Critical Implementation Factors for Cloud-Based Enterprise Resources planning in the Nigerian Maritime Transport and Supply Chain

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Abstract. Technology has deeply impacted the practice of shipping in the maritime industry worldwide, this explains the way and manner big organizations have engaged modern technology like Cloud-based Enterprise Resources Planning, to manage the key parts of their businesses. Recent research and practices have shown that cloud-based ERP systems if implemented correctly could be a great beneficial advantage to the logistics and supply chain process of a large organization. Unfortunately, the implementation has been slow in the Nigerian Maritime Administration and Safety Agency (NIMASA). Reports have shown that there is a need to re-engineer linkages between service systems within the growing organizations. From the perspective of an enterprise like NIMASA, only limited research has been conducted that has played an important role in intimating the organization towards the adoption of a cloud-based ERP system as well as the post-implementation measures. Most recent studies have been conducted only in the context of generic information system adoption. Information system research is not strong enough without considering the articulating system speed and performance of CERP. This study investigates the critical factors influencing the adoption of Cloud-based Enterprise Resource Planning (CERP) in the Nigerian Maritime Administration and Safety Agency with a focus on Maritime logistics and supply chain. A structured based questionnaire was administered to 130 senior maritime workers in the Nigerian Maritime industry to extract factors that hinder the adoption of information systems like cloud-based ERP. The quantitative data were analyzed based on the impact ranking to inform a proposed implementation model for a Cloud-based ERP in the organization. The research also highlights some important Critical Success Factors like technology-related factors, funding for technology innovation (Economic and financial factors), Policy related barriers, and how they influence development in the Maritime industry.

1. 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. This includes the oversight function of the maritime transports and the 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 is controlled by the Nigerian Maritime Administration and Safety Agency (NIMASA), [3]. It is important to put that maritime transport logistics is an integral part 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 data and information management challenges, workforce and skill shortages, autonomy technology, piracy, and the shortfall in technology infrastructure resulting in stunted growth, and loss of revenue [3, 5]. [1] noted that the industry is currently confronted with inadequate and inefficient maritime logistics systems and technology infrastructural support. The declined in technology infrastructure within the industry has snowballed in recent years calling for a compelling need for the government to support and strengthen the capacity for the development and growth [6].

A report by the African Development Bank (AfDB) indicated that high-tech innovations in the industry, such as the Internet of things, Big data Analytics, a Cloud-based Enterprise Resource Planning (ERP) in particular has a lot of gain for the industry, however, meeting up to this requirement require technological and infrastructure which require adequate funding [7]. Adequate funding as well as ICT and technological acquisition is quiet crucial for associated logistics infrastructure support. Information technologies like cloud-based enterprise resources planning CERP have the potential to significantly alter how administrative, logistics, ship, terminal, and port operations function together. For instance, Cloud-based ERP and similar technology could enable data to be extended to the supply chain and enhance real-time status updates across the logistic chain while given a Value-added benefit like transparency on shipments, reduced handovers, waiting times, and handling costs [8].

The logistics sector operates with a growing amount of data. Therefore as the transportation and logistics industry continues to grow, there is a need for enhanced technologies solutions like Cloud-based ERP that can help to achieve efficient inter-modality, supply chain visibility, and end-to-end services in the sector. A Cloud-based ERP in the marine information system will enhance value chain competitiveness by enabling fleet operators to manage business functions like product distribution and process control [9]. Cloud-based ERP provides several opportunities and value-enhancing services for supply chain and logistics management. A simplified supply chain requires technology infrastructure like Cloud computing and ERP to achieve collaboration between actors in the shipping and logistics industries [10]. Ertuk and Arora [11] argued that Cloud-based ERP will help to provide real-time data, and access to the entire maritime organization regardless of location.

On the other end, Enterprise Resource Planning (ERP) are complex information management systems that provide a unified enterprise view of the business functions and helps in coordinating the interdepartmental activities such as human resources, payroll, supply chain management, training, organization policy, recruitment, and inter-service operations in automated ways [12, 13]. A report from previous studies has ascertained that an ERP system can improve organizational operational efficiency and enhances competitiveness in manufacturing, shipping, and logistics firms [14]. Enterprise resource planning (ERP) systems were all about the manufacturing industry and inventory control in the 1960s since the concept of ERP originated from Material Requirement Planning (MRP) and Manufacturing Resources Planning (MRP) majorly used in production and planning schedule. It was used to support business functional areas like finance, logistics with and material engineering [15].

