

# **Information Technology Infrastructure Related Issues that Affect the Efficiency of Operation in a Shipping Company**

Wijesundara KWEMGU<sup>1</sup>  
Perera GAKS<sup>2</sup>

## **ABSTRACT**

**The purpose of this study is to identify the information technology (IT) infrastructure related issues that affect the efficiency of operations of a shipping company, and to provide solutions to overcome those identified issues. Nearly 90% of the staff uses information systems to carry out their duties. But there exists some information technology infrastructure related issues. Most of the staff members use additional Excel Sheets to carry out their work. Also they face difficulties in the network infrastructure such as slowness of the systems. By taking those issues into consideration, the data were collected and analyzed. According to the results of data analysis, the root causes for the problems were identified. After generating alternative solutions, a feasibility study has been performed for those recommended alternative solutions. Finally best feasible solutions were selected.**

**KEY WORDS: Information Technology (IT), Excel Sheets, Computer Network**

## **INTRODUCTION**

Shipping or carriage of goods by water has played a significant role in the development of human society over the centuries. Shipping has been a crucial link by which commercial relationships have been established between widely separated parts of the world. There are two major types of shipping services; shipload services, which move goods in bulk for one or a few shippers and liner services, which carry relatively small shipments of general cargo on a regular schedule for many shippers. Most ships however are owned by firms whose prime business is shipping. These owners make their vessels available to importers/exporters through a highly efficient international network of shipping brokers.

The main responsibility of the shipping company where this study was conducted is to carry out the operations on behalf of a shipping line. These operations include loading and discharging of containers, issuing bill of lading, issuing delivery orders, creating work orders and collecting necessary charges etc.

In this type of a business it is critical to capture accurate and timely data in operations because the business heavily depends on that factor. So for that IT is used to integrate corporate functions and facilitate data exchange. Different systems are used for that. But it has been found that so many problems are faced by the staff as well as the customers.

## **RESEARCH OBJECTIVE**

The objective of this research was identifying issues/problems of current IT infrastructure and providing solutions to overcome those issues.

## **LITERATURE REVIEW**

Shipping industry is devoted to moving goods or passengers by water.

---

<sup>1</sup>Graduate, Department of Computing and Information Systems, Faculty of Applied Sciences, Wayamba University of Sri Lanka.

<sup>2</sup>Senior Lecturer, Department of Electronics, Faculty of Applied Sciences, Wayamba University of Sri Lanka.

According to Captain Piere Deseck, the shipping industry is very complex and has a lot of hazards. And also the rules that are applied to other branches of business can't be applied to shipping (Deseck, 2008).

Various studies have been undertaken to improve the efficiency of shipping operations. The introduction of containers resulted in vast improvements in efficiency of shipping operations, thus lowering costs and helping lower freight charges and in turn boosting trade flows.

Starting back in the 1990s, several studies have attempted to measure the effects of IT on shipping activities. Most of the analyses at the firm level established a positive relationship between IT and firm efficiency. Hopkins, Jeffrey W, Morehart and Mitchell used stochastic frontier analysis techniques to show the effects of IT use on firm efficiency. They found that IT had moved firms significantly towards an efficiency frontier (Hopkins, 2003).

Gene Gander says modern IT systems can help to integrate corporate functions and manage them throughout the freight forwarding process. The best solution, he says, involves the use of enterprise resource planning software. Further he names seven ways in which IT optimization can boost the efficiency of freight forwarding (Gander, 2009).

Also Anandhi S. Bharadwaj, Sundar G. Bharadwaj and Benn R. Konsynski use Tobin's  $q$ , a financial market-based measure of firm performance and examine the association between IT investments and firm  $q$  values. The results they found show that, IT investments had a significantly positive association with Tobin's  $q$  value (Konsynski, 2009).

## METHODOLOGY

This research tries to identify current issues of IT infrastructure and develop solutions to overcome those identified issues.

The design of this research will be "Correlational research design" because the goal of this research is to assess the relationship among the efficiency of operations and IT infrastructure.

A survey was conducted by using interviews and questionnaires because in this research it is essential to identify what are the problems faced by the users of the IT systems. Also understanding their IT knowledge will be a critical factor when developing solutions. Otherwise the solutions may not be practicable.

The research question is "What are the problems faced by using IT".

