THE EFFECTIVENESS OF RFID IN REDUCING INWARD GATE CONGESTION IN JOHOR PORT.

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I dedicate this dissertation to my parents Hj Maarof Bin Hj Abas and Hjh Hamidah Bt Hj Mohamad, my brother and sisters, my family and close friends. Without their patience, understanding, support, and most of all love, the completion of this work would not have been possible.

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ABSTRACT

This research primarily focuses on the application of RFID technology that allows the outward movement of materials and items in the outward gates. The research has proven that the number of utilized staff and overall time consumption has been effectively decreased. This decrease is then calculated and used to prove that the decrease in time and operational step as well as other items related within the research highlights an increased operational efficiency through the estimation of decreased time, decreased operational step, decreased time consumption as well as decreased amount of congestion occurring at the front outward gate. The outcome of this research has proven that by utilizing all the research parameters, it is determined that by the main characteristics, Johor port efficiency has been proven to be increased.

ABSTRAK

Kajian ini memberi focus dan penekanan terhadap aplikasi teknologi Rfid yang membenarkan pergerakkan bahan-bahan dan barangan di pintu keluar.
Kajian ini telah membuktikan bahawa penggunaan penuh terhadao staff dan jumlah penggunaan kesuluruhan masa telah berkurang memberi tanda bahawa ia adalah sangat efektif. Pengurangan dari segi penggunaan masa telah di kira dan digunakan untuk membuktikan pengurangan masa dan pengurangan cara kerja yang secara tidak langsung membabitkan peningkatan kecekapan kos operasi dan anggaran penggurangan masa dan juga kurangnya kesesakan di pintu keluar. Hasil kajian ini telah membuktikan bahawa dengan menggunakan semua parameter penyelidikan, telah terbukti kecekapan Johor Port Bhd telah meningkat.

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f	-	Min tasks per day
g	-	22 working days
x	-	Min process time before RFID
y	-	Min process time after RFID

GLOSSARY OF TERMS

RFID	-	Radio Frequency Identification
ISO	-	International Organization for Standardization
MIC	-	Ministry of Internal Affairs and Communication
MCMC	-	Malaysia Communication s and Multimedia Communications

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CHAPTER 1

INTRODUCTION

The roots of radio frequency identification technology can be traced back to world war 2. The Germans, Japanese, Americans and British were all using radar, which has been discovered in 1935 by Scottish physicist Sir Robert Alexander Watson Watt to warn of approaching planes while they were still miles away. Here the problem occurs where there was no way to identify which planes belonged to the enemy and which were a country's own pilot returning from a mission. The Germans discovered that if pilots rolled their planes as they returned to base it would change the radio signal reflected back. This crude method alerted the radar crew on the ground that these were German planes and not Allied aircraft. Watson Watt developed the first active identify friend or foe (IFF) system. They put a transmitter on each British plane. When it received signals from radar station on the ground, it began broadcasting a signal back that identified the craft as friendly. RFID works on this same basic concept. A signal is sent to a transponder which makes up and either reflects back a signal (passive system) or broadcast a signal (active system).

Advance in radar and RF communications systems continue through the 1950's and 1960's. Scientist and academics in the United States. Europe and Japan did research and presented papers explaining how RF energy could be identify objects remotely. Companies began commercializing anti-theft systems that used radio waves to determine whether an item had been paid for or not. Electronic article surveillance tags, which are still used in packaging today, have a 1-bit tag.

The bit is either on or off. If someone pays for the item the bit is turned off and a person can leave the store. But if the person doesn't pay and tries to walk out of the store, readers at the door detect the tag and sound an alarm.

Radio-frequency identification (RFID) is a technology that uses radio transfer waves to transfer data and a data collection technology that uses electronic tags for storing data. The electronic tags also known as an electronic label, transponder or code plate is made up of an RFID chip attached to an antenna. Transmitting in the kilohertz, megahertz and gigahertz ranges, tags may be battery powered or derive their power from the RF waves coming from the reader. Like bar codes, RFID tags identify items. However, unlike bar codes, which must be close proximity and line sight to the scanner for reading, RFID tags do not require line of sight and can be embedded within packages. Depended on the type of tag and application, they can be read at a varying range distances. In addition tagged cartons rolling on a conveyer belt can be read many times faster than bar coded boxes.