2. Overview of Cloud-Based ERP in logistics and transportation

An ERP software that is deployed into a cloud environment becomes Cloud-based ERP. Cloud-based ERP emerged in the mid-2000s with ERP services provided to customers inform of software as a service (SaaS), some ERP has also been provided using platforms as a service (PaaS) and infrastructure-as-a-service (IaaS)[16]. Gartner predicts that almost 32% of large companies have adopted CERP systems as a replacement for on-premise ERP. SaaS service model is expected to grow more in 2021, [17, 18].

Cloud provides a flexible, adaptable, scalable, efficient, and affordable solutions and it serves as a revolutionary approach to deploy any ERP solution using the cloud platform[19]. A CERP seems to be on the increase as more businesses and providers are transitioning to Cloud. Its usage can help to drive automation in the maritime industry[20]. Although many organizations have adopted ERP cloud-based solutions have been considered attractive 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 the cloud could enhance the multi-directional movement of products/materials and information, across the supply chain [21].

Some specific benefits of Cloud-based ERP as it is applicable in logistics and transportation include Optimization of organization inventory control system, [11]. Cloud-based enterprise resource planning (CERP) enables logistics companies to speed up the dispatch and order time and enhance the inventory management in the supply chain in the area of sales and services delivery, [11][9]. Cloud-Based ERP can improve the distribution of resources and centrally managed large information in a highly flexible and automated way [22]. Such is important in an industry with distributed freight, cargos, with a fast-growing expectation to deliver within a large competitive market.

In the Maritime industry, logistic operations need to be tracked in real-time with intelligent data for faster decision making. CERP supports the logistics business with valuable business intelligence and provides information exchange between the company and the customers [22]. Cloud-based ERP has been proved to be excellent in workforce management, training, human resources, and management of big data relating to the operation of the service [11].

In a cloud-based ERP, services can be utilized using any of the cloud layers, namely Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) [23]. Although common ERP implementation is hosted under SaaS and public cloud, [24] Proposed Cloud-based ERP for manufacturing systems using multiple layers of the SaaS model. According to [25]. 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.

![Cloud ERP ecosystem](image_url)

**Figure 1.** Cloud ERP ecosystem [26]

### 2.1 Cloud-based Enterprise Resource Planning System Area of Use
Cloud-based ERP has been considered useful in both small businesses and large organizations. In both cases it can be used in sales analysis and customer relationship management (CRM), track orders through quoting, sales order, and work order [27], [26]. In logistics, shipping, and Manufacturing industries, it has been used in recording materials and timing of the complex process, [28]. It tracks everything in inventory management and supply chain using a pre-defined inventory rule [29]. For example Table 1, shows some identified areas of use of CERP.
Table 1. Some Identified CERP Area of Use

| Area of Use                          | CERP Operational efficiency and gains                                                                                     | References |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------|------------|
| 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 | [11]       |
| Operations and logistics             | ERP has also been developed to manage and predict material requirements,                                                     | [28]       |
| 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 | [29]       |
| 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 fuelling the entire fleet, monitor vessel performance, and improve communications with suppliers. | [30]       |
| Sales, CRM, 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 | [27], [26] |

As argued in [11], [11], [15], CERP is a great system that can be employed to tackle the problem of data fragmentation in organizations and to combine all the data that flow in the organization logistics sector into one places. It also helps to minimize the operational challenges in the supply chain, finance, human resources, training. Cloud-based ERP offer increased opportunities for innovative business models. However, the Nigerian Maritime Administration and Safety Agency (NIMASA) is yet to realize the full benefits of Cloud-based ERP systems in their growing and challenging workforce [31]. It has not been adequately researched, the factors that are responsible for the slower adoption of CERP in the Nigerian Maritime Administration and Safety Agency which is an important regulatory body in Nigerian supply chain and shipping logistics. The critical success factors that will perhaps, aid rapid adoption in the industry are understudied. This paper investigates the critical success factors influencing the implementation of the Cloud-based ERP in the Nigerian Maritime Administration and Safety Agency and provides research answers to the following challenging questions:

- **RQ2.** What are the critical success factors influencing the implementation of Cloud-based ERP (CERP) in the Nigerian maritime sector?
- **RQ1.** What are the current Users’ thoughts and attitudes about the Cloud-based ERP implementation in the Logistics chain?
3. Methodology

Despite the expected benefits of CERP, the implementation is considered slow in the Nigerian Maritime Administration and Safety Agency especially in the logistics management and supply chain. This study uses the critical success factor approach to examine the current user’s thoughts and attitudes about Cloud-based ERP implementation in the organization. A questionnaire was developed considering the most frequently mentioned CSF for technological adoption like Cloud-based ERP in a large Organization. The data were collected from 130 key stakeholders in the Nigerian Maritime Administration and Safety after due ethical approval. The quantitative data were analyzed using PLS to inform the decision surrounding the lower adoption of Cloud-based ERP and the Critical Success Factors (CSF) for the implementation of technology innovation like Cloud-based ERP in the Nigerian Maritime Administration and Safety Agency logistics management and supply chain.