## DATA COLLECTION AND ANALYSIS

In this study, mainly two types of data were collected. They are the ideas, views and attitudes of staff members regarding IT systems as well as network infrastructure and technical data about the IT infrastructure such as server computers, components, network cabling, etc.

As the first step of data collection, a questionnaire was distributed among all the staff members of the organization to determine what kind of work they perform with the system, frequency of usage, difficulties face with systems, their view point of the systems, etc. The questionnaire consisted with two parts. One part consisted with questions relating to IT systems and other part included questions about network infrastructure. Both multiple choice and open ended questions were used in the questionnaire. Also it included a question to accumulate the comments and views of staff members about the IT infrastructure. Finally all the staff members were motivated and instructed to fill the questionnaire properly.

At the second stage of data collection, interviews were carried out with selected staff members from each department of the organization. The number of people interviewed was ten. Questions were asked to obtain deeper understanding about the attitudes, preferences and views on



IT infrastructure and performance with the systems. Therefore unstructured interview was used. This helped to determine whether improvement of IT infrastructure would add some value to the activities perform by them.

At the third stage, technical data about the IT infrastructure were collected. For this, an investigation was done by which details about server computers, client computers, network cabling, etc. were collected.

The data analysis procedure includes frequency analysis, descriptive analysis, cross tabulation analysis and pictorial analysis by using graphs.

The data analysis started with the frequency analysis procedure because it provides statistics and graphical displays that are useful for describing many types of variables. This includes frequency analysis of single answers and multiple answers of questions in the questionnaire.

Frequency tables were generated for different sets of variables to describe the pattern of frequency distributions of the variables such as usage of IT systems, usage of additional excel sheets, slowness of network, etc.

The descriptive analysis was performed to obtain univariate summary statistics for several variables in a single table and to calculate standardized values. The descriptive statistics considered for different set of variables were sample size, mean, minimum, maximum, standard deviation, variance, range, sum, standard error of the mean and kurtosis and skewness with their standard errors.

The cross tabulation analysis was used to form two-way tables. The test and measures of association for two-way tables were selected according to the structure of the table.

Bar charts were generated for particular variables because it can display the distribution of the variables clearly in pictorial form. Pie charts were also used in the analysis process to get a clear idea about

the percentages of distribution of variables such as usage of IT systems, usage of additional excel sheets, slowness of network, etc.

## RESULTS AND DISCUSSION

**Table 1 - Frequency table for usage of IT systems**

Description	Frequency	Percentage
Use IT systems	46	95.8
Do not use IT systems	02	04.2
Total	48	100.0

This interprets that 95.8% of the staff members use the IT systems to carry out their day to day work.

**Table 2 - Frequency table for usage of additional excel sheets**

Description	Frequency
Use additional excel sheets	38
Do not use additional excel sheets	06

This result indicates that 38 staff members use additional excel sheets to carry out their operations. Reasons for use of additional excel sheets were shown below.

**Table 3 - Frequency table for reasons for usage of additional excel sheets**

According to these results, most of the staff members (45.8%) use additional excel sheets to list out details and 41.7% use excel sheets for their convenience. 27.1% and 22.9% of the staff members use excel sheet for easy findings and for calculations respectively.

Reason	Number of Staff members	Percentage
compare details	09	18.8
convenience	20	41.7
get data in different systems in to one location	09	18.8
share details	06	12.5
easy findings	13	27.1
list out data	22	45.8
keep letter formats	09	18.8

