

Critical Implementation Factors for Cloud-Based Enterprise Resource Planning in the Nigerian Maritime Logistics Chain

Kuranga Akeem Sulaiman¹, Maslin Masrom², Nurazean Maarop³

Abstract— Recent research and practice have shown that cloud-based ERP systems if implemented correctly can be beneficial to the maritime logistics and supply chain process. It allows the entire Maritime Industry to share and analyze data across all divisions and help with the improvement of inefficient operations and processes in a large supply chain. Although a successful implementation comes with some challenges but the benefits are too strong to dispute. This study examined the critical success factor for the implementation of a Cloud-based Enterprise Resource Planning (CERP) in the Nigerian Maritime industry through a comprehensive review of the literature and a methodology involving interviews with managers and top executives in the Nigerian Maritime industry to extract their views. Empirical data were collected from 130 participants including top management and users involved in the Maritime industry through a survey questionnaire. The results of the survey and studies conducted established that the implementation is low in the industry also it was established that top management is committed to the implementation

Keywords—Cloud-based Enterprise Resource Planning, Maritime Logistics Chain, Nigeria Maritime Industry

I. Introduction

The Nigerian maritime industry covers all the maritime activities which take place within the country's maritime environment including underwater resources, on-shore economic activities, port activities, maritime transport (shipping), ship construction, repairs, and maintenance activities with a logistic chain that is responsible for the movement of about 90% of the country merchandise goods and cargoes of all types and volumes [1, 2]. The industry could not be said to be alone, the Nigerian Maritime industry is said to be dominated by major players such as the Nigerian Maritime Administration and Safety Agency (NIMASA), Nigerian Ports Authority (NPA), Nigerian Ship-owners Association (NSA), the Nigerian Shippers Council (NSC), Ministry of Trade and Transportation, operators, financial institution and private investors [3]. It is also important to put that the maritime sector is an integral aspect of the Nigerian economy with just the transport sector contributing about 10% of Nigeria's GDP, [4].

However, the industry has been confronted with series of challenges such as security, rising cost of doing business,

inadequate manpower, and limited maritime experts resulting in stunted growth, and loss of revenue [3]. According to [5], current challenges facing the Maritime industry include piracy, declined infrastructures, human resources, and inadequate manpower development, [1] noted that the industry is currently confronted with inadequate and inefficient maritime logistics systems and technology infrastructural support. Also, challenges that could not be underestimated facing the industries include Training and Manpower Capacity Development, ICT Deployment, data and Information management, and paucity of funds [6].

A report by the African Development Bank (AfDB) has advocated a full digitalization in the industry, According to [7], meeting up to this requirement require technological and infrastructure which require adequate funding which is considered other challenges facing the industry. Meanwhile, the maritime logistics chain operate with a growing amount of data consuming manpower as the transportation and logistics industry continues to grow, hence the need for a faster, smarter, and organized technological manpower to enhance productivity, [8]. The transportation and logistics sector is under constant pressure to remain competitive to deliver amidst global competition. As observed in the background, technological change is seen as the strongest determinant for maritime reforms. Although the demand to provide effective and efficient connectivity within the maritime logistics chain require a constant approach to the dynamics of technology which is now a common global agenda [9]

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Often the Nigerian maritime logistics chain shares information across many platforms to different departments. In modern logistics industries, data sharing across the supply chain has been enabled with cloud base enterprise resources planning system to give higher levels of transparency and providing consumers with better decisions about the products they buy and creating a layer of trust between the brand and consumer [10]. The maritime transport is the backbone of trade in the Nigerian Maritime Industry, the implementation of a Cloud-based ERP in the marine information system will enhance value chain competitiveness. Although limited studies have been conducted in this regard, some studies conducted only emphasize the potential of the maritime logistics chain in enhancing Nigeria's economic growth, most of them are looking towards macroeconomic policy and economic viability[4].

According to Cloud-based ERP provides many opportunities and value-enhancing capabilities for supply chain logistics organizations. A simplified logistics chain require communications infrastructure to achieve collaboration between actors including shipping agents, forwarder, customers, consignee, port authorities, inland carrier, and including seafarer [11]

[12] argued that **Cloud-based ERP** will help to provide real-time data, and access to the entire organization, regardless of location or time, including warehouse management systems, and transportation management systems. It can change the local shipping business radically, opening ways for many opportunities in the shipping industry. Although the impact of technology-based like this has been under-researched in the Nigerian context [13] making it look as if digitalization has less been seen as a strategic management tool that could help position the industry for growth in the competitive market place.

