

Review

Effective Cloud Resource Utilisation in Cloud ERP Decision-Making Process for Industry 4.0 in the United States

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Abstract: Cloud enterprise resource planning (C-ERP) represents an evolution of traditional ERP, which also offers the advantages of cloud computing (CC) such as ease of use and resource elasticity. This article presents the opportunities and challenges of the C-ERP adoption for industry 4.0 in the United States as well as the factors that boost or hinder such a decision. The quantitative research method is used to gather the predictor factors and correlation amongst them. An online survey questionnaire received 109 responses, mainly decision-makers and professionals from the US consumer goods industry. Statistical analysis has been carried out to rank the different levels of influence in the C-ERP adoption decision. The predictor's complexity and regulatory compliance positively influence C-ERP private service deployment, whereas technology readiness is a good predictor of community service deployment. This paper also proposes a decision support system (DSS), tailored to industry 4.0, and aimed at assisting decision-makers in adopting C-ERP as an effective resource for decision-making. The DSS is built upon the predictors using the analytic hierarchy process (AHP) and it supports decision-makers in the selection of services and deployment models for C-ERP as a resource.

Keywords: cloud ERP; consumer goods industry; industry 4.0; cloud services; cloud models; decision making process; decision support tool; resource utilisation



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1. Introduction

This study aims to understand the factors that influence companies in the decision to migrate enterprise resource planning (ERP) as a resource to the cloud and design a decision support system (DSS) to assist the decision-making process. The research is contextualized in the United States, and it aims to identify the cloud services and models adopted within the consumer goods industry for the ERP. The research participants were recruited via panel services from Survey Gizmo with a target audience mainly defined by IT managers and senior managers. In particular, the adoption of cloud ERP (C-ERP) as an effective resource for many organisations is a crucial step, and early adopters may directly impact their business if an inadequate solution is selected [1]. Thus, one of the first essential steps in the decision-making process is understanding the factors that influence the adoption of C-ERP. The organisational size can play an important role [2–6] for the decision making process. Additionally, it is suggested that the industry might be a determinant in C-ERP computing adoption for effective resource utilisation [7].

There are various global changes in production such as innovation and customer demand-dynamics, global operating but locally-responsive markets, business to business

(B2B) interactions between SMEs (small and medium enterprises), risk management and uncertainty, and financial and operational costs that hinder the workers' productivity [8]. To overcome these challenges, effective countermeasures have to be taken wisely. Industry 4.0 incorporates 'customer' ingenuity across a series of production materials and responds to the customer as an integrated production business. The continued production of smart products helps performance-oriented business, reduces energy and material consumption and promotes environmental sustainability, health and safety and economic competitiveness. Further Industry 4.0 embedded to reduce the cost of using advanced data analytics, modelling, and simulation in key production processes, to build pre-competitive infrastructure including network technology and information, collaboration, and shared business data, creation and provision of comprehensive access to next-generation sensors, including low-cost sensing and sensor fusion technology, establish intelligent production bedside testing beds and make them available to companies of all sizes [9–11].

This study focuses on the consumer goods industry (which exploits both manufacturing products and a large IT component to reduce overall costs) and investigates the factors fostering the C-ERP adoption, by starting from a depth analysis of cloud computing (CC).

The research process methodology followed the software development lifecycle such as analysis, design, implementation and testing. In the analysis phase, a literature review was performed on CC factors and narrowed down to C-ERP factors and decision support tools to understand how companies reach a determined decision whether to migrate ERP to the cloud. The research hypothesis was formulated upon deductive analysis of academic literature. Thus, the research method was based on surveys using a theoretical foundation such as technology, organization, environment (TOE) and the diffusion of innovation (DOI) [12]. In the design phase, the TOE framework and DOI [13] allow considering variables such as technical, organisational and environmental which set the context for innovation adoption; similarly, the artefact design allows analysing the different decision support tools developed. The online survey questionnaire method is utilised to generate empirical data and exercised to detect further issues related to the factors that influence C-ERP adoption.