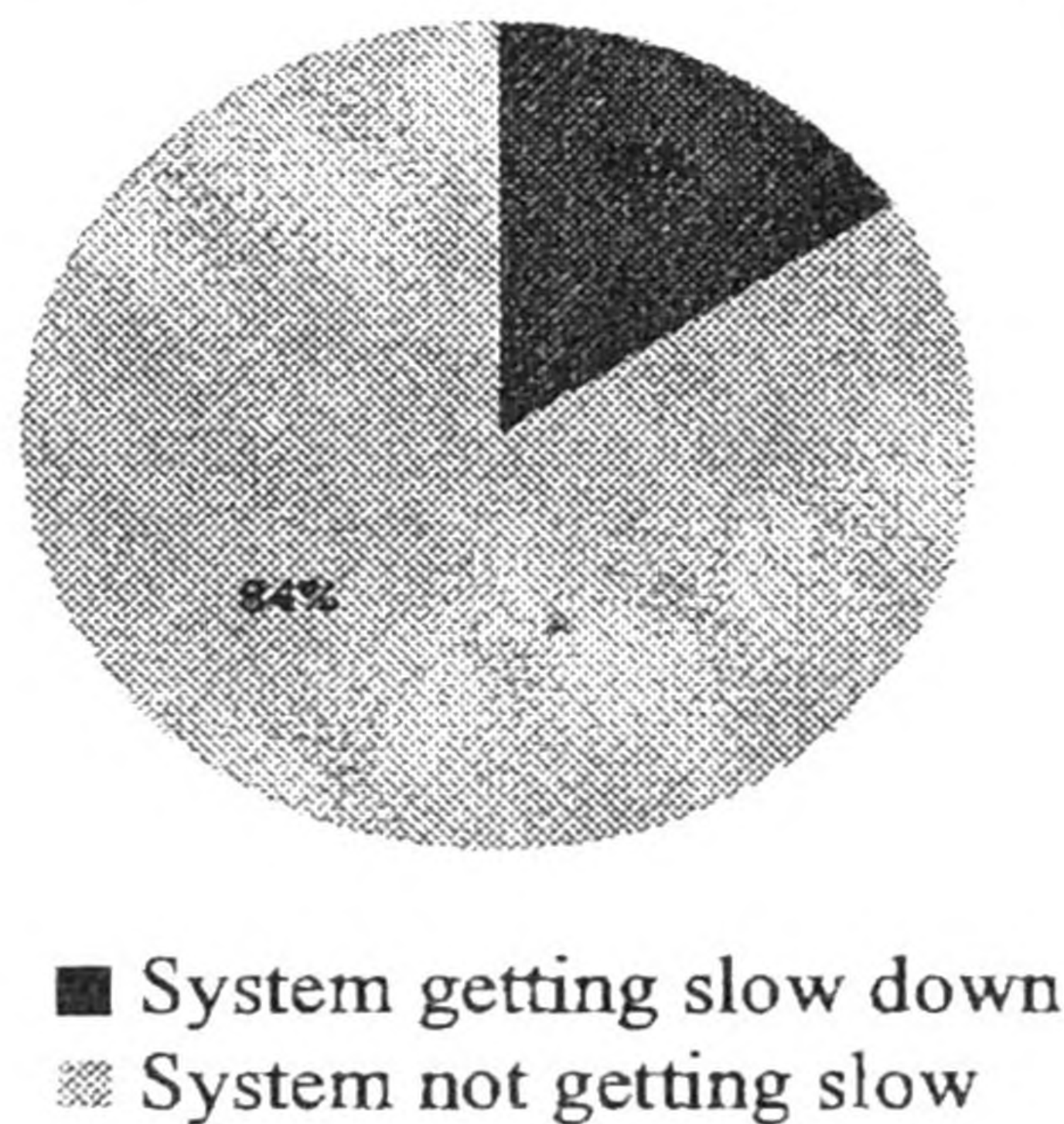


INFORMATION TECHNOLOGY INFRASTRUCTURE RELATED ISSUES THAT AFFECT THE EFFICIENCY OF OPERATION IN A SHIPPING COMPANY

principle standers	01	02.1
calculation	11	22.9
prepare reports	07	14.6

By considering the information gathered by interviews, most of staff members list details on excel sheets as an aid for providing information to customers when they ask for any. To provide that information, most of the times they need to refer to more than one system. It is time consuming and staff members provide this information while they do their work. So by taking that information in to a single excel sheet staff members could reply customers quickly. But it takes some time to create and update the excel sheets. So the root cause for this problem is there is no way for customers to know information they need other than asking from one of the staff members of the organization.

**Figure 1 - Pie chart for system slowness**



The above graph shows the staff member's responses regarding computer network infrastructure. According to these results, 84% of the staff members stated that the systems get slow down while they work with IT systems.

