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RFID (Radio Frequency Identification) Applications in Cargo Transport and Delivery Industry

(A case Study in Turkey)

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ABSTRACT

This research aims to investigate the feasibility of the RFID (Radio-Frequency Identification) technology in cargo delivery companies and shift their barcode system to RFID. Research accomplished in one of the biggest cargo delivery companies, which has 19 regional offices, 30 transfer hubs, almost 750 branch offices, 3,000 vehicles and more than 11,000 employees all around Turkey.

During the research process, the whole operations in the branch offices and transfer hubs were observed. The processing time, workers, current barcode technology and the division of labour have been determined. The interviews were conducted with managers of branch offices and transfer hubs. Besides, a questionnaire was held with 55 people from different position in the company. This survey aims to investigate the experience of the staff, and their aspect regarding company's strategic management policy and current barcode technology. Also, it investigates to what extend RFID is known by employees and their willingness to change their system.

Numerous global RFID software and hardware suppliers companies were contacted to estimate the cost of the project.

Interviews and survey results show there are problems that result in loss of time and labour and reduce service quality which are caused by current barcode system. In addition, research has clearly shown RFID is unknown by employees.

The research has revealed RFID applications are not as expensive as previously thought, if it is compared to cost and benefits. The greatest obstacles to the spread of the application are the size of the company and the technology is not well known.

Overall, in the coming years, RFID seems to be the appropriate solution which will reduce the human factor and increase service quality in the process and to meet the increasing demand in the cargo industry.

Key Words: RFID, Cargo Transport and Delivery, Barcode Systems

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CHAPTER 1 INTRODUCTION

Transportation is one of the factors of production that provides the time and space, usefulness, and a tool that may affect the sectors positively in the event that is fast, safe, efficient and minimum cost. Transportation is a sector that has a close relationship with all industries and affects these industries directly. Transport services are one of the major duties of managers in logistics operations and transfer policy links all logistics activities (www.globalkargo.com/kargo-tasimaciligi.aspx, 2013).

In Turkey, cargo transportation is a general name that is used for parcels lighter than 100kg and files (Yuksel and Odabasi, 2009). The turnover of the cargo companies has been increased steadily in line with population and economic growth although new competing firms have entered the market. The companies that wish to meet the growing demand and increase the quality of service have to follow the new technologies (Ustundag, 2008).

Cargo transport and delivery service is an industry that required human contribution intensively. Services are carried out based on labour and manpower (Yuksel and Zaim, 2009). This situation brings about a number of challenges. Delivery to the wrong address and lost parcel which are the most common mistakes that caused customer dissatisfaction and cost are caused by human error. Parcel transportation services consist of many stages, which start taking the cargo from sender and finish delivery to recipient. In this service chain, any mistake reflects to company as customer dissatisfaction. In cargo sector, another vital issue is to employ qualified workers. As the cargo services required intensively human power and labour the jobs are not preferred by well-educated people and this reduce the quality of the services and customer satisfaction. Besides, employee turnover rate is high owing to the nature of the work. As a result, it is difficult to employ experienced workers and labour cost is high in the sector. In this regard, it has vital importance to reduce the impact of the human factor in order to lower the costs and increase quality of service.

Looking at the technological infrastructure of the cargo enterprises in Turkey, even the leading companies began to emerge the barcode system last fifteen years. Although different applications are self-renewing and implemented consistently over the time, it can be seen clearly that the barcode system is far from to meet the requirements, capture safe and quick service quality in terms of both customer and employees. Even in the biggest entrepreneur, when the operations examined, it is clear that the need for a system which provide more secure, more quickly service and reduce lead times and human factor in the system.

This study investigates the applicability of RFID technology in parcel transport and delivery companies instead of barcode system in Turkey. RFID is the wireless non-contact use of radio-frequency electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects http://en.wikipedia.org/wiki/Radio-frequency_identification, 2013)

Data collection, service delivery, object tracking and system management can be carried out without human intervention with this technology and communication infrastructure. The system does not require the visibility of the object and use wireless technology. The system decreases the error rate and increases the service speed and quality of service (Yuksel and Zaim, 2003).

The main subject of this study is to answer the question that whether barcode system can be shifted to RFID and be able to offer appropriate solutions in terms of cost and launch new work plan which will change the all operations entirely.

A. Research Questions

The proposed study was conducted to determine the viability of using RFID in cargo transport and delivery industries. The research intended to answer the following questions:

1. How financially viable is the installation of RFID in the operation of cargo transport and delivery industry?
2. How effective is the implementation of RFID in the operation of cargo transport and delivery industry?
3. Can the RFID reduce the workload of the employees?
4. How can the RFID improve the delivery time in the cargo transport and delivery?
5. What is the level of acceptability of RFID for the workers of cargo transport and delivery companies?
6. How can a company of cargo transport and delivery benefit from the use of RFID?

B. Research Objectives

The research proposal would be able to attain the following objectives:

1. To investigate the feasibility of the project.
2. To discover new, faster and more reliable service solutions for cargo delivery companies.
3. To introduce the workers in a cargo company about RFID.
4. To investigate new systems that will reduce the workloads of workers in operation of a cargo delivery system.

In the first stage of the research, a cargo company, which is one of the biggest and leaders, was chosen in Turkey as a case study. The information regarding the history, structure and services was collected from their web site and company manager by in person interviews.

During the interviews, seven meetings had been held with one regional manager, one computing manager, four branch managers, and one manager of the transfer hub. The research was introduced to the managers and the information was collected regarding the company, industry and services of the company.

In the second stage, a survey was conducted in the company. Results of the survey provides significant information regarding adaptation phases of new technologies to company. The survey consists of 30 questions. The questionnaire was answered by one regional manager, one computing manager, one manager of a transfer hub, four branch managers, twelve office staff and 36 couriers. Primarily, the questionnaire aims to evaluate the educational and carrier background of participants. Also, some questions were design to evaluate how well the participants know and use the barcode system effectively. In addition, some questions aims to estimate the willingness and perception of the participants regarding RFID application which wants to launch and their expectations from the new system. Also, surveys aims to measure perspective and awareness of the managers and lower tier employees about company strategic management policy. Furthermore, this study hoped to create a positive perception on employees regarding mentioned issues. It is intended that the research project would be instructive and motivate during the process of adaptation.

The observations have been made regarding the operations in the company units which will be described in detail in later chapters. All activities carried out in transfer hubs and branch offices were recorded. The contribution and role of the barcode system were examined in the process. The errors that caused customer dissatisfaction and loss of time were observed. It is

attempted to identify the compliance with the human and machine is running effectively at every stage of process. The time and manpower planning was recorded during the loading and unloading of vehicles at transport hub and branches.

In the next step, it had been contacted with the local and global firms that provide RFID software and hardware and discussed upon possible solutions regarding changing the old system and launch RFID. It was asked offer letters from the companies that produce appropriate solutions and gave reasonable prize for project and it has been worked to calculate the approximate cost.

Calculation of the costs is vital in terms of to show the feasibility of the project. While calculating the costs, every single unit was calculated separately. Considering each unit meets their own cost. It is easier to make a decision so the managers can have a clear idea about the time that regaining the investment. Similarly, cost of a worker was calculated for one year. If RFID system replace to barcode, it is evaluated the workload will fall in the new system. RFID costs will compare with labour savings so this calculation makes the feasibility study easier.

C. Structure of Dissertation

Chapter 1 Introduction, in this section, brief information is given about the project, research aims and questions are defined and this section is mentioned about the necessity of the project, gives information about company.

Chapter 2 The literature review, this section gives answer for question such as: What is the RFID, the history and development process of the technology, area of use, advantages and disadvantages of RFID, the comparison of RFID and barcode systems and software and hardware requirements of the system also it is explained the importance of this research in terms of literature and industry.? Also, a few RFID example pilot applications are explained.

Chapter 3 Methodology will look at source of data collection, sample frame, sample size, techniques used in analysis.

Chapter 4 Analysis, in this section, the company chosen will be examined, there are SWOT analyses of the company and their service units are explained in detail, also company's whole operations are explained, the interviews and survey results are interpreted also cost analysis of the project is explained in this section. Also, the whole project is evaluated and researchers comment is presented regarding viability of the project.

Chapter 5 looks at discussion, conclusion and recommendation for future work: Discussion section brings critical point of view the whole research and tries to show deficiency of the project. Conclusion makes a brief summary of the whole project and lastly a recommendation for future works consists of advice for researchers who want to make research in the same field.