To pre-test the survey questionnaire, it was distributed initially to five participants to collect review comments and amend the inquiry accordingly to ensure facts and content validity. The subsequent step was to deploy a soft launch of the survey to 30 decision makers to check content validity as a pilot. Upon the conclusion of a successful pilot, the survey was deployed to 200 respondents, and in total, 109 responses were considered valid (i.e., 54.5% response rate). The panel services targeted decision-makers from the consumer goods industry and in possession of ERP to ensure reliable test data. The testing phase began with a statistical analysis of the data collected to evaluate the reliability and internal consistency. The subsequent test focused on regression analysis to check on the correlation of the factors. Furthermore, the decision support tool has been also implemented upon collection of the survey data. Finally, an evaluation of the IT artefact DSS in the form of a qualitative interview was executed towards the experts' sample to understand whether it fits requirements from decision-makers or not.

The main objectives of this research study are listed as follows:

1. Identify and evaluate existing factors in the consumer goods industry that influence the adoption of C-ERP.
2. Design a DSS to assist the decision-making process of adopting C-ERP.
3. Validate the DSS to aid the decision-making process in the consumer goods industry with expert samples.

The research project comprises the following phases:

1. Research Breadth: field research through a hierarchy of several topics regarding factors influencing CC, decision-making process analysis, participants for surveys, designing the surveys and the design of decision support tool. The objective is to elaborate on a decision support tool based on collecting data from the survey.

2. Research Depth: explanatory phase that comprehends answering the research questions.

The following research hypothesis are considered for this study: a decision framework tailored to the consumer goods industry can better support the decision-making to adopt C-ERP computing.

Hypothesis 1 (H1). *Opportunities and concerns identified adequately will justify C-ERP adoption.*

Hypothesis 2 (H2). *Supported and ready organisations from different sizes will benefit from adopting C-ERP.*

The following hypothesis have led to the research questions as listed in Table 1.

Table 1. Research questions, motivations and outcomes.

Research Questions	Motivations	Outcomes
How do companies perceive Cloud Enterprise Resource Planning (ERP) opportunities and concerns?	This question is intrinsically related to the first hypothesis (H1), aiming to understand the perception of opportunities and concern and the predictor to build the decision support tool.	The perceived opportunity lies mainly with a relative advantage in economics and efficiency, followed by compatibility.
Which services and deployment of cloud ERP computing are mostly adopted?	This question has a purely demographic reason, aiming to understand the current and future (within the next two years) status of cloud ERP adoption.	The predictors have the most influence on the service model than the deployment model. Most of the predictor's influence IaaS and PaaS but not SaaS. The predictor's complexity and regulatory compliance influence private cloud deployment
How do companies decide to do cloud ERP?	This question, motivated by hypothesis (H2), is related to the company's characteristics that include cloud ERP adoption.	The predictor's organisation size, technology readiness and vendor support influence positively cloud adoption as IaaS. The predictor's technology readiness influence positively community cloud deployment.

The rest of the article is structured as follows. Section 2 is the foundation of the research around CC, narrowed to C-ERP opportunities and concerns. Furthermore, this section describes the innovation adoption theories, decision-making theories, and decision support tools available in the literature. Section 3 focuses on the study's research method, specifications, design, as well as on IT artefact design and specifications. Section 4 reports the adopted research process from the results analysis to the IT artefact development. Section 5, instead, presents the results obtained via quantitative research, related to the significance of the factors influencing C-ERP decisions and their correlation and obtained through statistical tools. Similarly, the IT artefact decision support tool is also evaluated by sample experts. Finally, Section 6 focuses on Research findings, final remarks and recommended future research directions, concluding the article.

2. Background and Review of Literature

Cloud computing is a topic that is being researched within the academic and non-academic literature regarding adoption factors. However, almost no research is performed

in C-ERP [14,15] in one industry setting. Similarly, the decision-making process of C-ERP has little research. The consumer goods industry and retail market research report show that companies are adopting CC hybrid model as a current and future strategy. Despite so many technological and economic benefits, organisations are reluctant to adopt CC, especially in ERP, as these are perceived as a critical mission system [16]. ERP allows the integration of systems and business processes across the organisation. Depending on country location, industry, size, competition pressure may perceive opportunities and concerns differently. There is a gap in the literature related to the type of industry to adopt C-ERP, as companies from different sizes perceive opportunities and concerns differently [1,2,17]. Relevant factors reside in size, business criticality and organisational relevance [18–21].