This study attempts to make a step toward addressing this significant knowledge gaps by investigating the critical success factors influencing the implementation of Cloud-based ERP in the maritime logistics chain of the Nigerian Maritime Industry. In this study, we address the following research questions (RQ).

RQ1. What is the current level of research and digitization in the Nigerian Maritime Industry and its logistics chain management?

RQ2. What are the Critical Success Factor influencing the implementation of Cloud-based ERP (CERP) in the Nigerian maritime Sector?

II. Methodology

To answer these research questions, a comprehensive literature review and empirical study were conducted. The literature review assists the study to map and evaluate the relevant and existing literature that have provided insights into the Nigerian Maritime sectors as well as where critical success factor have been considered in the planning process of CERP

technology. Also, a methodology involving interviews with managers and users in the Nigerian Maritime Industry was conducted to extract their views and critical success factor that could aid in the actual implementation of a CERP using theme-based Quantitative data. Based on the information obtained from the survey, the findings were compared with some widely mentioned CSF for implementing technologies in logistics management and supply chain.

III. Literature Review

Enterprise resource planning (ERP) systems are complex information management systems that could place huge demands on corporate time and organizational resources, however, it provides benefits like unified enterprise view of the business functions, and procedures including coordinating all interdepartmental activities to increase communication and responsiveness to all stakeholders in automated ways [14, 15]. Previous studies have ascertained that ERP the system improves organizational operational efficiency and enhances competitiveness in manufacturing, shipping, and logistics firms. It helps to simplify logistics and human resources management issues [16].

Enterprise resource planning (ERP) systems are suites of the application consisting of different integrated software modules that could help organizations with a unified view of the business process and aid in the management of an organization's resources in an automated way [17]. The focus of ERP in the 1960s was on manufacturing systems and inventory control. ERP originated from Material Requirement Planning (MRP) and Manufacturing Resources Planning (MRP) that was used in the olden days in production and planning schedule. It helps to support the business functional areas like finance, logistics. With costume software packages designed to handle quantitative inventories, [18].

In most of the world, logistics companies have taken the affordability advantages of information technology and commercial software packages to supports large business units like the maritime industry, supply chain management, manufacturing industries, sales, accounting and finance, human resources management [18]. Enterprise resource planning ERP is a solution-oriented suite that is designed to manage a large organization's resources in an integrated way, [14]. According to [16] ERP has encouraged linkages and seamless business integration processes with many organizations that perform similar functions, fostering business to business communication, interdepartmental communication using electronic web interchange. Although an ERP system comprises of a bunch of software package tailored to assist in doing business. Research has indicated that ERP can be tailored to any organization to ease the ways of doing business in engineering, construction, and logistics firms[19].

Popular ERP applications in the logistic information system include SAP R/3 which has been used in related industries to effect changes in IT systems and business processes [20]. Extant studies have demonstrated that ERP could aid in a drastic reduction of manpower, it can reduce work overload and assist in coordinating huge logistics information. Among the most important attributes of ERP in logistics and transportation sectors is its ability to enhance system automation and integrate business processes across organizational functions and locations. Information could be shared and accessed in a real-time environment to facilitate rapid and better decisions and cost reductions[21, 22]. Thus, successful deployment and use of ERP systems in maritime transport are critical to organizational performance and survival.

In [23] enhancing logistics with ERP systems has revealed that logistics practices have a positive effect on industry performance and competitive advantage. The impact of ERP was felt on supply chain and aid information flowing across all the departments in the maritime sector. According to [23], the ERP system is an important tool in maritime transport and other business processes unit, including the finance, materials, and manufacturing. Effective implementation and integration of the ERP system in maritime transport provide greater planning, decision-making, and project execution, it equally increases the performance of the industry.

The ERP system has been used to elevate transport problems in [24] to support strategic management and decision making in the transport-Shipping and Logistics companies. Since the global industry is increasingly turning to enterprise resource planning (ERP) systems with a complete collaborative model that could enhance smooth business practices and procedures in the shipping industry, cloud computing service providers have provided substantial cost-effective global operational and relationship benefits to host ERP applications in the cloud [25, 26].

Similar ERP systems have been implemented in large enterprises outside Nigeria with a particular focus on operations and logistics [27] that yielded many gains such as enhancing operational efficiency.