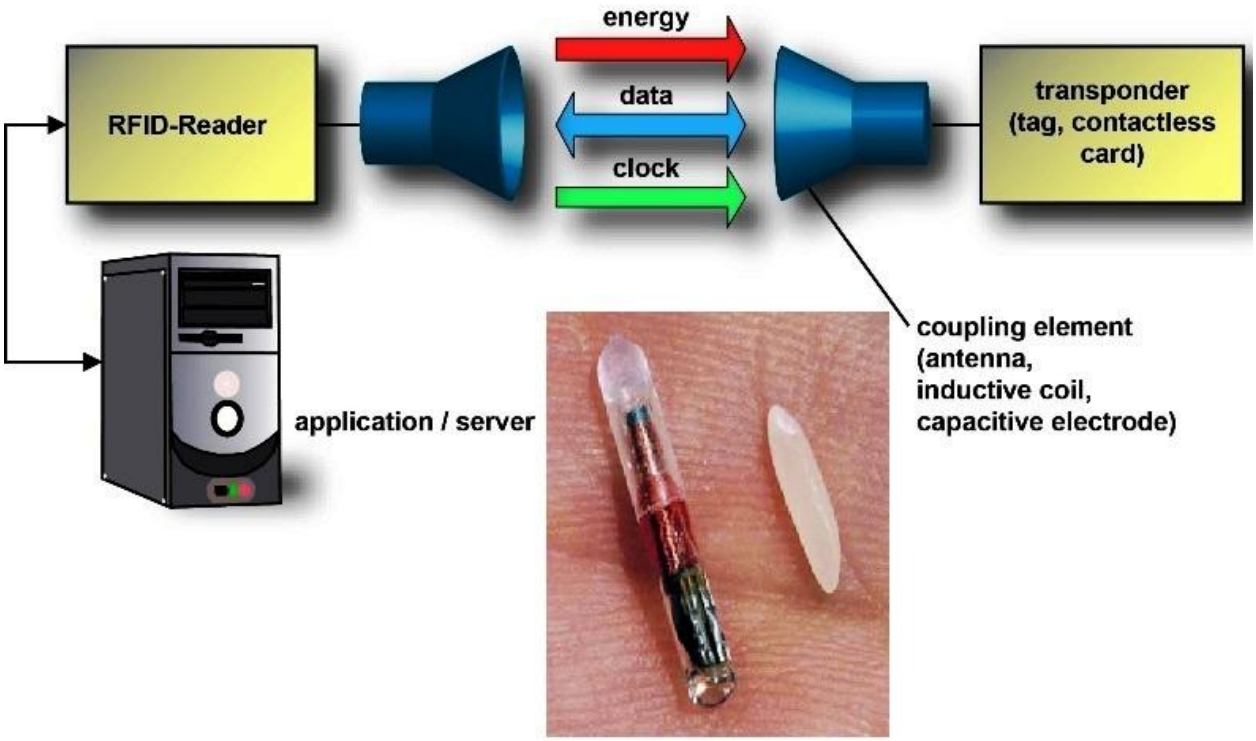
CHAPTER 2 LITERATURE REVIEW

A. Introduction

Innovative technology is used interchangeably with information technology in modern business settings. It has become the driving force that impels companies to achieve economic gains, implement quality improvements and realize cost savings in their business settings. This is because companies, old and new, are now tied to the wonders of modernization that is happening around the world. New gadgets have been produced by technology-based companies such as Apple, Microsoft, Samsung, HTC and others. Modern gadgets include mobile phones, tablets, laptops and personal computers. Today's businesses will be greatly enhanced by the use of RFID, improving efficiency in operation and management, and in the long run supporting decision-making processes (Vacca, 2009).

The technology involving RFID is vital to the delivery of timely information, the real-time management of inventory, forecasting of demands and supply and the control of storage areas and marketing outlets. This is the reason by business success is experienced by a myriad of business establishment wholly dependent upon the RFID technology such as retail outlets, cargo and transportation, manufacturing and even health care facilities. Most of the pioneering sectors which have used this technology for a long time include the supply chain management, security-based establishments, toll-ways and "big-box" stores such as Walmart. RFID is also used in the delivery of basic services such as health care, infrastructure components, software and hardware development and most importantly, government service.

According to Barjis and Wamba (1997), "Any basic RFID system is a combination of three major components, namely: a tag (active, passive or semi-passive) which serves as an electronic database and can be attached to or embedded in a physical object to be identified; a reader and its antennas which communicate with the tag without requiring a line of sight; and a host server equipped with a middleware responsible to manage the RFID system and interacts with intra- and inter-organizational information systems". The following diagram (Figure 1) shows what RFID looks like and how it works:Figure 1



B. History of RFID

RF or Radio-frequency technology has come far from its roots at the beginning of the twentieth century. Russian physicist Leon Theremin is commonly attributed as having created the first RFID device in 1946. While Theremin may be recognized for the first successful application of the technology, RFID has earlier roots (Glover & Bhatt, 2006).

RFID is a combination of radar and radio broadcast technology. Radar was developed in the U.S. in the 1920s. Scholars noted the relationship between electricity and magnetism, which is a foundation of radio broadcasting, at the beginning of the nineteenth century. Aseminal paper in 1948 identified the vast amount of research and development still needed before "reflected-power communications" could be used in applications (Li et al., 2006).

Interest in implementing RFID in libraries is on the rise. RFID technology has been used to raise efficiency in transport, business and theft-monitoring systems. The evolution of RFID described below suggests that libraries may well benefit from widespread use of this technology.

a. 1920s Foundation Established
   - Radar was developed as a technology in the U.S. in the 1920s.
   - RFID, a combination or radio broadcast technology and radar, was developed soon after.

b. 1930s Progress
   - Britain used a related technology, an IFF transponder, to distinguish enemy aircraft during WWII.

c. 1940s RFID Invented
   - Radar is refined.
   - Harry Stockman publishes "Communication by Means of Reflected Power."

d. 1950s Time of Research and Development
   - Technologies related to RFID were explored in laboratories.
   - Designs developed for long-range transponder systems for aircraft.

e. 1960s Applications Abound
   - During the 1960s inventors began applying radio frequency technology to devices aimed at markets beyond the military.
   - Companies Sensormatic, Checkpoint and Knogo develop theft prevention production for public consumption using Electronic Article Surveillance
   - EAS is an affordable and relatively simple technology. "1-bit tags" meant that systems could only detect the presence of absence of the tag.
   - EAS represents the first and to-date, most popular use of RFID technology

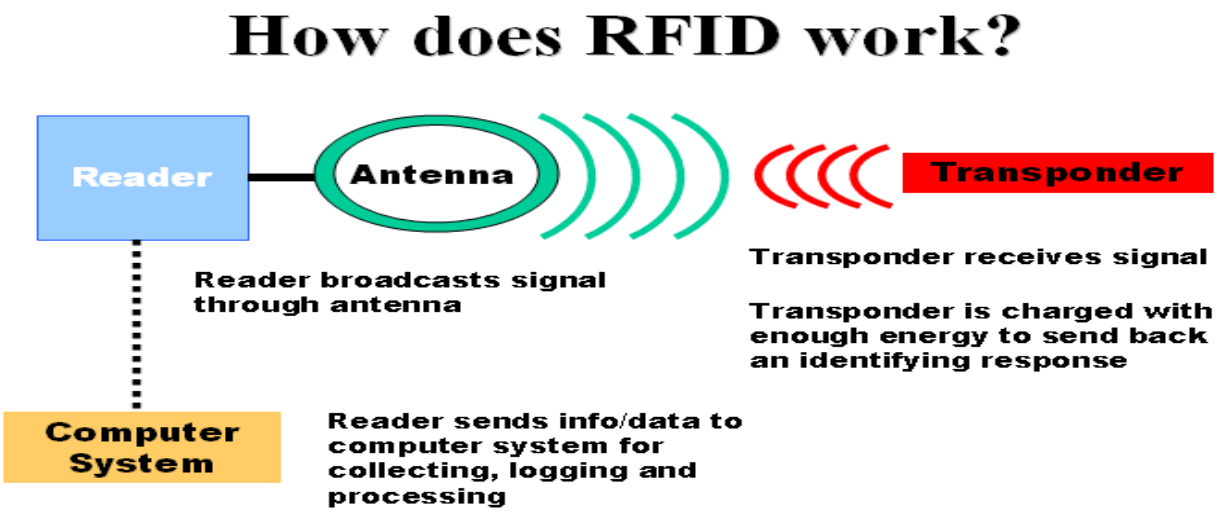
f. 1970s Hard at Work
   - Academic institutions, government laboratories companies and independent researchers are all working to develop RFID technology.
   - Work done at this time was aimed toward electronic toll collection, animal and vehicle tracking, and factory automation.