The factors influencing the C-ERP adoption are related to the TOE and DOI frameworks where technological, organisational and environmental contexts play a role in influencing or hindering the decision. Mostly, the decision to adopt C-ERP is perceived as a strategic organisational decision [22,23]. This research aims to help managers to assess the opportunities and concerns in the consumer goods industry and assist them with a decision support tool to select the service and deployment models founded on the theories of diffusion of innovation [24] and technology, environment and organization [13].

2.1. Literature Review

The literature search process is relevant as it has two main purposes, such as high-quality papers' identification and its applicability to the research conducted. According to Brocke et al. [25], the researcher usually lacks transparency about the search process posing doubts on the search process's reliability and validity. The literature review is indispensable as a strategy to formulate the research arena, detailing the survey and summarising previous research conferring increased knowledge to any research area. The systematic literature review is conducted upon three aspects: input, output and process [15] where searching, filtering and reviewing are key parameters of the process. Another approach to the literature review is to perform a comprehensive literature review of the research topic in the most critical databases. Knowledge is gathered in the different databases constituting the state of knowledge as trends and patterns are identified when reviewing papers [26]. According to Salleh et al. [15] and elaborating upon the comprehensive literature review concept, this research proposes to extend knowledge in the C-ERP adoption factors and decision-making process concept over the subsequent steps.

The following library databases were accessed: ACM digital library, Springer, IEEE Xplore digital library, Science Direct, Scopus, Wiley Online Library and Metalib. Google Scholar is used to pointing out the specific journals databases not previously mentioned. The current literature also searched theses on the topic "Cloud Computing" and "Cloud Computing Decision framework".

The searching keywords used were, "Cloud ERP", "Cloud Computing" and "Decision", "ERP Cloud Computing", "Effective Resource Utilisation", "Cloud Resources", "Decision Tools", "Cloud Computing Adoption Factors", "Cloud ERP and Industry 4.0" "Cloud ERP Determinants", "Cloud Computing Opportunities", "Cloud Computing Concerns", "Cloud ERP and Opportunities", "TOE Model" and "Cloud Computing", "Cloud ERP" and "Concerns", "Cloud ERP Decision Tools" and "Cloud Computing decision making process".

2.1.1. Cloud Computing (CC) Paradigm Shift

CC allows organisations to consume IT services that improve business agility and cost reduction [27]. Both gears strengthen CC: technological maturity and service-centric offerings. The first gear originated from technological innovations known as virtualisation of servers, high-performing networks and automation in data centres [28,29]. The latter emanated from increasing demand on services prospects. ERP and CC's junction permits companies to reap better benefits than ERP on-premises. A C-ERP system promotes

standardisation of the process and business functions across the enterprise [30]. The ERP system present in an organisation is quite powerful since it gives visibility to the entire value chain. Thus, C-ERP enables several benefits from agility, flexibility, and efficiency, essential characteristics that an organisation needs to possess in a globally competitive economy [31].

2.1.2. Cloud Enterprise Resource Planning (C-ERP) Setting

According to Salleh et al. [15], the C-ERP definition in academia has been quite controversial as there is no consensus on the exact meaning of a cloud enterprise system (CES), also known as C-ERP. Due to limited research, there is also a limited theoretical definition of CES. The common ground on definition relies upon four attributes such as virtualisation, agility, on-demand and pay as you go. The same ambiguity applies to the definition of C-ERP, as vendors and academia do not agree on one universal definition. Thus, this study will use the definition types of C-ERP, which is in line with the NIST definition [32], represented in Figure 1 [33]. C-ERP can be referred to as a cloud infrastructure where the hardware is virtualised; a cloud platform where hardware and operating systems are combined; or as a cloud application regarding software as a service (SaaS). C-ERP refers to the usage in this research of CC technology according to the National Institute of Standards and Technology (NIST) definition of three service models, four deployments, and five CC characteristics. Therefore, academia defines CES as scalable IT resources via the internet to several users. On the other hand, the industry elaborates CES definition upon vendors' services offerings that may apply only to some organisations [15].

