



INFORMATION SYSTEMS AND OPERATIONAL EFFICIENCY OF MARITIME FIRMS IN PORT HARCOURT

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Cite this article:

Chukwudi I. C., Ebeye N. M., Blessing R. A. (2024), Information Systems and Operational Efficiency of Maritime Firms in Port Harcourt. British Journal of Computer, Networking and Information Technology 7(2), 1-13. DOI: 10.52589/BJCNIT-MZBTS2ND

Manuscript History

Received: 20 Jan 2024

Accepted: 23 Apr 2024

Published: 17 May 2024

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ABSTRACT: *The study examined the relationship between information systems and operational efficiency of maritime firms' in Port Harcourt, Rivers State. Three research questions and three research hypotheses were formulated to address the specific objectives of this study. The RBV theory was adopted in this study and also quantitative research design using a correlational method of investigation. The population consists of 16 maritime firms in Port Harcourt. Census sampling was applied with focus on managers. Four managers per firm were sampled; a total of 64 managers were sampled. The reliability of the instrument was determined using Cronbach alpha test and it stood at 0.88 higher than the benchmark of 0.7. The data collected for this study were analyzed through descriptive and inferential statistics. The Spearman Rank-Order Correlation Technique was employed to test the various hypotheses formulated. The result of the analysis revealed that the information system is significantly and positively related to the operational efficiency of maritime firms' in Port Harcourt, Rivers State. The empirical results of this study confirmed this as a positive and significant relationship was found between processing transaction systems and operational efficiency of maritime firms, and between electronic data interchange and operational efficiency of maritime firms. Based on these findings, it was concluded that the information system with its dimension of processing transaction system and electronic data interchange will improve operational efficiency of maritime firms in Port Harcourt. This study recommends that maritime firms should leverage on information systems as this would ensure reduction in cost and improve operational efficiency; they should use processing transaction system in order to facilitate the recording, tracking, and management of business transactions within the organization and the port, and they should adopt electronic data interchange for processing of documents and timely delivery of same.*

KEYWORDS: Information System, Processing Transaction System, Electronic Data Interchange and Operational Efficiency.



INTRODUCTION

It appears that globalization has impelled enormous demands for marine transportation as most exports and imports are done through sea routes. This has demonstrated the importance of maritime in the socioeconomic development of every nation as an epicenter of the growth of every sector across the globe. Maritime has a connotation with the world's oceans that belong to all and sundry as necessary life supports ecosystems that perform higher than 90% in terms of volume and 70% by global trade value (Rodrigue, 2020). Maritime is regarded as the most effective way of conveying raw materials and finished goods around the world because 80% of the items involved in international trade are basically transported via sea routes (Sarkar & Shankar, 2021). However, for maritime firms to be efficient in their operations, they must adopt information systems.

Information system is a collection of people, procedures, and resources that collect information, transform it and distribute it within an organization (Soukaina, 2020). Information systems collect, supply, arrange, and use information to ensure the efficiency and effectiveness of an organisation's operations (Pierson & Harner, 2006). According to Nowduri (2011), information systems enable management to quickly make decisions about different issues in the organisation. These information systems have become important in logistics service and entail a significant tool to reduce costs and effectively serve clients through better customisation of the service provided. The basic purpose of any information system is to help its users obtain a certain type of value from the information in the systems, regardless of the types of information stored or desired value type. The integration of information systems in logistics has contributed to competitive supply chains that accord certain companies competitive edges in the market, with new methods implemented to prevent any inherent danger and loss of life (Weiss, 2011).

The literature reviewed shows that there are no thorough studies on information systems and operational efficiency of maritime firms' has been performed. In fact, the literature has exhibited little concern about the direct impact of information systems on operational efficiency of maritime firms. Previous studies concentrated mainly on the influence of information systems usage on organisations in general without paying attention to maritime firms in Port Harcourt. Therefore, this study examines the relationship between information systems and operational efficiency of maritime firms' in Port Harcourt, Rivers State.

Statement of the Problem

The current port situation has been profoundly affected by the increase in the volume of commercial traffic. This has resulted in high operational cost orchestrated by the use of manual clearing systems. Most operational activities of maritime firms are being carried out via the physical presence of the individuals involved.