A. *The benefit of Cloud-Based ERP*

Cloud-based ERP is seen to increase the speed of the business process and help to drive automation in the maritime industry[28]. Although many organizations have adopted cloud-based solutions to be their primary sourcing applications over on-premise applications. By hosting the ERP process in the cloud, data is made available in a centralized location with complete accessibility to various stakeholders. The logistics and transportation system is a critical industry with interconnected operations, the overall running of an ERP system using cloud could enhance the multi-directional movement of products/materials and information, across the supply chain[26]. Cloud-based enterprise resource planning (ERP) enables organization the advantages of paying for just

the services consumed without constraints in maintaining the information technology infrastructure [29]

In a Cloud-based ERP system, distributed resources are hosted in the cloud services and centrally managed, which allows high automation, flexibility, fast provision, and ease of integration at a low cost. The cloud-based ERP solution has become a prevailing technology delivery platform most industries are using in delivering enterprise solutions across their business [30]. As an industry with distributed freight, cargos, and with a fast-growing expectation to deliver higher than before, the Nigerian Maritime logistic chain stands to benefit enormously from the cloud-based ERP which can reduce physical resources and can be used to provide information exchange and communication between the host of Internet of things (IoT) technology [31]. Figure 1 present Cloud-based ERP ecosystem adapted from [19].

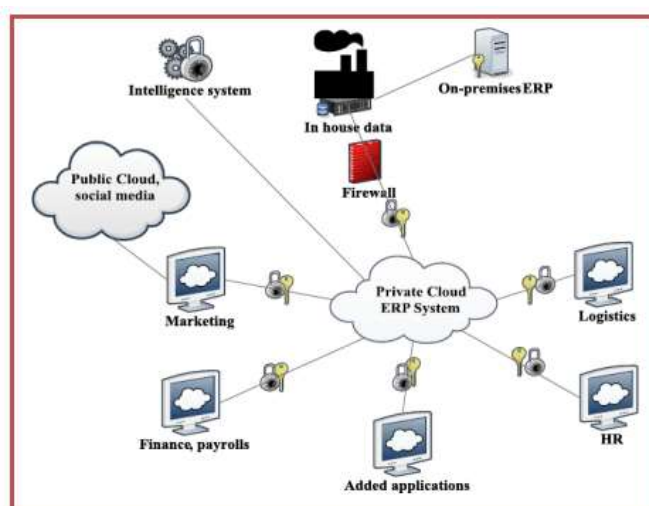


Figure 1. Cloud ERP ecosystem [19]

In a cloud-based ERP, services can be utilized using any of the cloud layers, i.e. Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) [32]. Although common ERP implementation is hosted under SaaS and public cloud. [30] Proposed Cloud-based ERP for manufacturing systems using multiple layers of the SaaS model. According to [33]. The benefit of cloud-based ERP could be felt in industries including port sectors and businesses that are gaining wider distribution around the world. Thus according to the literature search, limited studies have mentioned CSF in technological implementation in the Nigerian Maritime Industry while cloud researchers have neglected the variances and unique features of CERP in the Nigerian Maritime industry. Table 1 presents a list of studies on ERP system implementation and its operational efficiency and gains.

TABLE I. SOME IDENTIFIED CERP AREA OF USE

Area of Use	CERP Operational efficiency and gains		
	Table column subhead	Subhead	Subhead

Area of Use	CERP Operational efficiency and gains		
	Table column subhead	Subhead	Subhead
Operations and logistics	ERP is made up of major investment within Hawke's Bay New Zealand operational management and has been used to address issues relating to an organizational failure in information coordination due to the application of legacy systems		[12]
Operations and logistics	ERP has also been developed to manage and predict material requirements,		[22]
Operations and logistics	ERP has been implemented in Huck International, Inc., an aerospace fastening Systems in North American and Europe to manage the engineering and manufacturing operations, as well as process control of an enterprise data		[34]
Operations and logistics	United Arab Shipping Company shifted its fuel purchasing process to a cloud-based fuel management system. The system allowed the shipping firm to create a blueprint for fueling the entire fleet, monitor vessel performance, and improve communications with suppliers.		[35]
Human Resources, Finance, and Asset management	ERP system has been used to enhance information coordination, rapid transaction processing, operational performance, financial management, customer services, web-based interface, and more effective communication by integrating data flow across different departments in		[36], [19]

B. Critical success Factor influencing the implementation of CERP in Nigerian Maritime Sector

This section identified critical success factors as it aids in identifying peculiar technologies in an organization. Critical success factors (CSFs) is an important concept in management tool and it has been used to evaluate technology and trends in large industries. The concept of critical success factors (CSF)

was introduced by Rokhart in 1979. Although many researchers and informatics systems have adopted CSF as a means to support strategic planning and implementation of new technology. In Rockhart's work, CSF allows a clear definition of scope and needs of the organization, [37] argued that critical success factors will help to develop a user acceptance model and helps to identify important organizational areas that need attention. In an implementation of a technical innovation like CERP, CSFs are those conditions that must be met for the implementation process to occur successfully [38]. Many studies have explained the concept of critical success factors in ICT projects using different models. This study gathered information from comprehensive literature review some conditions that are considered necessary for the CERP implementation to occur successfully

We found several articles that provide related answers to the above question but instead of relying on already published literature, we survey the opinion of actual users in the Nigerian Maritime industry to identify the exact CSFs as it is peculiar to the industry. However, from the comprehensive literature reviews, different categories of critical success factors were identified. We presented the ones that were widely cited for the implementation of a Cloud-based ERP project in table 2.