4. Critical success Factor Approach

This section identified critical success factors for CERP implementation in the Nigerian Maritime Administration and Safety Agency using the Critical success factor approach for implementing CERP. Since it has been identified that CSF is a peculiar enterprise approach that may be used to extract information that will ensure the survival and continued success of a system or application[32]. Central to the CSF approach is the question: what key performance indicators (i.e., specific information and measures) needed to ensure the successful implementation of a new system. This question is tactical and has been tailored towards the realization of the implantation of CERP in NIMASA. The CSF concept has evolved over years and it has remained till today a valuable set of strategic research in planning, design, and implementation of many information-management-related activities, [33].

CERP is an important information-management system crafted for manufacturers, logistics, shipping, and supply chain and critical success factors (CSFs) are an important concept in understanding the possibility and non-usability of the management tool. It has been helpful in the modeling of technology adoption in large and growing industries. Successful implementation of CERP in many industries has been challenging with a problem relating to post-implementation failure, cost, lack of top management support, technology maturity, and user's attitude to change management. The concept of critical success factors (CSF) had been introduced by Rokhart in 1979 to ensure a successful implementation of a new system and used to reduce the high failure rate, [33].

Although many researchers have adopted CSF as a means to support the strategic implementation of a new system [34-37]. CSF allows a clear definition of the scope and needs of the organization. [38] argued that critical success factors help to develop a user acceptance model and help to identify important organizational needs.

4.1 Survey of Users’ thoughts and Management attitudes towards Cloud-based ERP Implementation in NIMASA

The result obtained from the survey was interpreted to inform this discussion. The study revealed that automation has not yet taken a center stage in the Nigerian Maritime industry. Financial and human resources departments in the maritime sector are currently working with a broad range of ERP programs, although they were On-premise ERP deployment to enhance operational decisions in the department. Although, a large industry like the maritime sector, of course, need an ERP system in all department to control the whole operational processes. ERP is a type of a data management system that tie together finance, human resources, projects, and supply chain, implementing the same in logistics and transportation will yield more agile advantages.

When surveyed about the level of CERP deployment within the sectors along with the benefits derived so far, most of the senior maritime workers submitted that the maritime sector has received significant attention towards the implementation of CERP in its finance, human resources, and marketing department. However, the logistics and supply chain have a mere implementation level. The low rate of CERP in logistics and supply-chain has much to do with the technology maturity, economic, and financial factors. Although, the high implementation level of CERP in finances and human
resources has helped to lower operational cost, reduces financial leakages, and improved efficiency in the finance and account sections even though part of some implementation is still on-premise ERP deployment. For instance, the implementation has taken (34.8%) cloud-based implementation in Human resources management, (18.2%) cloud base implementation in the Marketing and sales department, (15.2%) in Material management, and 22% cloud-based ERP in Finance and account sectors respectively.

However, only (5.3%) of implementation in the logistic chain which is a major business function of the industry. The result gathered suggests that technology innovation is largely focused on three areas including transactional activities, human resources management, and end-to-end planning as indicated in figure 2.

![Figure 2. Level of CERP implementation in the Nigerian Maritime Agency](image)

4.2 Slower Adoption of CERP in the Maritime Industry

Even though CERP has significantly benefitted departments such as finance, human resources, and material management, CERP uptake at the logistics and supply chains has been slow. According to research, the maritime industry lags in terms of its use of information and communications technology [39]. According to [40, 41] factors contributing to the slower adoption of ICT platform in the logistics and supply chain management can be categorized into ten:

1. User-related barriers
2. Economic and financial factors
3. Operation related factors
4. Top management and Management capability
5. Technology related factors
6. Collaborators influence
7. Policy related barriers.
8. Infrastructural deficits
9. Lack of innovation skills
10. Lack of government support for innovation
This study chose to address the technological related factors as proposed [42], most organizations would not be able to continue doing business without considering the information system. In this regard, one of the most crucial factors to sustain a firm’s adoption of CERP is to make top management and stakeholders to fully realize the benefits of information technology (IT), i.e setting comprehensible targets for IT systems and providing a strong commitment to their successful implementation [43].

