.

The foregoing research on information technologies applications in logistics sector has reached the following conclusions.

1. Information Technologies used in Logistics sector are; Electronic Data Interchange (EDI), Barcode and Radio Frequency Identification System (RFID), Enterprise Resource Planning (ERP), Order Management System (OMS), Warehouse Management System (WMS), Transportation Management System (TMS), Advanced Planning System (APS), Vehicle Tracking System (VTS), Collaborative Planning/Forecast/Replenishment (CPFR), Vendor Management Inventory (VMI), Quick Response (QR) and Efficient Consumer Response (ECR).

2. The aim of Information Technologies used in Logistics Sector is;

The main objective in logistics sector is to reach the highest point in customer services, and to create competitive advantage by using optimum resources and investments. The Information Technologies used to reach these aims also serve for the same aims.

3. The benefits of Information Technologies to logistics organizations are;

- It helps management function for delivery and administration to be done effectively and productively,

- It provides safety for vehicles, goods and drivers,
- It provides significant decreases in costs and time periods of delivery time,
- It provides organization to stand in front of its customers with faster and stronger operation management,
- It decreases the operational costs of the vehicles,
- It provides fast and safe transfer of the data.

4. The benefits of Information Technologies to the customers of logistics organizations are;

- Fast and quality service,
- Product safety,
- Accurate place and time information for the delivery of the product,
- Time and cost savings,
- Satisfaction.

As the result of this study, it is seen that software programs used in logistic companies provide many advantages in supply chain management both for logistic companies and for their internal and external customers. Shortly, it is necessary for logistics to follow the technologies of supply chain management closely.

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