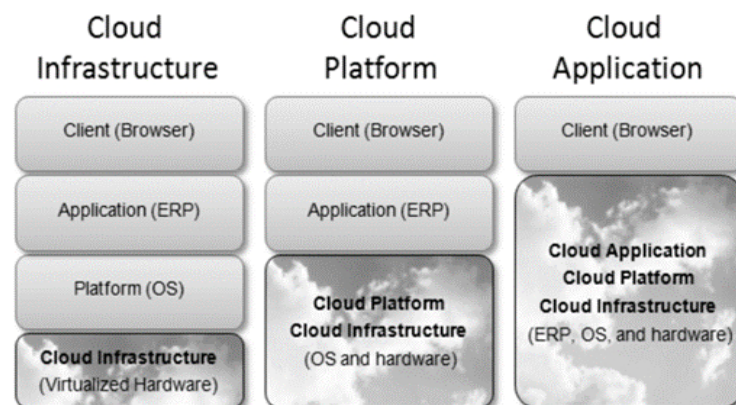


Figure 1. Types of cloud enterprise resource planning (C-ERP) [33]. (Reprinted with permission from ref. [33]. Copyright 2011 Springer Nature).

2.1.3. Cloud ERP (C-ERP) Service Models

A vast majority of applications supporting IT functions are depicted by the necessity of high computing processing capabilities, scalability, and storage [34,35]. Based on these requirements, CC allows companies to receive services in different compositions such as SaaS, platform as a service (PaaS) and infrastructure as a service (IaaS). CC characteristics are accessible regardless of location, ease of acquisition and maintenance, and natural to pay such as a utility. According to Purohit et al. [36], C-ERP is still in its infancy, and some organisations are more inclined than others to adapt it depending on business fit. According to Saa et al. [16], the difference between traditional ERP and ERP IaaS is related to the fact that the infrastructure follows a pay per usage model. Al-Ghofaili and Al-Mashari [37] have investigated C-ERP versus traditional ERP and concluded that ERP system adoption is based on three parameters: data security and privacy, organisation size and investment on ERP. ERP on IaaS is more suited for mid organisations that possess a limited amount to invest in ERP and accept a lower security level.

Traditional ERP is more suited to large organisations with critical data to safeguard, required for business continuity and can afford to have an additional server to implement

ERP on the server. Similarly, Saa et al. [16] conclude that large organisations prefer to have ERP on-premises for mission-critical systems and high-security standards. Boillat and Legner [38] define PaaS as the deployment or development environment for the developers. It delivers all services that developers need over the internet for developing software regarding infrastructure and programming tools. Saa et al. [16] have indicated that ERP SaaS is beneficial to small organisations as they benefit from the C-ERP as “a ready to use” application. Al-Ghofaili and Al-Mashari [37] uses the terminology ERP on SaaS to differentiate C-ERP service as depicted in Figure 2. ERP SaaS is more suited for small organisations that do not have the initial budget to implement ERP; thus, it is a solution that is cost-effective while accepting a lower security level. Purohit et al. [36] conducted a study about ERP on-demand known as SaaS. It is improving the business value of IT investments while comparing the study between ERP and C-ERP. According to Fauscette [3], C-ERP SaaS disrupts and creates new business value while gaining a competitive advantage.

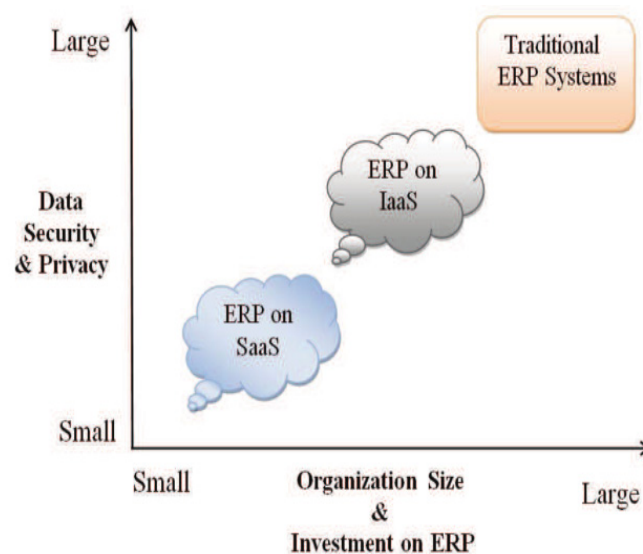


Figure 2. ERP system adoption [37]. (Reprinted with permission from ref. [37]. Copyright 2014 IEEE).