For the implementation of CERP in the Maritime Logistics chain, [44] suggested the involvement of all stakeholders to make good decisions about the implementation needs and the change process. Another critical success factor considered for the implementation of CERP is the deployment of technical resources and technical capabilities that will enable organizations like NIMASA to develop and maintain an information system. Based on wide literature on CERP implementation, adequate internal technical resources and staff technical capability are considered by many scholars and IS experts as a crucial factor for ensuring the success of the CERP implementation [45]. Similarly, an important factor was mentioned by [46] which is the ability and willingness of the organization to reengineer CERP processes.

When this study surveyed the opinion of users in NIMASA and requested to rank the factors they considered that might be influencing the implementation of CERP in the organization, the majority of their submissions are related to difficulties and lack of funds in reengineering new process like CERP. Aside from this, four other key factors were submitted among the factors responsible for the implementation of CERP in the maritime logistics and supply chain: Technology related factors, funding for technology innovation (Economic and financial factors), Policy related barriers, and operation-related factors as presented in figure 3.

![Figure 3](image_url)

**Figure 3.** Factors influencing the implementation of CERP in the Maritime Logistics and Services operation and their impact factors.

### 4.2.1 Technology related factors:

According to Gartner, CERP requires adequate technology shift, and organization needs to realize the benefit of moving away from an on-premise system to cloud-based applications[16], from a comprehensive review of the literature, many government agency decision to adopt cloud computing is still very slow and cloud-based infrastructure is still at the entry stage in Nigeria. [47] today's turbulent business environment can be corrected with technology and flexibility to adapt to these technological changes is the key to the success of any business. Meanwhile, the lack of skilled cloud computing administrators, data security risks, and high cost are the main reasons why the government and organization in Nigeria have to hesitate to adopt cloud-based services. According to [48], technology maturity, data security risk, and employee IT expertise are the key factors to consider when adopting a
cloud-based ERP project. Where no IT architecture or the technology infrastructure is not yet mature, the issue of new innovative ideas and technologies became a setback (Schniederjans & Yadav, 2013).

4.2.2 Funding for technology innovation (Economic and financial factors)
It is evident that many studies have been conducted on the benefits and challenges of cloud computing and the benefit in shipping and logistics operations have been argued to be very important [10, 21, 23, 24]. However, the factors affecting its implementation in NIMASA could not be far from cost, limited IT experts, security, and risk. This is similar to recently studied on the actors affecting cloud-based ERP adoption in a large organization. [49] explains how funding for technology innovation is associated with the concerns identified in adopting cloud-based ERP in different countries.

4.2.3 Policy related barriers
Though the availability of quality IT infrastructure is still a problem in many developing countries, Cloud computing as a new computing paradigm is still a debate for policyholders. According to the National Information Technology Development Agency (NITDA), director general, Nigeria as a country is yet to tap into the full benefits of Cloud technology because of the number of challenges facing and confronting the nation’s IT industry. Although the benefit of CERP was not disputed during the survey, many respondents were aware of the great benefit CERP could offer government institutions, but the country is still constrained with poor Internet connectivity and lack of relevant policies [50-52].

4.2.4 Operational-Related factors
Apart from the relevant technological factors that have been identified in the implementation of CERP, the operational related environment also top the list of factors influencing the adoption of a new information system. Operational factors mentioned in the survey included top management support, organizational readiness, centralization, and formalization constraints. Operational factors were identified as competitive pressure and vendor support. According to [42], operational related factors are likely to have a greater effect on the implementation and adoption of CERP along with the following model.
5. Conclusion

Usually, the maritime industries all over the world adopt new technology faster based on the demand and market pressure, but technology like cloud computing and ERP remains untapped in the Nigerian maritime logistic chain, this study has revealed the real critical success factors that may help in the re-engineering of the new processes. Analysis from 130 respondents indicated that all identified CSF were significant predictors of Cloud ERP systems in the Nigerian Maritime industry. In examining the organizations that have adopted Cloud ERP systems, they have enjoyed a higher level of relative advantage, compatibility with higher top management support. Meanwhile, the result of this study equally shows that top management are committed to CERP implementation. The majority of the respondents surveyed recognize the importance of CERP and related technology platforms like big data analytics, blockchain, and cloud computing in the future of the shipping and maritime industry. Thus this study has shown that CERP can turn the logistics chain in NIMASA into actionable insights, the shipping, and logistics sector can have more opportunity to drive service efficiency and quality. Thus, some existing critical challenges in the adoption and post-implementation process were identified such as security of organization data within the cloud environment, perceived cost increase, low technology capability level, continuous funding for technology innovation like CERP which is mostly on pay per use.

Vital to the success of any shipping and logistics agency, implementation of CERP is one IT system that can enhance best practices in the industry. Consequently, implementing such systems will enhance service distribution in the Nigerian Maritime Administration and Safety Agency (NIMASA).
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