Interestingly, despite the attempts made by some developed nations to revolutionize their maritime industry through digitalization, it looks like the Nigerian maritime sector has not done enough to fully integrate its system with the necessary automation whereby information could be readily available not only to the operators but also to other stakeholders. In a situation whereby most operational activities of maritime are being carried out via the physical presence of the individuals involved, and office transactions like memos are majorly done by signing on hardcopies, it seems such a system is yet to move away from analog to



digital. In the opinion of Fruth and Teuteberg (2017), maritime use of information systems is still in its preliminary stage. Scholars have emphasized that the application of information systems in ports will facilitate process management and flow control, which in turn will minimize data entry and congestion reduction. It is on this premise that this study of the information system and operational efficiency of maritime firms in Port Harcourt was carried out.

Aim and Objectives of the Study

The aim of the study was to examine the relationship between information systems and operational efficiency of maritime firms in Port Harcourt, Rivers State. Specifically, it intends to:

- i. investigate the relationship between information system and operational efficiency of maritime firms' in Port Harcourt, Rivers State.
- ii. evaluate the relationship between processing transaction system and operational efficiency of maritime firms' in Port Harcourt, Rivers State.
- iii. examine the relationship between electronic data interchange and operational efficiency of maritime firms' in Port Harcourt, Rivers State.

Research Questions

To address the objectives of the study, the following research questions were formulated and answered:

- i. What is the relationship between information system and operational efficiency of maritime firms' in Port Harcourt, Rivers State?
- ii. What is the relationship between processing transaction system and operational efficiency of maritime firms' in Port Harcourt, Rivers State?
- iii. What is the relationship between electronic data interchange and operational efficiency of maritime firms' in Port Harcourt, Rivers State?

Research Hypotheses

The following research hypotheses were formulated and tested:

H₀₁: There is no significant relationship between information system and operational efficiency of maritime firms' in Port Harcourt, Rivers State.

H₀₂: There is no significant relationship between processing transaction system and operational efficiency of maritime firms' in Port Harcourt, Rivers State.

H₀₃: There is no significant relationship between electronic data interchange and operational efficiency of maritime firms' in Port Harcourt, Rivers State.



LITERATURE REVIEW

Theoretical Review

This study was anchored on Resource-Based Theory.

The resource-based theory is rooted in strategic management literature and has been applied in management studies to expound and demonstrate the resources of an organisation that have the capability to engender performance and sustain competitive advantage (Barney et al., 2021). The assumption of resource-based theory is that the internal resources of an organization determine the level at which such establishment (be it private or public) can achieve competitiveness in a business arena (Schauerte et al., 2021; Sheehan & Foss, 2007). In effect, a firm's internal resources serve as the major determinant of the effectiveness of its strategy, decision making and organisational outcomes (Ghasemaghahi et al., 2018; Grant, 1991). In the classification of internal resources of a firm by Grant (1991), they are categorized as all assets like capabilities, digital transformation, processes, structures, strategies, information, skills, and technical know-how to achieve rare results.

Resource based theory has done much in revealing to the enterprises the competitive position that best exploits their internal resources and capabilities relative to external opportunities (Barney et al., 2021), but the main criticism of resource-based theory is that it has managerial implications and is limited in applicability (Foss, 1998; Hitt et al., 2016; Nothnagel, 2008). However, the assumption of this theory could be relevant in this study as the managers and leaders in the maritime sector are expected to see modern digital technologies as transformational and innovative substances to deliver exceptional services to the end users. Similarly, the theory is relevant in this study because of its emphasis on considering employees as important resources of organisations by ensuring effective communication, training, and motivation for them to achieve better results with the use of digital technologies.

Concept of Information systems

Information system is rooted in informatics; informatics takes an all-inclusive view to change human practices, generally for the better by applying digital technology to allow individuals to collect, process, and dole out information (Beyene, 2018; Schulman et al., 2021). However, from an organisational viewpoint, informatics seeks to enable decision-making via information systems (Lind et al., 2021; Gillingham, 2018). Reix (2016) defined information system as a collection of people, procedures, and resources that collect information, transform it and distribute it within an organization. This is the association of human, material and software resources intended to collect, formalize, archive, browse, associate and disseminate information in this same organisation.

Information technologies play a necessary supporting role in the establishment and deployment of information systems. Information and Communications Technology (ICT) is the main catalyst for internal and external integration. According to Sweeny and Evangelista (2005), the different types of ICT allow a level of internal integration (port community) and external as well as the integration of processes inside and outside the seaport. A good number of scholars and managers in the maritime industry acknowledge that the marine transportation sector stands to benefit from a particular field of study and application owing to the rising levels of digitalization taking place in the maritime space (Del Giudice et al., 2022; Yang, 2019).