CSF	[39]	[10]	[40]	[41]	[42]	[43]	[44]
Top management support and commitment	√	√	√	√	√	√	√
Technology and infrastructure maturity		√		√	√		√
Knowledge management and Organizational fit for ERP			√				
Risk and quality Organizations committed to the idea of CERP	√			√		√	
Change management program					√		

CSF	[39]	[10]	[40]	[41]	[42]	[43]	[44]
and culture							
Project cost planning and					√		
Appropriate business and IT Legacy system considerations	√		√	√		√	√
Data conversion and integrity							√
Implementation strategy and timeframe	√	√		√	√	√	√

enhance capacity development in human resources management. (18.2%) submitted it has helped to meet ever-increasing customers in the marketing and sales department, (15.2%) claimed it has helped to resolved operational inefficiency in the material management. However, only (5.3%) respondents agreed that the implementation has been effected in the logistics chain which is the chain agent in the industry as evident in figure 2 and figure 3

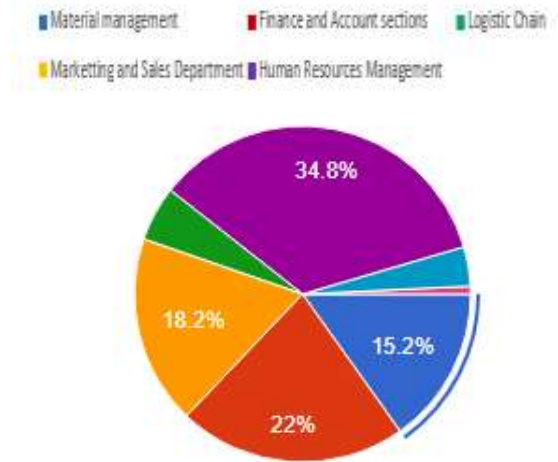


Figure 2. Level of ERP implementation in the Nigerian Maritime Agency.

iv. Discission

According to the literature search result, the above ten CSF was considered critical in the CERP implementation. We adopted them in our theme-based questionnaires for the Nigerian Maritime Agency staff to fill. First, we ascertain the level of awareness and implementation of On-premise ERP implementation in the industry.

CERP Implementation in the Nigerian Maritime Agency

Findings from the survey revealed that automation has to take the center stage in the Nigerian Maritime industry. On-premise ERP has been implemented to enhance operational decisions across the industry. Thus, the automation has only taken a center stage in some departments like human resources and finances in the Nigerian Maritime Agency, there is currently ERP automation in payments and collection processes.

When asked further, what benefit has been derived from the CERP, (22%) of the respondents submitted, it has helped to lower operational cost, reduces financial leakages and improved efficiency in the finance and account sections. (34.8%) submitted it has helped to

After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save So far, CERP has taken a high implementation stage in finance, human resources, and marketing, however, the implementation in the logistics and supply chains are a little bit slower in the maritime industry as reported in figure 3.

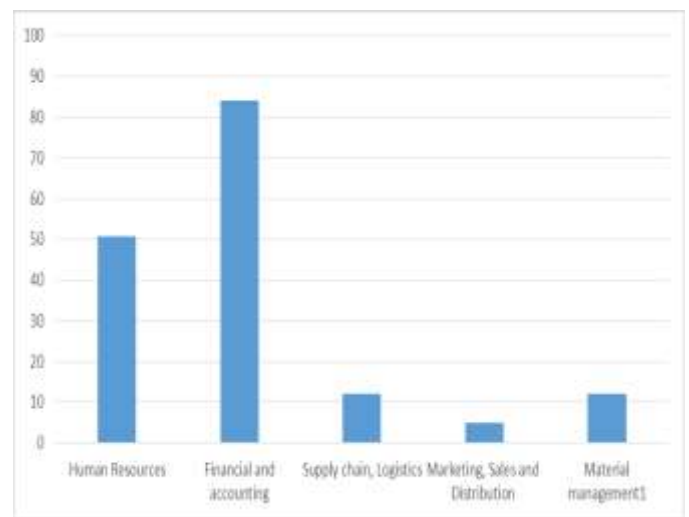


Figure 3. ERP Implementation in Nigerian Maritime Agency

Evaluation of the critical success factor for the implementation of CERP in maritime logistic chain required top-management support. The study presents the index score rating of some widely cited CSF based on the 5-point Likert scale