RFID has its own standards where the standards have been set by a number of organizations. The organizations are International Organization for Standardization (ISO), the International Electro technical Commission (IEC), ASTM International, the DASH7 Alliance, EPCglobal, Federal Communications Commission (USA:FCC), Spectrum Management Branch (Canada:Industry Canada), ERO,CEPT,ETSI (Europe),Malaysian Communications and Multimedia Commission (Malaysia: MCMC), Ministry of Internal Affairs and Communications (Japan:MIC), Ministry of information Industry (China). ICASA(South Africa). Ministry of Economic Development (New Zealand), Infocomm Development Authority of Singapore (Singapore) and Agencia Nacional de Telecomunicacoes
(Brazil: Anatel).

There also several specific industries that have set guidelines including the Financial Services Technology Consortium(FSTC) has set a standard for tracking IT assets with RFID, the Computer Technology Industry Association CompTIA has set a standard for certifying RFID engineers and the International Airlines Transport Association IATA set tagging guidelines for luggage in airports.

RFID is a superior and more efficient way identifying objects than manual system or use of bar code systems that have been in use since the 1970s. RFID tags hold more data than bar codes, but a major differentiator is the unique serial number in the RFID's Electronic Product Code (EPC) because it allows tracking of individual items. While a UPC bar code might identify a 16 oz. bottle of mayonnaise, an EPC RFID tag could identify that single bottle. In this case, item level tracking could determine in the food had passed its expiration date. Tracking livestock was one of the first uses of RFID, as well as vehicle and container tracking. RFID is also used to track people. In 2004 an amusement park in Denmark put RFID wrists bands on children, which could be quickly located by readers in the park if they were lost. RFID chips are even implanted into humans. A tamper proof identification device that is implanted under the skin of a person for medical or security purposes. Using RFID technology a wand is waved over the skin to pick up the unique number stored in the chip which is no longer than the tip of a ball point pen. In October 2004 the chip was officially approved for U.S medical applications by the food and drug administration.

RFID tags can be either passive, active or Semi tags. Passive tags have no power source but use the electromagnetic waves from the reader to energize the chip and transmit back (backscatter) their data. Passive tags can cost less than a quarter and be read up to approximately 10 feet from the reader's antenna. Active tags have a battery that can transmit up to 300 feet indoors and more than a thousand feet outdoors. Used for tracking trailers in yards and containers on the loading dock, active tags cost several dollars and may periodically transmit a signal for readers to pick up or may lie dormant until they sense the reader signals. Semi passive tags, also called semi active tags, combine passive backscattering with a battery that allows the device to beep, blink or perform some operation. For example a semi passive tag on refrigerated cartons can include a sensor that when interrogated, reports the temperature range during shipment.

Depending on mobility, RFID readers are classified into two different types they are fixed RFID and mobile RFID. If the reader reads tags in a stationary position, it is called fixed RFID, These fixed readers are set up specific interrogation zones and create a bubble of RF energy that can be tightly controlled if the physics is well engineered. This allows a very definitive reading area for when tags go in and out of the interrogation zone. On other hand if the reader is mobile when the reader tags it is called mobile RFID. Mobile readers include hand helds, carts and vehicle mounted RFID readers from manufacturers such as Motorola, Intermac,Impinj,Sirit and etc.

1.1 Background of Problem

Congestion at Johor Port become more crucial, the Johor Port Shipping and forwarding Associations wants the transport ministry to come up with the solutions to reduce congestions at Johor Port. Despite having raised the issue with the port operator on several occasions they want a long term solution and not something which is done on an ad hoc basis or as and when the situation arises. The problem had been going on for years and if the port operator could not solve the issue and need relevant authorities to involve solving it and closely monitoring will all parties concerned for the benefits of the country's logistic sector. Johor Port is not transparent and responsible and as a service provider they had a duty to explain to port users on the problem.

What is obvious is that there is a variety of problem that arises from the delays currently happening in Johor Port. Primarily this incursion in time as well as the delays happening increases costs as well hinders company productivity which relates directly to profit. Financially speaking, delay in managing a product would be increased primarily in re-moving these materials, storing these materials as well as additional charges incurred due to the change in re-scheduling vessels to transport these materials.