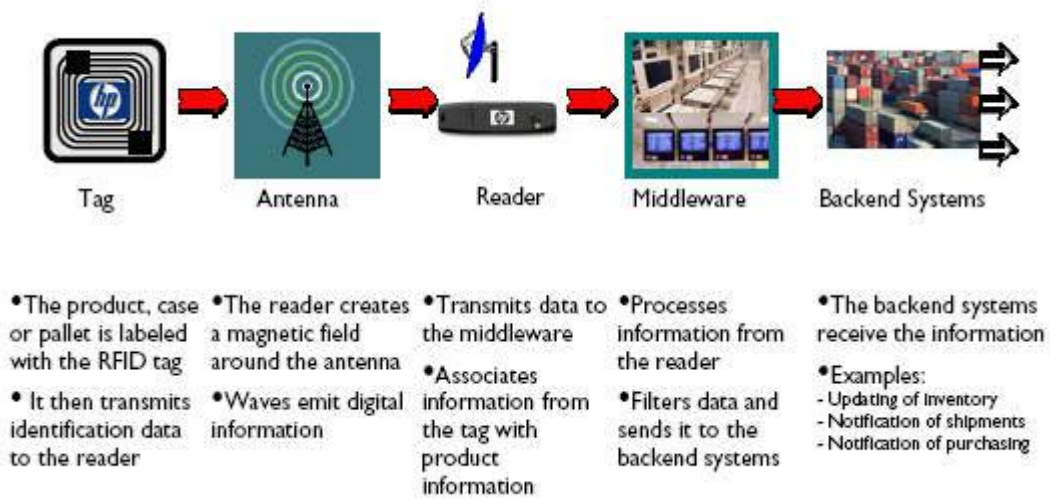
g. 1980s Commercial Expansion
   - RFID technology is fully implemented. Europe and the U.S. apply RFID to transportation systems, animal tracking, and business applications.

h. 1990s RFID Becomes Commonplace
   - RFID uses are so widespread that standards begin to emerge.
   - RFID is widely used by consumers and companies globally.

i. 2000s RFID Enhancements (Powell & Skjelstad, 2012).
- Improved technology leads to miniaturization.
- Cost of RFID continues to fall.
- Private authentication develops as key concern in library implementation

C. How Does RFID Work





There are four required components that allow RFID to work (Glover, 2006):

1. The RFID Tags
2. The RFID Interrogators (or RFID Readers)
3. The Antennas
4. The RFID Information Processing Systems

In the simplest example, an RFID reader connected to an antenna, uses radio frequency waves to obtain a signal from an RFID tag that is within its field of communication. An RFID Information Processing System translates that signal into an

identifier. Combining the above components together forms an RFID System. RFID systems are commonly differentiated, or categorized, in one or more of the following ways:

- Method in which the RFID tag is powered
- Frequency or frequencies in which it operates
- Field of Communication
- Communication Protocol

There are many other names used for RFID technology that are used for differentiation which are simply short-cuts or marketing terms that refer to devices that have one or more of these specific characteristics. For example, a "Smart Card" refers to an RFID tag that uses the ISO15693 communication protocol operating at the 13.56 MHz frequency using near field communication. When there are multiple RFID tags using RF communications, an RFID system is sometimes referred to as a Wireless Sensor Network (WSN). As rules are put in place to make automated decisions based on the data generated, the WSN evolves into an Intelligent Sensor Network (Stuker & Gille, 2010).

D. Technical Infrastructure of RFID

The technical infrastructure comprises a radio transponder and receiver, more commonly known as a tag and reader. Information related to a given object is stored on an affixed tag and transmitted to a reader over a radio frequency (RF) connection. The reader in turn connects via wired or wireless networks to servers hosting RFID applications that make use of transmitted RFID data, and, in the case of supply chain applications, middleware manages the flow of RFID data between readers and enterprise applications (Dobkin, 2008).

RFID Tags

Tags contain a microchip and a transponder. The microchip stores data related to the object and the transponder transmits that data to readers. Tags are initially programmed (data is written to the tags) at the point of manufacture (factory programming), but can also be programmed by an OEM or end user (field programming). Tag data usually includes a unique identifier code and sometimes additional information, depending on the application and the amount of memory on a tag.

Tags are either passive or active. Passive tags are smaller -- about the size of a grain of rice, and getting smaller. They are activated when they enter the range of a reader's signal. The reader's antenna sends power to the transponder, activating the data stream. (Semi-passive tags have a battery that runs the circuitry of the chip, but does not power transmission of data to the reader.) Passive tags are much smaller in size and memory than active tags, and cheaper to manufacture. Passive tags currently cost about 50 cents, although with mass adoption of RFID, the goal is to eventually produce a 5-cent tag. In October 2005, Smartcode Corporation announced a 7.5-cent tag, when produced in volumes of 1 million, and 7.2-cents for orders of 10 million or more.

As discussed above, passive tags are most suitable for supply chain applications that require billions of tags with small amounts of memory. Active tags are larger than passive tags, about the size of a small coin, and cost $20-$100 each, depending on volume. They contain their own power source, thereby constantly transmitting their signal up to several hundred feet, compared to a passive tag's read range of a few inches to a couple of meters. Active tags are therefore more appropriate for items that are high in value and/or are tracked

from a distance, like rail cars and shipping containers. Active tags can also be rewritten or reprogrammed by readers, whereas most passive tags are read-only.

Sensors can also be integrated with an RFID tag for more dynamic information, for example, the tag on an automobile tire may integrate data from temperature and pressure sensors for remote monitoring. Tags can be printed on paper or plastic and attached to an object, or they can be embedded under the skin of animals and humans. (In one more creative experiment they were eaten by pigeons, which then activated a network of closed-circuit cameras throughout an urban area as they flew by.5)

RF Connection

Tags transmit data to readers over different radio frequencies, depending on the application needs. RF frequencies are dividing into several bands including low frequency (LF), high frequency (HF), ultra-high frequency (UHF), and microwave. Passive tags transmit at all frequencies while active tags transmit at higher frequencies only (those in the UHF and microwave bands). The exact frequency that can be used within the various bands, as well as power (output) levels, are controlled by the regulatory body of each country. Each frequency varies in terms of regulation, performance (range, bandwidth, output), and the size and cost of the associated technology. Over the last few decades, RFID solutions have emerged around only a few frequencies, each of which optimizes these variables to meet the needs of the different application types particularly on database management (Lin et al., 2007)

RFID Readers

Readers are larger, more complex, and more expensive pieces of RFID hardware compared to tags. The typical fixed readers used in supply chain type operations cost $1,000-$3,000. With mass adoption, the goal is closer to $10-$100 per reader Mobile handheld readers cost a few hundred dollars, and are being used increasingly in supply chain operations. Wal-Mart recently announced that it was exploring readers embedded in forklifts that would replace reader portals, as well as wearable readers that employees would attach to their belts.8Consumer-oriented readers are also appearing on the market, particularly in Japan.

RFID readers embedded in cell phones are also becoming increasingly common – also primarily in Japan at this time -- enabling a variety of mobile services including information and marketing applications, and tracking children, elderly friends and relatives, patients, etc. The reader captures the information transmitted by a tag, decodes it and delivers it to a host computer for ID resolution (if applicable) and further processing. Some readers come with "write" capabilities, meaning they can add or change (reprogram) the data on a tag. Readers have traditionally connected to the host computer over wired networks, but some of the newer readers will use Bluetooth, WiFi, or WiMax connections to transfer data to servers.

For example, the IDBlue is a handheld Bluetooth-enabled RFID reader that connects to the RFID application server via a Bluetooth connection. Readers embedded in cell phones connect to content using the mobile phone network. Multi-protocol readers have been developed for reading multiple frequencies within a particular band, as well as between bands. However, reading between bands usually involves a trade off in speed and other performance characteristics (Quinn, 1985).

E. Advantages and Disadvantages of System

A. Advantages of RFID:

- Efficiency in Inventory Handling
- Good Return on investment (ROI)
- Minimal vulnerability to damage

B. Disadvantages of RFID:

- Orientation problems and dead areas
- Concerns on Security
- Ghost tags
- Issues about proximity
- Tags and unreadable
- Vulnerable to damage

F. Why RFID is not Widespread in the Companies

A. The use of RFID is not widespread in most companies because of the following reasons (O'Connor, 2004):

1. Lack of investment
2. Inappropriate cost-benefit effect
3. Lack of personnel training
4. Lack of maintenance
5. Traditional system is still favoured
6. Need for repairs and maintenance
7. Incompatibility with the business requirement

The major reason why a company fails or refuses to implement an RFID technology is its incompatibility with the business since it may not have the resources to support the system or that it is more viable to use the manual system due to a fewer volume of transactions (Lindquist, 2003). Manual work may be more feasible and accurate due to fewer transactions to accomplish. On the other hand, in terms of security, the RFID may only be resorted to if there is an increase in personnel so that security and safety of everyone demands that a system such as this has become necessary (Mehjerdi, 2001).

G. Comparison of the RFID and Barcode Systems

The following is a comparison of the RFID and barcode systems as extracted from the Adaptalift (2012) blog site:

Advantages	▪ Much smaller and lighter than RFID tags and therefore easier to use. ▪ Less expensive than RFID	▪ Can read RFID tags from a greater distance than barcodes. ▪ RFID tags don't need to be

	tags; as barcodes are directly printed onto plastic or paper materials and therefore the only cost involved is the ink; a tiny overall cost. ▪ Barcodes work with the same accuracy on various materials in which they are placed. ▪ Barcodes are a universal technology in that they are the norm for retail products; stores that own a barcode reader can process barcodes from anywhere in the world. ▪ In many cases; barcode accuracy has been said to be the same or even better than RFID tags. ▪ Today barcodes are found on almost every item and there are no privacy issues involved with its use.	positioned in a line of sight with the scanner. ▪ RFID tags can be read at a faster rate than barcodes; as approximately 40 RFID tags can be read at the same time. ▪ RFID tags can work within much greater distances; information can be read from a tag at up to 300 ft. ▪ RFID tags are read/write devices. ▪ RFID contain high levels of security; data can be encrypted, password protected or set to include a 'kill' feature to remove data permanently. ▪ RFID tags carry large data capabilities such as product maintenance, shipping histories and expiry dates; which can all be programmed to the tag. ▪ Once these are set up; it can be run with minimal human participation. ▪ RFID tags are more reusable and rugged as they are protected by a plastic cover.
Disadvantages All Barcode Blog (2013).	▪ Barcode scanners need a direct line of sight to the barcode to be able to read. ▪ In order to read the barcode, the barcode scanner needs to be quite close; around no more than 15ft. ▪ Barcodes have no read/write capabilities; they do not contain any added information such as expiry date etc. They only contain	▪ RFID involves assembling and inserting a computerized chip; which works out to be more expensive. ▪ RFID readers struggle picking up information when passing through metal or liquid. ▪ Reader collision can occur where two signals from different readers overlap and the tag is unable to respond to

the manufacturer and product. ▪ They are very labour intensive; as they must be scanned individually. ▪ Barcodes have less security than RFID; as they can be more easily reproduced or forged. ▪ Barcodes are more easily damaged; as the line of sight is needed to scan, the printed bar code has to be exposed on the outside of the product. ▪ If a barcode is ripped or damaged there is no way to scan the product.	both. ▪ Tag collision can occur when numerous tags in the same area respond at the same time. ▪ RFID still has two separate chips (read only and readable/writable), which cannot be read by the same machine.