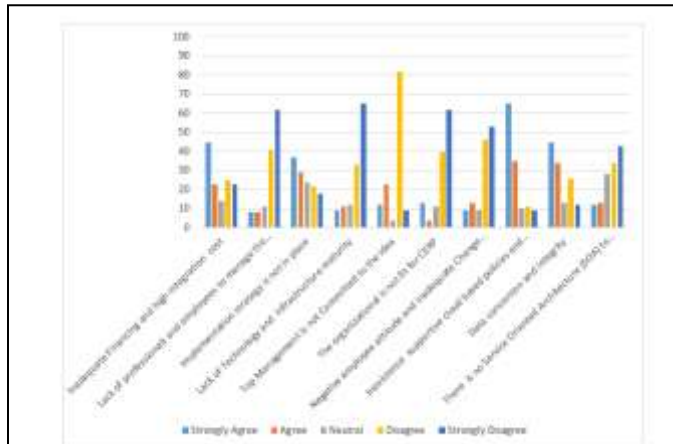


Figure 4. Top management index rating of some identified Critical success factor as it may affect the implementation of CERP in the Maritime Logistics and Services operation

Using a five-point Likert scale, top management in the Nigerian Maritime Industry supports the idea of CERP and the positive responses show that the executives are committed to the implementation. However, the financing level seems too low. The responses as shown in Figure 3 indicate that (45%) strongly agree and (23%) agree that inadequate financing and high integration cost might hinder the implementation of CERP, see figure 4.

Lack of supportive cloud-based policy and legislation are also factors that may hinder the implementation of CERP. Thus this submission looks quite tricky, as the study suggested that the industry is technology fit to host CERP. Fairly (62%) strongly disagree that the organization is not fit for CERP. This requires subsequent research on this submission. Meanwhile, the study revealed that CERP has been adopted in the industry but mainly in finance, sales, and marketing

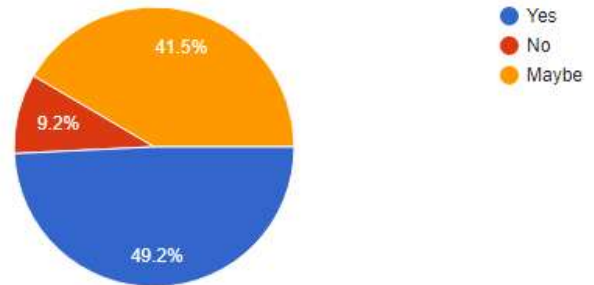


Figure 5. Has the organization fully automated ERP with the Cloud platform?

The study proved that the identified CSFs are crucial to the implementation of CERP in the Nigerian maritime logistic chain. According to their ranking index, “top management commitment” is highly ranked positive with 82% participants in agreement. The survey also indicated that the Nigerian technology infrastructure is mature to host an advanced system like CERP with sound IT literacy personnel in the working environment. The study also suggested that there is Service Oriented Architecture (SOA) on ground to support the integration. One could deduce from the study that the level of digitalization in the Maritime Agency is increasing, although little bit unimpressive in some critical services operation like the supply chain and logistics management. A review of the benefits of Cloud-based ERP in the maritime industry, supply chain, and logistics management shows that innovation can reduce many of the challenges in the Nigerian Maritime industry

v. Conclusion

This study has shown that automation and digitization are currently advancing in the Nigerian Maritime Administration Agency. Thus this study points out some existing critical challenges in the automated process and provides recommendations for action in research and practice. Among the recommendation in practice is to implement new technologies and concepts such as cloud-based enterprise resource planning, for effective digitalization in the Maritime sector. Having highlighted the critical success factors (CSF) for the implementation of CERP, the study found most of the participants as fairly positive about new technology including the top management commitment which is the most widely referenced critical success factor (CSF) for implementing new technology. The study recommends adequate broadband internet infrastructure as the CERP will be highly dependent on infrastructure as well as supportive cloud-based policies and legislation to link the industrial and operational processes with the Cloud services providers platform. The significance of the cloud-based platform will change the working patterns of the existing on-premise ERP as the industry continue to

generate large amount of data sources. Although intensive research work is required as the study also shows that there exists limited number of scientific publications in the area of information technology.

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