Dimensions of Information Systems

Electronic Data Interchange

Electronic data interchange (EDI) is a technique that replaces the physical exchange of documents between companies (orders, invoices, delivery notes) by exchanges, in a standardized format, between computers connected by specialized links or through a (private) value-added network (Schulman et al., 2021).

The data is structured according to international technical standards of reference. For example, the sending by fax of an order and its input by an operator of the supplier company is replaced by the transmission of information that is routed to a computer of the supplier to interpret the command. The use of EDI can bring significant benefits in terms of the organization, such as faster data exchange, the reduction of communication costs, management of logistics processes, and reduction of delivery times, which improves the efficiency of the supply chain (Gillingham, 2018).

Processing Transaction Systems

Processing transaction systems (PTS) refers to computer systems and software that facilitate the recording, tracking, and management of business transactions within an organization. Barry and Arthur (2002) submitted that processing transaction systems capture, process, and store the detailed data necessary to update records about the fundamental business operations of an organization. To Ralph and Reynolds (2017), transaction processing systems (TPS) are the basic business systems that serve the operational level of the organization. Stair and Reynolds position Transaction Processing Systems as fundamental business systems operating at the operational level of an organization. Furthermore, Kenneth and Jane (2016) defined transaction processing systems (TPS) as information systems that process data resulting from the occurrence of business transactions.

Concept of Operational Efficiency

Operational efficiency is seen as the few methods and techniques used to achieve the essential goal of conveying quality products and services to clients within the most cost-effective and opportune way (Neil, 2019). Additionally, Brady and Allen (2006) stated that operational efficiency is "the continuous improvement of processes, systems, and activities to maximize productivity and minimize waste, resulting in enhanced performance and value for the organization." It involves optimizing resources, including labor, capital, technology, and time, to achieve desired outcomes without waste. Sathye (2005) opined that operational efficiency is the effective and judicious use of people, required machinery or equipment, proper tools, expected materials, and funds for the achievement of organizational goals and objectives. Better use of any one of these, or a combination of them, can boost output and lower costs for goods and services. Kim and Kim (1997), cited by Mboma (2006), posted that operational efficiency is the strategic planning done by a company to ensure a favourable ratio of costs to output. It deals with reducing waste and optimizing resources to offer clients better services. The ability of a firm to offer goods or services promptly to its esteemed customers in the most economical way feasible while maintaining the high quality of its goods, services, and support is known as operational efficiency.



Information Systems and Operational efficiency

Christopher (2005) studied and found that logistics performance increases when the members of the supply chain collaborate using Internet tools. Moreover, the study showed that poor information systems resource management has repercussions for the performance of the entire supply chain, leading to increased management costs. Olugbode et al. (2008) conducted a case study that investigated the impact of the adoption of new information systems on the old model of company operation. Observation and interviews were used to collect the requisite data. The study revealed that the adoption of new information systems has led to different achievements in the company. The achievement appeared in company operational practices and business systems, which have reduced company operating costs. Almost all other studies found the same outcome (Mithas & Rust 2016; Carr 2016; Popa et al., 2016; Shahriari et al., 2016).

Empirical Review

James and Ulingeta (2018) investigated the role of information systems usage in enhancing port

logistics performance using the port of Dar es Salaam, Tanzania. Specifically, the study examined the role of information systems usage in contributing to reducing shipping and trucking costs, improving on-time delivery of goods and services, increasing trade volume, and enhancing organisational logistics capability. The study employed a quantitative approach, with questionnaires deployed to gather data about information systems usage and the attendant effects. The reliability was measured using Cronbach's alpha. A canonical correlation analysis was performed to estimate the relationship of information systems usage to the port logistics performance. The study established that relationships exist between information systems usage and the perceived decrease in shipping and trucking costs, timely delivery of goods and services, perceived increase in trade volume, and enhanced organisational logistics capability.

Regan and Golob (2000) assessed the tracking industry perceptions of congestion problems and potential solutions in maritime intermodal operations. In all, 450 companies were surveyed. The study revealed that information systems hint at a particular promise of reducing delays inside and outside the ports; however, the negative effect on trade is high due to congestion. The findings imply that congestion affects trading activities whereas the adoption of information systems may reduce or alleviate the problem.

Adewoye et al. (2011) investigated the role of investment in information systems on service delivery. The study observed that there is a close link between information systems usage and services delivery. The findings show that the adoption of information systems at a university allows different activities, such as examination processing, student registration and assignment provision, to be performed on time.

Obiri-Yeboah et al. (2013) assessed the types of technological facilities used by bank customers and the challenges they faced. The results showed that the knowledge customers had about the services affected the number of times they used the service and the number of times they visited bank branches. The study findings imply information systems have great contributions to service delivery on a timely basis; however, the customers' knowledge about the technology also influenced the level to which customers used the technology.