From a logistic point of view, when there are delays, the charges for moving the materials around are increased, late arrivals of materials causes factory productivity to be halted or disturbed, the cost of paying the unused manpower as well as additional manpower required monitor and supervise the materials transfer. Leaving the materials in a new unplanned and undesignated area also increases risks of theft. Which is also in tandem with the warehousing problem which happens due to the delays that has happened. Manufacturers operating in Pasir Gudang industrial area were badly affected as they depended on the port to export their products to international buyers. Delay due to the congested had cause late shipment of raw materials from overseas resulting in interruptions in production. This kind of problem is not good for the country logistics sector and also sending wrong signals to investors.

1.2 Problem Statement

Various short-term mitigation was plan to incremental improvements to the situations and this will continue as an ongoing practice but still doom to solve the problem. The establishment of Tanjung Pelepas Port Sdn Bhd was been said to be the long term solution envisaged by the government at that time. Where they are two specialized ports. Port Tanjung Pelepas function is handle containers and Johor Port to handle conventional cargo.MMC corp has 70% equity interest in PTP and wholly owns Johor Port. In 2009, MMC had proposed to move Johor Port's container operations in Pasir Gudang to PTP. This would turn Johor Port into a non containerised port while PTP would focus on its forte of handling containerised cargo but the plan was turned down by the government. Johor Port Berhad are now operating at 80% to 90% capacity and with the bunching of vessel arrivals, the situations had become more worst.

In end of 2009 Johor Port Berhad has decide to improve their gates system operation by implementing RFID technology to its operations. The purpose of implementing the technology of RFID is to reduce congestion and indirectly to eliminate the congestion problem. By implementing RFID technology in operations, the cost has tremendously increased, but still they can't prove the effectiveness and the efficiency of the RFID technology. Therefore this dissertation uses the approach of evaluating the effectiveness and efficiency of RFID technology in gates system operations at Johor Port berhad.

The basic processes that make up the conventional gates operations are as follows :-

1. Container Pre-advise.

   Customer has to input certain information in the system in pre advise screen on the container and cargo to be trucked to the port in the Container Terminal Management System via the internet. He has to nominate the vessel name and the truck company who will truck the container number,size,type,weight, container seal number and cargo type. The customer must submit the pre advise at least 24 hours prior to the vessel arrival in order

not to miss the loading. The information for cargo and the container must be at all time accurate in accordance to the intended shipment so has not to miss match with the vessel loading plan. Do refer Figure 1-1.

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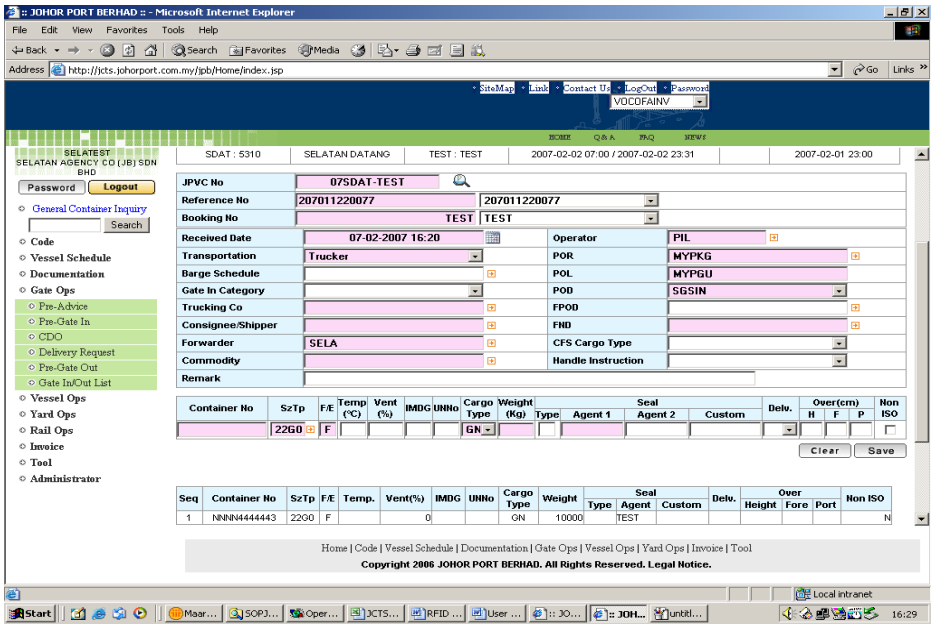