H. Data Management in RFID Systems

According to Barjis and Wamba (2010), "Large-scale application of RFID technology undoubtedly results in a more complex data management system. First of all, it might result in enormous data volumes. Whether the concerns of these data volumes are profound or it is rather exaggerated is a subject of research. Furthermore, it is also of research interest to study the relationship between different data hierarchy at items, box, and pallet level. The data management issue is also of interest for real-time decision-making applications. Both analytical and simulation methods may help with the study of data volumes and data management in large-scale RFID applications".

Supply chain management and real-time tracking requires a robust and comprehensive database to ensure that the preservation and storage of information and data is secured and well protected from intrusion and or being deleted inappropriately. RFID systems are made to provide efficiency in the delivery of service and to promote an expeditious processing of information. Old and dilapidated database systems must be replaced since they may not be compatible with the RFID technology. Also, the use of modern and updated software as well as the requisite upgrades is essential to the maintenance and long-life of RFID technology if a company decides to incorporate it in the business setting (Garfinkel and Holtzman, 2005).

The RFID system is continuously undergoing innovation with the use of advanced technology and infrastructures. As computer processors are getting powerful and smaller, RFID systems may soon become simpler and faster than in its current form.

I. Adoption Process of the Technology and Role of the Organizational Size

The adoption of new technology has compelled companies to install new and modern technological devices in bringing about a more automated and efficient task-making process

within a business environment. Organizations, whether profit-oriented or not, need all the technological resources appropriate to their business to achieve in a swift and efficient manner the aims they have bestowed upon themselves – profit-generation or continued delivery of service (for non-profits organization). It is essential, therefore, to manage task using modern technology to keep things in order and to promote quality work that focuses on time management and efficiency in the supply-chain or the marketing of goods and services. The technology is to be maintained with due consideration to providing security, to monitoring of inventories and stocks so that obsolescence and damages to goods are regularly monitored, and that delivery to customers is not hindered by unforeseen events or unexpected obstacles.

According to Wyld (2006), "In the end, the current push for RFID may be a small part of a larger mosaic." A futurist by the name of Paul Saffo has foreseen "that much of the focus on RFID today is on doing old things in new ways, but the truly exciting proposition is the new ideas and new ways of doing things that will come from RFID. Building upon the previously discussed ideas advanced on RFID as making possible an Internet of things" (Schoenberger, 2002). RFID can also be useful in a wireless Internet of artifacts (Gadh, 2004). RFID makes it possible to implement a sensor revolution by considering it (RFID) as a media technology in promoting the concept of intelligent artifacts or "smartifacts which are now being observed in the technology world but notably in "big-box" and retail stores. RFID is already everywhere including health-care infrastructures and social security as well as employment benefits (Rogers, 1962).

J. Sample Applications

Although RFID technologies have not completely replaced barcode systems in cargo delivery companies, some pilot applications have been applied by different companies. According to Saatcioglu (2010), the attitude of the leading firms in the sector is very important in terms of the acceptance of the technology in industry. As for the notion that many companies do not set aside enough budget allocation for research development, such companies are affected by the decisions of leading companies. One example application was tested by FedEx, the biggest parcel transportation company in the world.

This project can be summarised as follows. RFID wrist bracelets will be used instead of vehicle keys. Opening and closing vehicle doors will therefore take place automatically when couriers move a certain distance away from a RFID reader. Drivers thus do not have to lock their doors for every single delivery. The possibility of leaving doors unlocked and creating opportunities for theft will consequently disappear. Similarly, losses that occur because of lost keys, causing service interruption and extra cost, will also be reduced. In addition,, couriers will not have to spend time searching for keys during the day, shortening delivery time and increasing service quality. The application has been tested for 200 vehicles and proven to be successful. For this reason, it has been decided to use the application for all FedEx vehicles.

Another pilot application was tested by the parcel delivery company DHL and the computer company IBM. The aim of this project was to control the activities of the IBM repair department and the movements in and out of defective parts. DHL send special boxes containing RFID chips to IBM customers with defective parts. DHL sends the parcels to the IBM repair service. As a result of information sharing with the repair service, the service is already informed about problems and the numbers of parcels and can organises work plans accordingly. As a consequence of the pilot, DHL reported shortened delivery times and

increased service quality and IBM also achieved improved service quality and saved time and money (http://www.sembolbarkod.com/rfid-nedir/, 2013).

Very few existing studies have explored RFID applications in the cargo delivery industry, although this industry has significant potential for the introduction of such applications. Using RGID in the cargo delivery industry provides RFID suppliers with new investment and also opens up new study opportunities for researchers.

CHAPTER 3 METHODOLGY

A. Introduction

In this proposed research, the viability of using Radio-frequency identification (RFID) in the operation of a cargo and transport company would be investigated. The RFID or a wireless non-contact use of radio-frequency electro-magnetic field is usually utilized in transmitting data for identifying and tracking data that is affixed to it. With the said purpose, the RFID has already been used by companies in detecting or tracking their employees because of its automatic response to a sensor.

In this study, the use of RFID in the identification of items in a cargo company instead of a barcode technology would be investigated. The researcher is particular interested in the contribution of the RFID in lessening the workloads of employees along with the financial impact that it may bring to the company. Through the implementation of a RFID in a chosen cargo company, it is expected that the employees would become more efficient and profits would increase eventually.

B. Research Questions

The proposed study was conducted to determine the viability of using RFID in cargo transport and delivery industry. The research intended to answer the following questions:

1. How financially viable is the installation of RFID in the operation of cargo transport and delivery industry?
2. How effective is the implementation of RFID in the operation of cargo transport and delivery industry?
3. Can the RFID reduce the work load of the employees?
4. How can the RFID improve the delivery time in the cargo transport and delivery?
5. What is the level of acceptability of RFID for the workers of cargo transport and delivery company?
7. How can a company of cargo transport and delivery benefit from the use of RFID?

C. Research Objectives

The research proposal would be able to attain the following objectives:

1. To investigate the feasibility of the project;
2. To discover new, faster and more reliable service solutions for cargo delivery companies
3. To introduce the workers in a cargo company about RFID
4. To investigate new system which will reduce the workloads of workers in operation of a cargo delivery system

D. Research Design

The design of the research concentrated on obtaining the perception of the employees and managers of a cargo company in Turkey about the implementation of RFID. In doing so, survey questionnaires were distributed for the chosen cargo company. This pertains to the bottom-up approach of the research because the intention is to acquire the essential data from those who would actually use the barcode. Apparently, the perception of the workers or from the ground is investigating the topic at hand since they would know first-hand whether the proposed system would be effective or not. Moreover, the perception of the employees

whether to change or not the barcode system into RFID would determine the policy of the cargo company. This is how essential of obtaining the data from the stakeholders at the bottom first as an integral part of the research design.

The design also intended to obtain the perception of the top officials such as the managers or supervisors in order to have a deeper understanding about the impact of RFID on the operation of a cargo company. In this context, the researcher conducted an interview with one computing manager, four branch managers and one regional manager about the fundamental information such as company structure, services offered, the daily operations and their knowledge about RFID.

E. Research Philosophy

The study utilized the philosophical frameworks of positivism and phenomenological. In positivism, the data gathered was treated statistically (Bhattacharyya, 2009) . This would mean that the responses from the survey questionnaires would be calculated using standard deviation, mean, mode and median. From a positivistic point of view, every data is treated in quantifiable manner, which is very useful in answering the research questions.

Consequently, the responses obtained from the survey questionnaires would be deduced into numbers that would be treated as facts. In positivism, it is inevitable that ideas are examined as facts in order to be considered acceptable, which would be the case in this proposed research (Panneerselvam, 2004).

In connection, the overview of the research would be determined partially by the results obtained from the distribution of survey questionnaires. In other words, the primary data would be the responses of the workers. This is why the researcher would ensure that the sampling method to be used would be systematic as possible.

Aside from the positivistic perspective, the study also examines the data on a phenomenological level. This would imply that the responses of the key informants during the in-depth interviews would be analyzed on a qualitative manner. Subsequently, the researcher would analyze deeply the underlying meanings of the data coming from the in-depth interview (Gagnon, 2010).