SMEs and large-scale organisations can choose one of three options such as traditional ERP systems, ERP on SaaS, and ERP on IaaS depending on security, investment value, and organization size. The traditional ERP method can be used whenever organisation has sensitive and important data which is necessary for the development of a business or large-scale organisation that can incur additional costs in ERP implementation on a local server. On the other hand, SME organisations that are not able to make a higher investment can use these two others Cloud-based ERP systems (ERP in SaaS or ERP in IaaS). ERP in IaaS can be used in midsize organisations with a limited amount of investment or security and ERP in SaaS can be used by a small size organisation with a small amount of scrutiny or security due to ERP as SaaS is not just an ERP software provided in an ERP file but cloud-managed by cloud providers, so it will be expensive [37]. In large organisations, organisational costs go up due to the adoption of an ERP system and this can be seen as a barrier before a successful ERP implementation. Adoption of the C-ERP program requires new IT skills in the organisation, system users are required obtain support, organisations need to fix ERP problems and they need to upgrade the system to the latest versions to extend the ERP system operating and benefiting from the C-ERP system. In a large organisation, it is very difficult to train all employees with the latest IT skills on time. Furthermore, reluctance to switch to a new system can be high compared to SMEs. For SMEs, the number of employees is small and, therefore, they can be trained in a short period of time compared to large organisations [39]. SMEs and large organisations vary from one another in terms of many challenges except business complexity, integration, monitoring,

security, limited performance, efficiency, and integrity of the provider. From this limited list of challenges to cloud ERP, security has been a major concern for both SMEs and large organisations. The SMEs and large-scale organisations may require customized operations for their needs and SMEs should use the services provided by the Cloud Service Provider (CSPs). Customization can increase the cost of the ERP package and an SME will do so easily because it has to deal with cost overruns and customization [40]. Long-term costs in cloud ERP add up over time for large-scale organisations. Subscription costs allow SMEs and large companies to pay for the services they use and, therefore, do not have to deal with any IT infrastructure and hardware costs. Large-scale organisations have to make the decision to switch to C-ERP keeping in mind that their long-term operating costs should not be more than costs involved in implementing a critical ERP system. Furthermore, SMEs are very flexible to adapt to change business requirements and demands. Using cloud-based ERP solutions leads to the loss of IT capabilities in both SMEs and large-scale organisations. They are completely dependent on the CSP and the existing IT infrastructure in SMEs and large companies may encounter problems as well as the challenges of adapting the IT capabilities of a cloud vendor. Large companies can have their own dedicated network solutions and thus they can have an edge over SMEs. The management and rental of the most valuable assets is not controlled by the organisation's C-ERP module. This can lead to loss of information or theft as the seller reaches out in all details the company uses its leased services. SMEs compared to large organisations will not have the necessary power to monitor how the cloud vendor provides its services to them. Migrating SMEs can be easy as they are flexible to change and adapt to changing business needs. Money spent during the migration and user training in the new system can be compensated by SMEs for the benefits for C-ERP, as there is no cost for IT infrastructure and low power requirement. However, Migration can be a challenge for large-scale organisations to switch to cloud-based services and the associated costs of migration are very high. The existing IT infrastructure of the large-scale organisation will not return as much in the company as it is an asset. Also, the time taken for migration here can be longer in large companies compared to SMEs [4,19,41].

2.1.4. C-ERP Service Deployment Model

The organisation may select several service deployment model ranging from private, public, hybrid and community. Each service deployment model is linked to each organisation's needs as each one of them is related to benefits, costs, opportunities and risks (BCOR) [42,43]. Large companies are concerned with ERP on the Cloud and prefer to build a private CC environment to safeguard the data's sensitivity [31]. Most businesses adopting a private cloud are concerned with security and have a conservative mentality [18]. According to Aitah [44], the C-ERP model provides more security, although with higher cost. According to Grubisic [1], vendors perceive the hybrid solution as the overall solution in the market due to CC concerns. Furthermore, the author researched C-ERP's area with SMEs to conclude that the C-ERP hybrid model is not appealing to them, resulting in higher costs. According to Johansson [18], the hybrid solution is optimal for large companies as it allows them to keep on-premises or in a private cloud environment the critical modules. Similarly, the hybrid solution C-ERP is perceived as the strategy for the next five years [45]. SMEs are adopting the public cloud as it allows them to save initial capital investments and remain focused on core business activity [46–49] as depicted in Figure 3.