Figure 1-1 Pre-Advise Screen

2. Truck arrival at gate in.

Upon receive instruction from the customer, truck drive will pick-up the container at the customer's warehouse and will truck the container to the Terminal Container gate-in to gain entry to the container yard. Most of the time the truck driver will has to queue to wait for his turn to be served at the gate which normally will takes 5 to 10 minutes. During the peak period there will be an average of 10 to 40 containers waiting at the 6 lanes gate waiting to be served. Therefore the waiting time for the truck reaches the gate-in will be longer, in average 30 to 45 minute. Do refer Figure 1-2.

Figure 1-2 Container Trucks Queue At Terminal Gate In

3. Gate-in process & physical inspection.

Once the truck is position in the gate-house, container is being physically inspected on the container details such as container number size, conditions, vessel name, port of discharge, container seal number matching with pre-advised.and at same time to weigh the container to ascertain container weight. To ensure the container cargo is safe before entry to yard, the gate keeper will inspect the container seal in good condition and not being tempered or broken. If everything goes well this gate-in information verification and container physical inspection will only take 2 to 3 minute. In some instances some containers have to be rejected due to container condition and overweight or miss-matched physical data with the system. Do refer figure 1-3.

Figure 1-3 Terminal Gate

4. Gate confirmation.

Upon passing the gate-in physical inspection, the container is given a yard location to stack or position the container in the yard. The Gate Clerk is also conveying container planned location to the driver for him to proceed to location for off-loading the container. The container location is also being updated in the computer system to alert the yard Crane Operator. Containers with same vessel for loading will be located in one or two group locations depending on the total number of containers to be loaded.

5. Stacking container.

The truck driver proceeds to the yard location and engage with the yard crane to off-load the container. The yard Crane Operator will check his order list to check the container number and location to ensure he is picking-up the right container for the right stacking. In normal condition the process of lifting and stacking containers will take less than 5 minutes. But during peak period where bunching of truck arrivals going to same yard crane , the off-loading will take up to 45 minutes. Do refer Figure 1-4.

Figure 1-4 Yard crane Operations off-loading container from truck for stacking at yard

6. Empty truck leaves the port.

Once the container is safely off-loaded from the truck to the yard , the drive will proceed the terminal gate-out to complete the delivery cycle for sending export container from the customer's premise to port. By this time container arrival and stacking data are being updated accordingly and real-time display on the web site for customer to view the whole processes log.

1.3 Research Questions

This dissertation will primarily focus on efficiency and how it can and has been increased due to the implementation of the RFID system. So the research questions would as follows:-

1. How is operational efficiency defined?
2. What is RFID?
3. How is RFID implemented in Johor Port?
4. How has the implementation of RFID help increase operational efficiency of Johor Port?
5. How does implementing RFID help decrease congestion happening in Johor Port?
6. What are the suggestions which can be implemented in order to further increase the efficiency of Johor Port?

Port effectiveness and efficient become an important element and criteria in operations. Effectiveness and efficient can be a valuable assets for a port to attract investors and to attracts more customer and directly improve their daily operations.

1.4 Research Objectives

A general characteristic of a rail network should facilitate the passengers in the first place to travel from one destination to other destination. But with the experts planner, the implementation of the infrastructure is not just facilitating and transferring passenger from origin to destination, it is also as a part of the responsibility to ensure that the infrastructures are sustain in a long term, adapt to any new urban development and definitely reliable of transferring people from the origin to the destination. So, the goals of this dissertation are:

1. To evaluate the network complexity of light rail services in the study area using the β-indicator and directness of services to measure the competency.

2. To compare the existing network with the other service provider by measuring the network complexity for each system.

3. To measure the Directness of Services for each proposals for the purpose of measuring the flexibility level and convenience of the network itself to the users.