F. Research Approach

The study utilized a combination of qualitative and quantitative techniques in order to produce more reliable results. Quantitative technique such as survey questionnaires was conducted in gathering measureable responses of the targeted population (Rugg et al, 2007). In this technique, the number of respondents was selected from the cargo company for the snap shot analysis of the general tendency about RFID. The goal of using quantitative method was to gain a general overview of the workers about the proposed system.

To complement the quantitative research technique, an in-depth interview with key informants particularly a selected number of managers was conducted. This method has to be performed in order to get the other side of the issue coming from the top officials. This would increase the level of objectivity of the results since the stakeholders from the bottom and from the top were seriously considered in gathering data (Kumar).

Consequently, a mixed method approach would gain a better understanding of the phenomenon being investigated. While the qualitative approach captures the subjective experiences of the participants, the quantitative one would give a snap shot analysis of the participants' attitudes toward the use of RFID.

G. Time Horizon

In undertaking the proposed study, the researcher constructed and prepared the survey questionnaires on the first one month. The remaining months were devoted on the distribution of questionnaires and the computation of data gathered. In summary, the study is expected to be finished in 4 months. Additionally, the researcher needed the assistance of two interviewers.

H. Data Collection Methodology

As mentioned, the data collection method was done through the distribution of survey questionnaires to the workers of a cargo company in Turkey. The objective was to acquire the data systematically and objectively by selecting the respondents randomly in the said cargo company. The participants answered 30 questions in relation to their experience about the company`s strategic management policy and current barcode technology. The survey questionnaires investigated the willingness of the employees in changing the current system.

Specifically, the chosen respondents were 12 office staff, 36 couriers and drivers. The researcher personally distributed the survey questionnaires along with two interviewers. The researcher ensured that topic of the study was explained clearly to the participants. The rationale for this was that the employees had already experienced the current barcode technology, which was why their perception was quite valid. The random sampling procedure had made the research methodology systematic and objective since personal biases of the researchers were eliminated.

. The researcher would ensure that the questions are easy to answer so that time and effort of the respondents would not be wasted. Moreover, the independent variables are age, gender, occupation. The dependent variable is the perception of the employees about the implementation of RFID in the cargo company.

In terms of the interview with key informants, an unstructured interview was conducted. The managers were chosen purposively since they had the direct knowledge about the effectiveness of implementing RFID to the operation of the cargo company. It was significant that the effectiveness of RFID would also be viewed from the vantage point of these key informants.

CHAPTER 4 ANALYSIS

A. Structure of the Company and Their Services

The company vision is: to offer high quality and customer-oriented services with our qualified staff and by using the ever-developing technology to provide value and create difference for our stakeholders and to transfer our leadership in the sector to the international market. The company mission is: to perform the work correctly and non-faultily in the first time with its modern, fast and quality service concept, to sustain our leadership in the sector and become an ideal company in Turkey by acting in compliance with the laws, commercial and social ethics (http://www3.yurticikargo.com/hakkimizda/Sayfalar/felsefemiz.aspx)

X Cargo Company

X cargo was established in 1982 as the first cargo delivery company in Turkey and today the company has 19 regional offices, 30 transfer hubs, almost 750 branch offices, 2500 vehicles and more than 10.000 employees all around the Turkey. Thanks to international partner Z company, it is possible to send dispatch to 230 countries since 2003.

The milestones of the X Company

- The company was established as the first cargo delivery company of Turkey in 1982
- Agency system was set up in 1992
- Mobile solutions was used the first time in Turkey in 1993
- Rolling band system was set up the first time in Turkey 1994
- The company was certificated by Turkish Quality Standard Institute TS 11595 in 1995
- International carrier service was set up in 1996
- The company became member of FIETA in 1997
- The company was certificated by TS EN ISO 9002 in 1999
- The hand terminals was used the first time in 2000
- Electronic tracking system was set up in 2001
- ERP and performance system was launched in 2004
- Completion of KOPS, an operational system that connects all company`s units on a real time basis in 2005
- Packaging and payment delivery system was launched in 2006
- Yurtici mobile and “Haval” which are new marketing programs was established in 2007
- “Self service”, fully functional online customer service was launched in 2009

(http://eski.yurticikargo.com/tarihce.asp, 2013).

B. SWOT ANALYSIS

SWOT analysis can give meaningful information in terms of identify the weaknesses and strengths of the company and to discover the new opportunities that come from outside and threats that will affect the company in the future. The information is based on the opinions of the company managers and observation of the researcher and the information taken from the company website. An appropriate analysis that takes into account internal and external factors will enable to use potential of the company optimally. Also, this analysis makes it possible to take precautions against the risks that could arise in the future. Furthermore, it plays a key role to observe the opportunities and make the right investments in the right time to reach the promised vision in the future.

1. The Strengths of the Company

- The brand image: the company was launched as the first cargo delivery company in 1982. Since then the company has continued its investments. The company has a reliable company image in the eyes of customer that provide fast and high quality service.
- Widespread service network: the whole country is in the range of enterprise and the same quality service has been carried around the country
- Thanks to an agreement with GeoPost, one of the biggest cargo delivery companies in Europe, it is possible to send cargo to 230 different points around the world.
- Possession of specialised staff: as the company has been operated in the sector for many years, the company has well-trained and experienced employees.
- Competitive advantage: thanks to economic strength and brand image, the company has competing supremacy against the other companies.
- Flexible price policy: the company can apply flexible prize policy thanks to brand image and competitive advantage
- Market conditions: it is required large investments to join the market so it is not easy to enter to market for a new company.
- Resistance against the economic fluctuations: as a result of working with numerous institutional customers it is not affected greatly by changes in demand.
- Being a part of different enterprises ensure economic security and easy communication possibilities with other industries.
- Technological infrastructure: in comparison to other companies to be using more advanced technologies.
- Environmental policies: the effort to reduce carbon emissions and applications for the use of recycled materials make it possible to adapt to modern applications that would occur in law and legal regulations.
- Social responsibility projects: Besides of commercial services, the company has sported a large number of social, educational, artistic, cultural and sporting activities.
- Flexible solutions: Ability to produce a variety of customer solutions for specific institutions and thus earned customer loyalty.
- Easy of propagation: Thanks to widespread infrastructure, the company can launch new branch offices for the regions where economic activities increase.
-

2. The Weaknesses of the Company

- Unwieldiness: the company consists of large number of units this makes the change difficult.
- The cost of investments: Investments are required large amount of money.
- The geographical area: As the company offer service in a wide geography it is difficult to capture the same service quality for all regions where there are not cultural and economic equality.
- Difficulties of follow the current technologies: it is demanding and costly process to adapt new technologies and hitches occurred during this process.
- The problem of finding personal: As the services based on manpower, it is difficult to find educated people to employee for courier services thus it is caused to reduce to quality of services.

3. Opportunities

- The growth potential of the industry: ascension of the economy and demand for cargo services are new opportunity for sector and the company.
- Improvement in transport infrastructure services: Along with economic development, increase in investments of road, port and rails and airport provide new transport formation options that faster, cheaper and safer.
- Globalisation: improving trade and political relations with de eastern and European countries is expected to create a positive impact on cargo industry
- E-Trade: Rapid increase in the e-trade is another factor that required using cargo services intensively thus it is another opportunity for the company.

4. Threats

- Economic crises: probable economic crises are one of the biggest threats, to not only the cargo industry but also the whole economy of country.
- Globalisation: globalisation both could be an opportunity ant threat, it will enhance the competition global companies to enter the market easily.
- The political stability problems in the Middle East: Political instability and possible war situations are threats both country economy and transportation industry.
- Natural disasters: Given the structure of a country's geography from time to time, natural disasters like, earthquake, fire, floods, landslides affect the country's economy and they are threats for cargo transportation.
- Traffic accidents: All across the country, high rate of traffic accident affects the quality of transport services.

C. The Service Units of the Company

1. Branch Offices:

The company's services have been provided by branch offices that are established in all cities of the country depending on economic and population density. There are almost 750 branch offices in Turkey. In Istanbul that is the most populist city, there are almost 250 branch offices and in some cities that located generally in the east, one branch office would be enough to meet the demand. Approximately, between 10–20 employee are employed depend on the size of the branch offices. There are one branch manager, between 2–4 office staff, between 5–15 courier, between 2–5 vehicles and the drivers as the same number as vehicle. There are between 10 and 25 employees depending on the size of branch office.

The main task of branch offices are distribute the cargos and files which was taken from transfer hubs in the responsible area, at the same time, to collect cargoes from the region and collect them at the branch to move to transfer hubs at the end of the day. Different sending options can be booked depending on the delivery of cargoes, such as customer can bring the cargo to branch or cargo can be taken from customer address.

2. Transfer Hubs

The main tasks of transfer hubs are separating the cargoes that collected from city centre and distribute them by their destination. At the same time, classifying the cargoes that come from other cities, branch by branch a load the cargoes to a branch's vehicles. There are 30 transfer hubs in the country and these centres are located relating to work volume. There are five

transfer hubs in Istanbul that has the highest density but some regions especially in eastern cities, one transfer hub would be enough to meet the demand for a few cities.

Although all the transfer hubs have similar systems they have different number of employee and sizes depends on their work volume. Between 50 and 250 staff can be employed in a transfer hub.