**Table 4 - Frequency table for system slowness**

Description	Frequency	Percentage
Regularly	10	26.3
Rarely	21	55.3
Very rarely	07	18.4

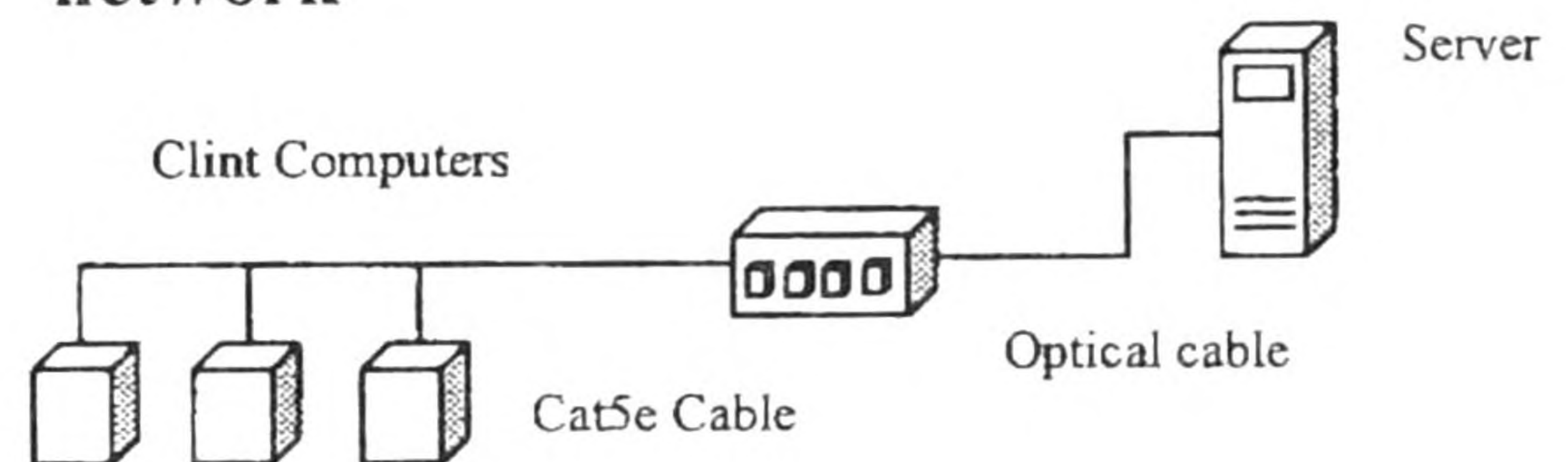
According to these results 26.3% of the staff members stated that the systems are getting slow regularly, 55.3% stated rarely and 18.4% stated very rarely.

**Table 5 - Details about network system**

Network type	Virtual local area network (VLAN)
Number of server computers	05
Number of client computers	48
Network cables types	
From server to router	Optical cable
From router to client computers	Cat5e Cables
Network cards on client computers	100 Mbps

When considering the network system, 84% of the staff members stated that systems become slow down while using. 26.3% of them stated that systems getting slow down regularly. 55.3% stated that it happens rarely. The systems host on five server computers. Those servers connect to a switch through a fiber optic cable. 48 client computers are connecting to the switch by cat5e cables. Most of the systems are not hosted in local servers. They are globally used systems which are hosted in foreign countries. Only the shipping system is hosted in local server. Following figure shows basic design of the computer network.

**Figure 2 - Basic design of the computer network**



Since the organization uses some international systems, the reason for slowness may be a slowness of those systems. But these international systems are maintained well and when the network is getting slow down, it affects to both international system and local system. According to that finding, it can be concluded that the reason for network



slowness is due to a problem in the local network. So the cause will be with the server computers or with the network cabling. But the IT department verified that the servers and the router are performing properly. When considering the network cabling, servers connect to a switch through a fiber optic cable. 48 client computers are connecting to the switch by cat5e cables. The optical cable transmits data in gigabit speed. But the cat5e cables transmit data in 100 Mbps. This might be a bottleneck for the slowness. Hence whole network functions in 100 Mbps speed. So the cause for this problem is with the network cabling.

**LIST OF ALTERNATIVE SOLUTIONS**

As a solution to reduce usage of excel sheets, the existing systems can be developed to provide all the details in one system, so that staff members can find all details in one system. The best way is to develop an enterprise resource planning system by combining all the systems. So all the details will be available on a single system. But most of the systems used by staff members are provided by the principle company. These systems are used in more than hundred countries. So developing this type of system needs huge amount of work and the cost will be very high.