1.5 Research Hypotheses

A hypothesis can be simply defined as a guess on how the research might turn out. The findings of the hypothesis therefore needs to be in line with the research objectives. I hypothesize that this research will prove that through the defined characteristics of operational efficiency, that the RFID system implemented in Johor Port has in many ways increased its efficiency. 1) The congestion will be proven to have decreased before and after the implementation of RFID. 2) That RFID will increase a variety of areas in operational management. 3) A large area of operational management can be identified as to where to further implement RFID and increased efficiency. And based on those data, 4) further suggestions can be devised in order to ensure and increase the efficiency of Johor Port.

1.6 Theoretical Framework

This study will help to determine three main things which is also the main characters of evaluating efficiency. Firstly, the reduced time in operational processes. With the RFID inserted firmly into the processing method now, less time is being utilized which helps with decreasing congestion happening in Johor Port as well as eliminating problems of delays. The second is the lesser man-power being utilized in the processing which helps decreases the overall operational cost of handling the containers. Finally is the difference in steps that need to be taken before and after the RFID system was implemented. Where a process which might have taken 10 procedural steps before the RFID implementation took less after RFID was introduced into the system. Finally in which areas can more changes be made in order to further increase efficiency of the port operations. The importance of Johor Port is undeniable to the customers utilizing its services. In which case, implementation of RFID and how it decreases congestion, manpower as well as reducing the steps required is vital to the not only the operational efficiency of the port but also all the companies who are using Johor Port as the main medium for moving and transporting their containers.

1.7 Scope of Research

My research will be subject of only these few elements.

1. The change in manpower required before and after RFID is implemented
2. The amount of time required to process containers before and after RFID is implemented
3. The steps taken to process these containers before and after RFID is implemented.
4. The analytical data available which will determine just how much these elements have been affected by the implementation of RFID and whether these data prove the efficiency of Johor Port has been increased primarily due to the implementation of RFID.

1.8 Research Assumptions

To proceed with the research objectives some assumption has been made. There are :-

1. Location of the destination for collection and delivery will not be the same each day for a truck.
2. Cost, time and accuracy will not be the same for each destination for collection and delivery.
3. The overall outcome will prove that the MITS system is effective or wasn't.

1.9 Assumption of Research

To outline the areas affected by RFID primarily decrease of processing time and congestion, decrease of manpower and manpower costs, and decrease operational steps taken after utilizing RFID, and finally identifying the key areas where RFID has yet to be implemented and can affect change as well.

The differences of processing time and operational processes that occurs currently in Johor Port due to the implementation of RFID

1.10 Significance of Research

The importance of Johor Port no longer needs to be emphasized and that if its operational efficiency can be developed and enhanced overall it will ultimately lead not only to a better company productivity but also national global profile will also be increased gradually. The conventional method of processing containers has been replaced with the better method of using RFID and thus it merits a research on just how much and how it does improve the efficiency of operational processes. This research will utilize all the data collected and define in which areas RFID has had the most effect as well as other key areas where RFID can further develop and enhance the operational processes of the organization.

1. The study will describe the before and after data available which will prove the changes that has happened in Johor Port operational procedures and how this can be translated to enhance operational efficiency.

2. This study will look at the decreased time operational processes, decreases the requirement of manpower, decreases overall congestion and finally decreases the processing steps required when processing these containers

1.11 Research Design

The design of this research is highlight the difference in time required in processing with customer containers, the decreased manpower required in processing these containers and finally the decreased amount of steps in processing these containers and how that can be translated into key areas used to evaluate operational efficiency of the port as a whole.

1.12 Thesis Outlines

Chapter 1 – Introduction

The introduction covered the background of problem, problem statement which includes the idea of evaluating effectiveness of RFID by reducing congestion at Johor Port inwards and outwards gate system. Continued with research objectives, questions, hyphoteses, significance and inter-related issues which disscussed in theoretical framework. Scope of research, assumption and are briefly explained the focus of this research and finally brief the method of measuring the purpose of this research.

1.13 Chapter Summary

The importance point covered in this chapter is basically the current operational situation in Johor Port. Due to the influx of congestion as well as other operational problems which have occurred, Johor Port has decided to implement RFID in which case a large change can be seen especially in the determiners I have highlighted. These changes are positive but mentioning these changes alone will not warrant an official praise to the steps Johor Port has taken. An official research will need to be conducted in order for the public and the customer to fully appreciate the development that Johor Port has taken in implementing RFID. This is what this research will answer.

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