3. Regional Directories

There are 19 regional directorate offices in the country. The main tasks of the units are to control the activities of the branch offices that were established in their area of responsibility and to ensure the operations are carried out as it is supposed to be. Also, accompany them during in marketing activities and determine the specific conditions of agreements with institutional clients. Besides, regional offices managers follow and record the result of the inner company training and report the problems of the branches to head office.

4. Head Office

this is the place where all the activities and operations were controlled. Investment and management decisions were taken by head office. There are central department of marketing, accounting, research development, human research, finance and computing. Almost 200 people are employed in head office.

Current tracking technology: The company uses barcode system which works online to track the parcel movement and keep the data. The system makes it possible to keep all the data about the cargo and customer. A barcode label is printed out from the printers to stick in every single delivery and barcode labels are read by handheld readers in every stage of the service from sender to receiver.

D. The Operations

The cargoes are brought to branch offices by customer or courier to be sent to any address. The staff load information to the system about the cargo, sender and receiver and barcode label is stuck the delivery. All cargoes are collected in the branch office and moved to transfer hubs at the end of the day. The cargoes are unloaded from vehicles of branch office and divided to their destinations. In the next stage, staff of transfer hub loads the cargoes to large trucks that will move the cargoes to another region. In the transfer hubs where the cargoes terminate, they are unloaded and divided to their branch offices by workers and loaded to vehicles of branch office. Cargoes are moved to branch to distribution and they are distributed. Over the whole process, cargoes change hands many time and they are read by handheld readers in every stage of the movement.

Cargoes are required to scan by barcode handheld readers numerous times in every stage of the process form sender to receiver. This process is required handling of every individual parcels. Although the system allows customer to track their delivery online in every stage of service, it is caused the waste of time and labour.

1. The Daily Operations in the Brach Offices

The branch offices are opened at eight a.m. and close at seven or eight p.m., depending on the daily workload. In some cases the closing time may exceed until a few hours in case of some mishap and such situations occur commonly. The manager and office staff come to office at the opening time but drivers and courier go to transfer hubs two hours earlier than opening time of branch office, about six a.m. More than two hours is spent in the transfer hubs by courier to load the vehicles in one visit. Although there are some minor differences among

the distribution system of transfer hubs regarding their locations and distance from branch offices, almost they work with the same system. The vehicles of branch offices go to transfer hubs three times in a day, morning and afternoon they pick up cargoes to distribute and at the end of the day vehicles leave the cargoes that are collected during the day. More than two hours is spent in the transfer hubs in one tour so the staff spend approximately five hour in transfer hubs. The staff is worked actively in these stages. Besides, the staff distributes and collect the cargoes in the region during the day. The services are conducted based on physical strength intensely and it is served six days in a week.

2. Daily Operations in Transfer Hubs

There are some differences among the transfer hubs in terms of size and work volume so that the figures will be given as two extreme tips for the smallest and biggest transfer hubs, the figures of the other transfer hubs will be between that two examples. Seventy per cent of the whole operations are carried out at night, 30% during the day. The shift systems that make it possible to work 24 hours and transfer hubs serve seven days in a week.

As a smallest size transfer hub: approximately 50 people, 2 managers and 4 staff for office works and rest of the staff are employed to load and unload the tracks. As a small sized transfer hub, it is served for ten branch offices. In one day, 40 branch vehicles are loaded and 20 unloaded, also ten large trucks run between cities are loaded and unloaded.

As a biggest sized transfer hub: There are almost 300 staff in the biggest transfer hub. The shift system and working hours are the same as the other transfer hubs. It is served to almost to 75 branch offices. In every day, 50 trucks are loaded and unloaded approximately. Also, more than 300 branch vehicles are loaded and 150 vehicles unloaded in one day. Branch offices are located in an optimum distance from branch offices in the out of the city where industrial areas located. Transfer hubs are designed like large warehouse that allow working with many cars at the same time and providing park areas for vehicles.

E. Implementation of Services

The company promises using the latest technologies to provide the fast and reliable service as a service policy so that the latest technologies are followed and updates are performed on barcode system from time to time. In this sense, call centres that serve 24 hours actively, SMS services, applications that are based on smart phone technology are used and updated. Although the whole applications and effort on the system it can be seen clearly that there are hitches which is an obstacle to meet the demand and provide the modern, fast and safe cargo transport services. These factors are pushing the company to search safer, faster and modern applications in cargo services.

It may have been hitches that caused human error frequently during the load and unload process in transport hubs. Sending the cargoes to wrong branch offices is a common error which is happen as the transfer from large trucks to branch vehicles is not done at the same time. Another common error is to forget the parcels in the transfer hubs or branch which causes disruption of the daily services and customer dissatisfaction. Such incidents affect the closing time of the branch offices and transfer hubs operations. Performance assessment applications that are done by head office to avoid such incidents affect the branch offices as financially and branch performance. Furthermore, spending time in transfer hubs both exceed the working hours of staff and delivery time besides that period of time is a tiring part of the job that required to much physical effort. For these reasons, it is difficult to find people for job and workers do not want to works in this sector for long time.

As it has mentioned before, this research investigates new solutions for the problems that described above, try to find faster, safer and more reliable technologies that reduce the human effect on the system.

Common opinion in the studies conducted on RFID is RFID is an expensive technology and it is shown as a reason not to launch RFID system in their company. In this research, it has been contacted with local and global RFID suppliers company via internet and phone to investigate the whole cost of the system which will replace to barcode system.

The whole operations and information regarding company and their current operations were described to company to be able get the best result. Considering the size of the company and complexity of their operations it is not easy to give certain figures but meaningful results are obtained when the offers letters that were asked from different companies evaluated. The offer of Ycompany will be demonstrated, as a probable solution as their cost and system was found acceptable by company managers.

F. The Cost of the Project

X company claims their system will replace current barcode systems to improve speed and accuracy of deliveries and shipments. Their application uses a combination of RFID readers, antennas, mobile readers, portals/tunnels, and our AIMS (Asset Inventory Management System) software.

The system is required to setup two tunnels per location, one for incoming packages and one outgoing packages. These numbers can be adapted to every single unit considering the volume of the work and portable tunnels can be design for branch offices, as there may not be appropriate environment in branch offices. Other hardware is handheld reader for inventory recovery and management and RFID tags must be put for each asset. Besides hardware, the system required software per location for shipping reconciliation and asset management

Estimated cost of the project as below:

- AIMS software - $10,000 Enterprise license, $500 per location
- Small tunnel - Alien reader and MTI antennas - $2,000/per
- Large portal - Alien reader and MTI antennas- $5,000/per
- ATID Handheld reader - $2,000/per
- Project management/requirement specs - $5,000
- 2 weeks development - $10,000
- 2 days training and support - $2,500
- RFID tags - $0.10/per asset

Description of Services

AIMS Software – RFID Enabled Solutions proprietary software. AIMS can be integrated with existing software or used as a standalone end-to-end solution. AIMS can be downloaded on a local server or accessed as a web service. Creating a custom dashboard and custom reporting will be done.

Portals – Large and small tunnels contain one or two readers and 2–8 antennas. Tunnels create a controlled environment and read range that allows us to achieve the highest speed and accuracy possible.

Handheld Readers – Mobile device used for commissioning, tacking inventories, and asset recovery.

RFID Tags – Each asset will be assigned a RFID tag. One tag will replace the current barcode tag on the outside of the asset. These tags are printable and can be used for barcode and RFID applications.

Development – Customising AIMS per the customer's business rules. This includes dashboard functionality, commissioning, alerts, reporting, and asset location information.

Owing to company policy, the branch offices have their own financial independency. Office equipment and vehicles are covered by branch managers and the investments were paid by branch offices so the cost will be calculated separately for each branch. Thus the applicability of the project will be visible more clearly and it will be easier to make an investment decision. Therefore, it will be taken into account a medium size branch offices and transfer hub.

The cost of the investment approximately for a medium size branch office that has 15 staff and 2 vehicles.

2 tunnel	$4,000
4 handheld readers	$8,000
RFID tags (Annual)	$10,000
Training and development	$2,000
Total cost (approximate)	$24,000

The cost of the project approximately for a medium size transfer hub.

4 large portal	$20,000
4 handheld reader	$8,000
Development and set up	$5,000
Total cost (approximate)	$33,000

It must be calculated how much money, time and labour can be saved if the project set up to evaluate the feasibility of the project.

In the current system, it takes almost two hours to load and unload the branch vehicles. Considering vehicles have to go to transfer hub three times a day, more than five hours is spent in transfer hubs by courier and drivers.

G. **Using RFID in the company:**

Using RFID is required to put RFID chips for every single delivery. There is no need to scan the parcels one by one. The whole cargoes in a vehicle can be read in a few seconds accurately and all data is loaded the system at the same time. If the barcode system is not using there is no need to handling for every single parcels. Cargoes can be loaded and unloaded gregariously by forklifts that there are already in the transfer hubs. The system will alarm in case of incorrect or incomplete loading or unloading. With this system, loaded process can be completed with only two people about in half an hour. In this way, loading and unloading process will be done in a shorter time with less number of workers. This means the workload and working time of the couriers will reduce significantly.