Another solution is to develop a new system where customers can search information without connecting with a staff member. This is an achievable solution since there are many ways available to achieve that objective. The best way to provide information to customers is through a web site. By developing a web site, company can make available information to customers very easily and effectively.

The solution to reduce network slowness is to replace the network cables with higher performance cables. The problem is the low bandwidth of cat5e cables. So there are many cables available to replace the cat5e cables which give higher

performance than cat5e cable. They are cat6 cables, cat7 cables, shielded twisted pair cables and fiber optic cables.

**Table 6. Specifications for different types of cables**

Category	Type	Spectral B/W (MHz)	Length (m)
Cat3	UTP	16	100
Cat4	UTP	20	100
Cat5	UTP	100	100
Cat5e	UTP	100	100
Cat6	UTP	200	100
Cat7	UTP	600	100

The general difference between category 5e and category 6 is in the transmission performance, and extension of the available bandwidth from 100 MHz for category 5e to 200 MHz for category 6. This includes better insertion loss, near end crosstalk (NEXT), return loss, and equal level far end crosstalk (ELFEXT). These improvements provide a higher signal-to-noise ratio, allowing higher reliability for current applications and higher data rates for future applications.

The category 6 link and channel requirements are backward compatible to category 5e makes it very easy for customers to choose category 6 and supersede category 5e in their networks. Applications that worked over category 5e will work over category 6.

Because of improved transmission performance and superior immunity from external noise, systems operating over category 6 cabling will have fewer errors vs. category 5e for current applications. This means fewer re-transmissions of lost or corrupted data packets under certain conditions, which translates into higher reliability for category 6 networks compared to category 5e networks ([www.techotopia.com](http://www.techotopia.com)).

All these cables had a gigabit bandwidth and cat6 is the cheapest cable. The maintenance cost of cat6 cables is lower than other cables. Also this cable works with most of existing equipments. Only the

switch needs to replace. So the best feasible solution will be replacing the existing cat5 cables with cat6 cables.

## CONCLUSION

When carrying out shipping operations, it is critical to capture accurate and timely data in operations because the business heavily depends on accuracy and time.

Currently the company at where this study was done gets the help of IT to carry out their operations in each department. Nearly 90% of the staff uses these information systems to carry out their work. But there exists some IT infrastructure related issues.

Nearly 86% of staff members use additional excel sheets to carry out their activities. They list details on excel sheets as an aid for provide information to customers. Also they face difficulties in the network infrastructure such as slowness. So the best feasible solution to provide information to customers and reduce use of excel sheets by developing a web site for the organization.

When considering the network system, most of the staff members stated that systems get slow down while using. There are five server computers and 48 client computers in the network. Most of the systems are not hosted in local servers; they are globally used systems which are hosted in foreign countries. Only the shipping system is hosted in the local server. There are several reasons for network slowness. One main problem is using slower bandwidth cables to connect client computers. The solution for this will be replacing the existing caballing with a higher bandwidth cable. So the best feasible solution will be replacing the existing cat5e cables with cat6 cables as the latter type is also cheap in price.

## REFERENCES

### INTERNET CITATIONS

Captain Piere Deseck, (2008) "Maritime knowhow" School of Navigation  
(Retrieved October 20, 2009)

Gane Gander (2009) "How optimizing your IT infrastructure can improve the efficiency of global freight forwarding" Killer publishing, LLC, May 07, 2009,  
(Retrieved October 17, 2009)

Hapag-lloyd.com, "Overview of the Hapag-Lloyd" online available at  
[http://www.hapag-lloyd.com/en/about\\_us/overview.html](http://www.hapag-lloyd.com/en/about_us/overview.html)  
(Retrieved August 2009)

Hopkins, Jeffrey W, Morehart and Mitchell, 2003, "Firm efficiency and information technology use: evidence from U.S. cash grain farms"  
(Retrieved September 04, 2009)

Anandhi S. Bharadwaj, Sundar G. Bharadwaj and Benn R. Konsynski, "Information technology effects on firm performance as measured by Tobin's q" *Inform*s  
(Retrieved October 18, 2009)

Techotopia.com "Network cable types and specifications" online available at  
[http://www.techotopia.com/index.php/network\\_cable\\_types\\_and\\_specifications](http://www.techotopia.com/index.php/network_cable_types_and_specifications)  
(Retrieved August 18, 2009)