Idris et al. (2013) conducted a study that investigated the roles of information systems usage in customer service delivery and firms' performance. The survey research design was applied to 25 firms. The study found that most of the customers rarely used online services in their engagement with firms. This study recommends that firm administrators should seek appropriate means of providing online services that parallel the customers' ability to apply the technology. The study's findings imply that the usefulness of information systems to an organisation depends significantly on how the user and recipient of the services interact when using such a system.

METHODOLOGY

The study adopted quantitative research design using a correlational method of investigation. The population consists of 16 maritime firms in Port Harcourt obtained from <https://www.finelib.com/cities/port-harcourt/transportation/shipping-companies>. The study adopted census sampling and studied the entire 16 firms with focus on managers. Four managers per firm were sampled; a total of 64 managers were sampled. The reliability of the instrument was determined using Cronbach alpha test with the aid of Statistical Package for Social Sciences (SPSS) version 23 and it stood at 0.88, higher than the benchmark of 0.7. The data collected for this study were analyzed through descriptive and inferential statistics. The Spearman Rank-Order Correlation Technique was employed to test the various hypotheses formulated through the aid of Statistical Package for Social Sciences (SPSS) version 23.0.

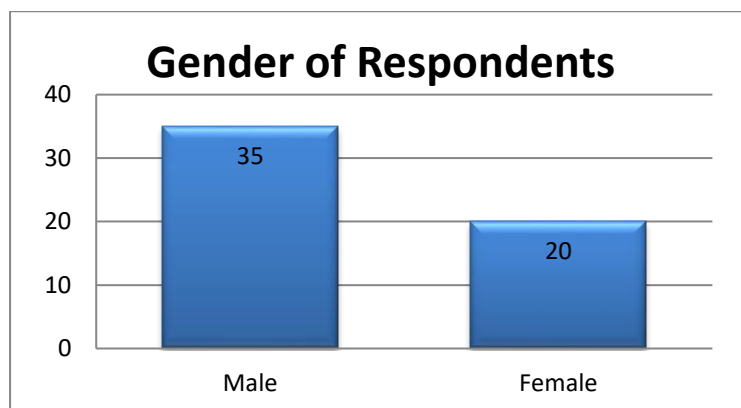
Data Presentation and Analysis

Demographic Analysis

Quest. Issued	Quest. Retrieved	Useful
64	60	55

Source: *Survey Data, 2024.*

The table above shows the questionnaire distribution and retrieval. The researcher issued 64 copies of the questionnaire and retrieved 60; 55 were useful and 5 were not useful. This represents an 80% response rate and it was considered significant for the study.



Source: Survey Data (2024)

The above chart shows the gender of respondents as a means of ensuring that both males and females are represented in the study: 35 (64%) of the respondents are males and 20 (36%) are females. This shows that the majority of the respondents are males.

Bivariate Analysis

Here, efforts were made to test the hypotheses formulated for this study.

Test of Hypothesis One (1)

H₀₁: There is no significant relationship between information system and operational efficiency of maritime firms in Port Harcourt, Rivers State.

Correlations

		information system	operational efficiency
Information system	Correlation Coefficient	1.000	.778*
	Sig. (2-tailed)	.	.023
	N	16	16
Operational efficiency	Correlation Coefficient	.778*	1.000
	Sig. (2-tailed)	.023	.
	N	16	16

*. Correlation is significant at the 0.05 level (2-tailed).

Source: SPSS Output (2024).

The table above presents the result of correlation analysis between information system and operational efficiency of maritime firms' in Port Harcourt, Rivers State. The result indicates that there is a strong correlation between information system and operational efficiency ($\rho = .778^*$) and this correlation is significant at 0.05 level as indicated by the symbol *. Based on this result, the null hypothesis (H_{01}) is rejected and the alternate hypothesis is accepted. This means that there is a significant relationship between information system and operational efficiency of maritime firms in Port Harcourt, Rivers State.



Test of Hypothesis Two (2)

H₀₂: There is no significant relationship between processing transaction system and operational efficiency of maritime firms in Port Harcourt, Rivers State.

Correlations

			processing transaction system	operational efficiency
Spearman's rho	Processing transaction system	Correlation Coefficient	1.000	.799*
		Sig. (2-tailed)	.	.023
		N	55	55
	Operational efficiency	Correlation Coefficient	.799*	1.000
		Sig. (2-tailed)	.023	.
		N	55	55

*. Correlation is significant at the 0.05 level (2-tailed).