It can be said the same daily operations can be carried out faster and safer than barcode system by employing less one courier. Examination of the system in terms of transfer hubs would show us more profitable results. Considering that almost all of the staff is charged loading and unloading in transfer hubs. Using of RFID would save large amount of labour and time. It is estimated there would be one-third saved in labour in the operations of transfer hub.

Calculation of the annual cost of a worker is a key issue to see profitability in terms of to have certain figures. The outgoing annual payments of employees are as follows.

1. Monthly salary
2. Monthly payments in food
3. Clothing allowance twice a year
4. Two bonus salary per year
5. The extras paid in case of the achievement of goals.

The salaries of the staff of transfer hub are paid by the company head office. The salaries of the staff of the branch offices are paid by branch manager with after calculating monthly progress billing as the branch offices have their own financial responsibility.

Considering the all payments, annual approximate cost of the one staff is $10,000.

The result of the obtained information so far is quite surprising. A survey was conducted with the employees at different positions in the company before sharing the obtained information

with managers. The survey demonstrates significant facts regarding the obstacles of the applicability of the project. These factors will be defined in further sections.

H. **Evaluation of Survey**

The survey that consists of 30 questions is shown in attachment section. Answers have been classified according to position of participant in the company. The first outstanding fact is the correlation between position and experiences in the company in such a way that although managers and high position staff have a long years experiences in the company, couriers and drivers are not keen to work for years. The degree of difficulty of the works and financial dissatisfactory can be shown as a reason. While the people who have satisfying salary want to keep their job, couriers and drivers tend to find another job therefore staff turnover rate is higher in these areas. It can be said new applications that reduce the workload will increase the loyalty of the staff in the company.

Owing to company policy, the people who worked within another cargo company are not allowed to work in the company. Therefore all their experiences regarding the industry concerned with the same company. The current barcode system and technological infrastructure have been updated from time to time. Seventy per cent of the employees have experienced such a process within the company. Impressions of these employees are vital in terms of to be able to make a comparison between old and new systems. Besides, these impressions give important point of view in terms of to estimate the perception of the employees for new investments. In comparison to the old and new systems, vast majority of employees regarded as tedious and laborious work about orientation process however the all participant who has experienced the both new and old system indicate that current system is faster and more decent, and all participant said that they did not want to work with old system also new system make it easier their works. It is believed this outcome will affect their willingness and prospective hopes in the stage of launch new technology like RFID. The question that regarding the error rate shows there is no significant differences between two systems but the general opinion says the new systems caused less error as it made the work easier. Another question that investigates the delivery time displays there is significant decline in office works and it affects the service quality and fast but as a whole delivery operations the improvement is modest. The question that examines the aspect of the employees regarding the new technology is essential. Although the answers to this question various, adaptation process takes almost six months to be able to use the system effectively. Common opinion of the staff is the system is used effectively by employees but deficiencies of the system leads to disruption of services.

According to survey, participants claimed they had information partly about the technology also participants believe they have more advanced system. In comparison with global cargo delivery companies, the general idea is not to be informed about their system but a sizeable group of staff claimed they had a similar technology and few staff answered as the company use older technology than global firms did.

One of the key questions in the text was to investigate to what extent is known about RFID. The answers show meaningful outgoing about the barriers of the project. Only few managers claimed that they had partly knowledge about RFID. Rest of the staff indicated that they have no idea what is the RFID. Although they know some application like bridge and motorway tolls, automat gate system etc., but almost the whole staff that joined the survey do not have regarding RFID application in cargo delivery services and its applicability.

According to survey the difficulties to use barcode system are as follows: barcode scanning is time consuming, difficulty use of hand terminals, and difficulties of storage and access of data.

Another question was asked to investigate the point of view of staff regarding the relationship between workload and the number of staff. Few people said another system can make it possible to do same works with less people. Little bit more than this group claimed the workload and the number of staff are almost balanced. That group generally consists of office staff and vast majority consisting of couriers has claimed the workload is much for one person, either a new system must be launched or more people employed.

Delivery time is a vital issue in cargo delivery services and according to small percentage of participant delivery time is ideal but big percentage of the participant said better system make it possible to reduce the delivery time. Besides, most of the participant has admitted errors were caused by human but the system is leaded to people to errors and any error can affects the whole service chain.

During the research numerous of questions were asked to managers except survey questions regarding maintenance of operations, performance of staff, RFID and company policy. Also, most of the couriers were surveyed in personal and other related questions were asked. All these factors were taken into account for the analysis and comments. Survey and in person interview are support each other. It can be seen clearly from the survey and interviews that the different point of view between manager and other staff.

In terms of managers, one of the big issues is to be able to find qualified staff. Owing to company policy, it is not allowed to work with people who worked within another company so that all new employees does not experience in the sector and work and it takes time to obtain experience in the field also this period of time affects the quality of services and delivery time. Other than this the managers biggest concern are arrangements for the regulation of disruptions in services, updating the systems which will reduce the mistakes and provide better services, get deal with the problems that occur between transfer hubs and branch offices.

The problems of the couriers and drivers are long working hours, physical challenges, dissatisfactory salaries, lack of vacation days, in case an interruption in the system cause extra working hours. A working on the change of system not welcome by the staff in the process of adaptation. At the beginning of the process completion of the works leads to an extension of working hours and also it is spent lot of time to make up the errors. However, almost everyone agree on a topic that after the process of adaptation is exceeded all operations can be done easier and faster than before.

In this research, the results that can be seen clearly from interviews and survey are that there are vital difficulties in the fast and safe delivery services which are promised. The current service infrastructure of the company cannot meet the growing demand that expands depending on economic growth. An ever-increasing workload of employees reduces both the quality of services and commitment to work and company.

One of the aims of this study is to calculate the cost of the RFID project and unit labour costs. According to offer letter of RFID suppliers the cost of the project for one branch offices is $24,000. Besides, according to branch managers the annual cost of one worker is almost $10,000. Also, based on the observation upon company operations, manager’s opinion and solutions of RFID suppliers, it can be said that in case of using RFID the same daily operations can be carried out faster and safer with less one person. Even if this state, workload is reduced, delivery time is shortened and service quality and speed are increased.

When the project analysed with respect to transfer hubs, the approximate cost of the project is $35,000. These figures are evaluated as reasonable by managers. In this state, a branch office can cover the investment in almost two years. In terms of transfer hubs the project is much more profitable. Almost the whole staff has been charged with loading and unloading in transfer hubs. In case RFID launch in transfer hubs it is estimated that the same operations can be carried out with a third of a small number of people. In this case, the cost of the investment can be covered in less than one year by saving employee salaries.

Another question investigated in this project was regarding service time, it can be seen obviously from their operations that it is spent great time by reading the barcode. The vehicles of branch offices spend almost two hours in every visit to transfer hub, it means that couriers, drivers and vehicles spend almost five hours in transfer hubs in every day. All service stages are required scanning by barcode during the day and this causes loss of large amount of time and money. In case of using RFID, the time that spends scanning barcode will disappear. It will take a few seconds to read the whole RFID chips without mistake. It is estimated it would be four hours' saved in a day.

Another research question was to investigate to what extend RFID is known by company managers and workers. As a term, RFID is a name that quite unfamiliar to all employees. Even though similar technologies like smart cards, highway and bridge tolls are used by everyone. They do not have knowledge about RFID and how can be applied in cargo transfer services.

One of the aims of this project was to inform the company's staff about RFID and possible RFID applications in cargo delivery industry. Besides, aims the project the point of view of the staff regarding company policy. It is believed that the information will provide useful answer to management that wants to launch new application and makes effort training and motivation of the staff in the stage of orientation process of new application. In this sense, the company has a leader firm image that follows the modern, current applications in the market. In-company training and trade image are important in the formation of this perception.

The company policy states that strategic management policies are adopted to perform its mission and achieve the company vision. The main task of the general management is to create and maintain the organisations that can adapt to the constantly changing environment.

Adapting RFID technology to cargo delivery operations is a work that must be achieve by the company that adopts strategic management policies.

It is required search and development investments to lead and apply pilot application for new project. It seems that, it will take time to bring the issue on the agenda of company management. Even though strategic management policies are accepted by company, global companies are followed in the adaption and implementation of project. There is any company that has launched RFID for whole operations. Example applications only can be seen in few companies as pilot implementation. It seems to be an important reference implementation of such a project by a company in Turkey.

CHAPTER 5 RESULTS

A. Discussions

In spite RFID seems appropriate solution for cargo transport and delivery services according to study, it might sound dubious about reliability of the study that there is no any cargo delivery company that use RFID technology in their entire operations. There is a steady spread of use of RFID in the retail sector and also automotive, medical and in all supply chain stage of production. The reasons of not to use RFID in cargo industry can be explained as follows.

First of all it can be said that the cost of use of RFID is the biggest obstacle the widespread availability of technology. RFID is a technology that is getting rapidly spreading and cheaper. The piece cost of the chip decrease rapidly but it requires large amount of investments and research allocation activities must start years earlier. Also, it means a large amount of barcode system investment would be waste and it is a difficult decision for companies.

Besides, in the process of set up the system is required many in-company training sessions. This process is time consuming and expensive that brings extra cost.

In spite the cost of the project is a vital issue, the research shows RFID investments can compensate itself in a not too long period of time. The more important obstacle front of the technology is not cost. Technology is unknown by employees and managers. The surveys and interviews showed the RFID is an unknown technology by company from workers to managers so there is no system changing and new investment plans in company's agenda.