Source: SPSS Output (2024).

The table above presents the result of correlation analysis between processing transaction system and operational efficiency of maritime firms' in Port Harcourt, Rivers State. The result indicates that there is a strong correlation between processing transaction system and operational efficiency ($\rho = .799^*$) and this correlation is significant at 0.05 level, as indicated by the symbol *. Based on this result, the null hypothesis (H_{02}) is rejected and the alternate hypothesis is accepted. This means that there is a significant relationship between processing transaction system and operational efficiency of maritime firms in Port Harcourt, Rivers State.

Test of Hypothesis Three (3)

H₀₃: There is no significant relationship between electronic data interchange and operational efficiency of maritime firms in Port Harcourt, Rivers State.

Correlations

			electronic data interchange	operational efficiency
Spearman's rho	Electronic data interchange	Correlation Coefficient	1.000	.801*
		Sig. (2-tailed)	.	.023
		N	55	55
	Operational efficiency	Correlation Coefficient	.801*	1.000
		Sig. (2-tailed)	.025	.
		N	55	55

Source: SPSS Output (2024)



The table above presents the result of correlation analysis between electronic data interchange and operational efficiency of Maritime firms' in Port Harcourt, Rivers State. The result indicates that there is a strong correlation between electronic data interchange and operational efficiency ($\rho = .801^*$) and this correlation is significant at 0.05 level as indicated by the symbol *. Based on this result, the null hypothesis (H_{03}) is rejected and the alternate hypothesis is accepted. This means that there is a significant relationship between electronic data interchange and operational efficiency of maritime firms' in Port Harcourt, Rivers State.

SUMMARY OF FINDINGS

- i. There is a significant relationship between information system and operational efficiency of maritime firms' in Port Harcourt, Rivers State.
- ii. There is a significant relationship between processing transaction system and operational efficiency of maritime firms' in Port Harcourt, Rivers State.
- iii. There is a significant relationship between electronic data interchange and operational efficiency of maritime firms' in Port Harcourt, Rivers State.

DISCUSSION OF FINDINGS

The analysis of the study revealed that there is a strong and significant relationship between information system and operational efficiency of maritime firms in Port Harcourt, Rivers State. This finding is supported by the study of Olugbode et al. (2008) who conducted a case study that investigated the impact of the adoption of new information systems on the old model of company operation. Observation and interviews were used to collect the requisite data. The study revealed that the adoption of new information systems has led to different achievements in the company. The achievement appeared in company operational practices and business systems, which have reduced company operating costs.

Also, the analysis of the study revealed that there is a significant relationship between processing transaction system and operational efficiency of maritime firms in Port Harcourt, Rivers State. This finding is supported by the study of Obiri-Yeboah et al. (2013) who assessed the types of technological facilities used by bank customers and the challenges they faced. The results showed that the knowledge customers had about the services affected the number of times they used the service and the number of times they visited bank branches. The study findings imply that information systems have great contributions to service delivery on a timely basis.

Again, the analysis of the study revealed that there is a significant relationship between electronic data interchange and operational efficiency of maritime firms in Port Harcourt, Rivers State. This finding is supported by the study of Regan and Golob (2000) who assessed the tracking industry perceptions of congestion problems and potential solutions in maritime intermodal operations. In all, 450 companies were surveyed. The study revealed that information systems hint at a particular promise of reducing delays inside and outside the ports; however, the negative effect on trade is high due to congestion. The findings imply that



congestion affects trading activities, whereas the adoption of information systems may reduce or alleviate the problem.

CONCLUSION

From the foregoing analysis, it is evident that information system is significantly and positively related to operational efficiency of maritime firms' in Port Harcourt, Rivers State. The empirical results of this study confirmed this as a positive and significant relationship was found between processing transaction system and operational efficiency of maritime firms, and between electronic data interchange and operational efficiency of maritime firms. Based on these findings, it was concluded that information system with its dimension of processing transaction system and electronic data interchange will improve operational efficiency of maritime firms in Port Harcourt on the basis of the results obtained from the analysis.

RECOMMENDATIONS

In line with the objectives of the study, the study recommends the following:

- i. Maritime firms should leverage on information systems as this would ensure reduction in cost and improve operational efficiency.
- ii. Again, maritime firms should use processing transaction system in order to facilitate the recording, tracking, and management of business transactions within the organization and the port.
- iii. Also, maritime firms should adopt electronic data interchange for processing of documents and timely delivery of same. This would reduce operational cost and improve efficiency.

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