Besides, cargo services must be provided continuously 365 days and 24 hours during the year. The integration process of the new system will take time and disruption would occur in services during this period of time.

To make the RFID system work perfectly all the units should be installed completely. Transition process may be required to work both barcode system and RFID to prevent errors. Pilot applications chosen for specific regions would be efficient in terms of to try the system. Transition process is a period of time that requires the dedication and commitment of employees. Extra working hour may be required from employees during this process.

Another issue is international transport services. There is partnership between national and international companies to serve international services. RFID system works as a whole chain, all companies must have the same technology to be able to track items.

Aside from these, this research estimate approximate cost analysis for system, cost analysis is done separately for transfer hubs and branch offices but all units has different number of employees and work volume so the cost of the project will be different for every single unit in this regard the costs that is given in this research is average figures. Also, it is a time consuming and demanding job to develop proper software that can meet all requirements of the system. The software prize that is given in this research is an average that is calculated by software supplier. It is required a meticulous study to obtain curtain figures. In case using RFID job times and plans change. New system may require regulations for all operations. This organisation is a difficult process all on its own.

There are almost 750 branch offices in the country but the research was conducted in four branch offices that are medium size. According to economical and geographic environment, customers and employees may have different demands from the company. There are different industrial and agricultural activities at different regions and this affects the service activities

and customer priorities. As the research conducted in limited area, it is difficult to give a common reflection.

In terms of the reach to more reliable results, these issues should be taken into account.

B. Conclusion

Today's technological facilities give rise to developments at blazing speeds in all sectors. The systems that work integrated computer systems offer as possibilities that we could not imagine a short time ago in service and production industry. Intensive competition in all sectors forces the companies to watch the current technologies and work on pioneering applications.

This study is upon cargo transport services. In this project, the disruptions that emerge owing to the nature of the services and current system examined. The services are based on human power and physical activity. The human factor is in the process in the whole step of the services so errors caused by employees are common, therefore it is clear there is a need for a new system that will overcome the deficiencies in the cargo transport services.

Application fields of RFID area are rapidly evolving. The technology offers wide range of solutions for companies in production and service industry. This study investigated whether RFID can take place or not in cargo industry. In addition, the cost of analysis and probably operation changes are discussed.

In the research section, RFID technology is introduced primarily. And, the history of development process of technology, working principles, software and physical infrastructure are determined. Barcode and RFID systems are compared and the positive and negative aspects of both systems are explained.

In the analysis section, one of the biggest cargo companies of Turkey was chosen as the case study. The company's SWOT analysis is explained. The structure of the company, their services and operations are explained in detail.

Furthermore, there is information regarding cost of the RFID system and results are interpreted about the profitability of the application. Also in this section, survey results are discussed and point of view of managers and employees about RFID and company's management policies are take place under this title.

The last section, discussion and result, aims to show the project from different perspective, tries to show the limitations and shortness of the project.

This study shows RFID applications are suitable for cargo transport services. The cost of the project is evaluated as reasonable by company managers. However, it was discovered there are bigger obstacles than cost in the stage of implementation. It can be said that, based on the results of survey and interviews, the company's employees have insufficient knowledge of RFID. A process of orientation to new system is a challenging period of time in terms of employees and it is required in-company training programs that will cause cost and extra time.

All data based on interviews, observation and survey reveals RFID technology is viable for cargo transport and delivery industry. It is strongly believed RFID will be used instead of barcode systems to meet the fast growing demand to be able to offer faster and safer systems that reduce the human contribution and complement the shortcoming of barcode system.

C. Recommendations for Future Study

Although there is numerous works regarding RFID in literature, only limited resources mention cargo industry so the topic is needed a number of new researches. In addition to being positive research results, it is thought to be useful for company's employees in terms of introducing the technology. In this regard, future works are crucial in the field. Also, the study that conduct on subject will trigger other researchers and there is no doubt that as the number of research increase more successful result will be reached and future works will help spread the technology in the sector.

Another fact that research shows RFID suppliers do not have appropriate work and solutions on topic. Also, this study encourages RFID supplier companies to work on this topic and produce more effective solutions. It can be said that new studies on work will provide more accurate and suitable solutions.

In future studies, giving more space for the views of top managers and to conduct new surveys with more people will provide more realistic results. This study is built on the application of RFID systems to replace the barcode, but as is explained in previous chapters, some pilot applications can be conducted with specific customers. Such application can be pioneers for the spread of the technology.

I hope this work encourages future studies and provides useful information for students, cargo companies and all people concerned.

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APPENDIX 1- SURVEY

Dear Participant,

This survey has been prepared to be asked to X Kargo company staff to investigate the feasibility of the RFID technology in the cargo transport and delivery industry. The survey consists of 30 questions. The questionnaire asks brief information about the experience of the employees and their aspect regarding company's strategic management policy and current barcode technology. Also, it investigates to what extend RFID is known by employees and their willingness to learn about changes to their system. Your answer will guide academic research. It is not required to indicate your ID and your information will be kept secure. The results of this research will be presented to the company management. This research aims to discover new, faster and safer work systems in the cargo transport and delivery industries.

QUESTIONNAIRE

1. Your title in the company

a) Manager
b) Office staff
c) Courier
d) Driver
e) Other (indicate)

2. Your age

3. Your gender

a) Male
b) Female

4. Your graduation

a) Elementary school
b) Secondary school
c) High school
d) Bachelor
e) Master

5. How long have you worked at Yurtici Kargo?

6. How many different barcode system have you used at Yurtici Kargo?

7. Have you used any other barcode systems in a different field (if so, please describe)?

8. How would you describe the process of the orientation for the new barcode system (you may choose more than one)?

a) Tiring and time consuming
b) I would rather not to change the system

c) I believe the work hampered
d) Unnecessary
e) Necessary
f) Definitely useful
g) Instructive
h) Enjoyable
i) Other (indicate)

9. How would you define the differences between previous and current barcode system?
a) I cannot see any differences
b) It is not as important as to be required to change the system
c) It decreased the work load and save time
d) It is innovative and useful

10. How the new barcode system changed your workload
a) My job is harder than before
b) I cannot see any differences
c) There is minor positive difference
d) My job is much easier than before

11. How the new barcode system changed your work time
a) I am doing the same job in longer time
b) There is no difference
c) Work time shortened slightly
d) I am doing the same job in a short time

12. How the new barcode system changed the ratio of the mistake in your job
a) I am doing more mistake than before
b) There is no difference
c) My mistakes decreased slightly
d) My mistakes decreased significantly

13. How the new barcode system changed the delivery time
a) Delivery time increased
b) Delivery time has not changed
c) Delivery time shortened slightly
d) Delivery time shortened significantly

14. How long did the adaptation period take to the new system (indicate week or month)?

15. Do you believe the system is used effectively by employees?
a) No
b) Partially
c) Yes

16. To what extent the barcode system helps you in the work process
a) It makes my job harder
b) I have no idea

c) It useful but could be better
d) It is perfect and could not be better

17. What is your knowledge about systems of rival companies in Turkey?
a) I have no idea
b) I know partially
c) I know all systems that are used in the cargo industry

18. How do you see your state in comparison to the other rival cargo companies?
a) We are their behind
b) We are almost the same state
c) We are front of them in the competition

19. Do you follow the technological developments in the global cargo companies?
a) No
b) Partially
c) I follow closely

20. How would you evaluate your company technology policy in comparison to global companies?
a) We have older technology
b) There is no significant difference
c) We have advanced technology

21. What do you know about RFID?
a) I have never heard of it
b) I know some RFID applications in different fields
c) I have detailed knowledge about RFID

22. Do you think RFID can be used in cargo transport and delivery?
a) I have no idea
b) I don't think it would be useful
c) It may be useful partially
c) I believe it would replace the barcode system in the near future

24. What do you think about the downsides of the barcode system (you may choose more than one)?
a) To read barcode is time consuming
b) The procedure is time consuming
c) It caused too much error
d) Hand terminals are not practical
e) The system is expensive
f) Data control is not practical
g) Other (indicate)

25. Do you think can the same job be done with less people by using another system?
a) I have no idea
b) The number of the employee is already inadequate
c) The balance between staff and workload is ideal
d) More effective system can make possible to maintain the same job with less people

27. What do you think about the delivery time?
a) Quite long
b) It is longer than it is supposed to be
c) Ideal
d) It is could not be shorter

28. How often is it seen wrong delivery and lost delivery?
a) It is common
b) From time to time
c) Occasionally
d) Scarcely

29. What do you think of the reason for lost delivery and to wrong address delivery?
a) Customer
b) Company staff
c) Barcode system

30. Do you think another system like RFID could reduce lost deliveries and other faults?
a) It is impossible, every system make mistake
b) Mistakes can be reduced by current system as well
b) Different system may reduce the mistakes
d) We need a new system as soon as possible

31. What do you think about to changing the current barcode system to RFID?
a) I do not want it at all. I am not ready to spend and time
b) I need to be convinced it is worth spending time on
c) It looks unnecessary for the present time but it may be possible in the future
d) We should start using RFID as soon as possible

You have finished all the questions. Thank you for taking the time.