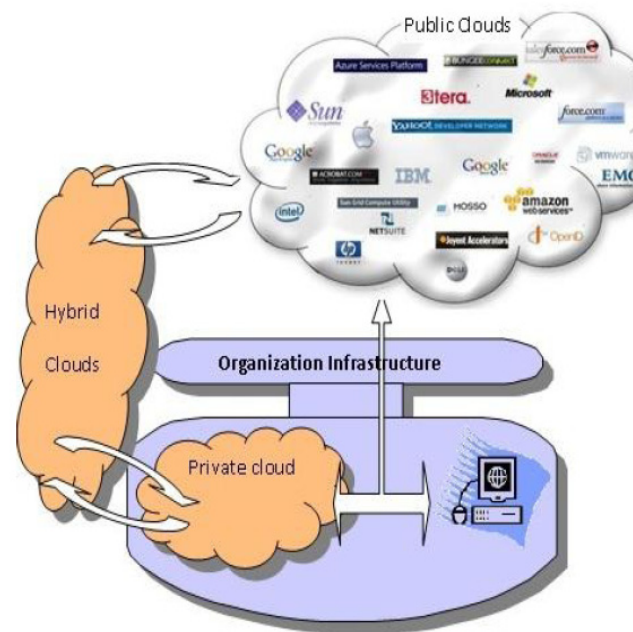


Figure 3. Cloud computing models [50].

Multinational enterprises use the public cloud for non-critical applications to maximise IT cost reduction and minimise security risks [51–53]. Organisations with the same set of goals, mission, and policy, compliance, and security requirements mostly use this model. Associations can share the infrastructure, or unbiased organisations having same concerns can gather together [46,54].

2.1.5. C-ERP Opportunities

CC opportunities can be achieved, associated with each service and deployment model, ranging from economics, technological and organisational perspectives discussed in the following subsections.

Cost Savings

From the economic point of view, the perspective to adopt C-ERP is associated with financial savings and an impact on the cost structure. The adoption of C-ERP permits three types of cost-saving such as lower upfront costs, lower operating costs and transparency of total cost of ownership (TCO) resulting in the enhanced financial image [18]. The C-ERP presents several benefits to companies depending on their size.

Flexibility

Navaneethkrishnan [31] recognises that C-ERP results in flexibility encompassing a competitive advantage for organisations. In his view, the determinants to adopt C-ERP are related to organisational parameters and industry size.

Scalability

Lenart [33] mentions that most of the benefits derive from manageability and scalability characteristics. Similarly, Saa et al. [16] recognise that scalability is an opportunity for organisations to utilise resources.

Agility

CC's advantage resides in increased agility as companies can respond fast to changing markets [12].

Efficiency

Technological benefits such as automated services derived from C-ERP reside in the fact that an organisation seeking a high degree of automation leads to increased productivity. The rise in efficiency derives from business process acceleration via automation in manufacturing, purchasing, distribution, and inventory. Likewise, C-ERP permits automation and an increase in productivity leading to improved overall efficiency improvement within the organisation [31]. The ease of maintenance and elasticity is a significant benefit that organisations have in adopting C-ERP. According to Jain, and Sharma [55], C-ERP led to improved business efficiency, operations and positive perception from users.

Improved Business Productivity

Navaneethakrishnan [31] concludes that it simplifies the business processes due to standardisation and improved collaboration across the multi-locations. The acceleration of the business process using automation of services results in increased productivity. Subsequently, it permits having data standardisation resulting in better management of operations. C-ERP allows integration with other solutions such as business intelligence leading to improved planning and decision-making.

New Business Models

The last characteristic that most senior managers are searching for is CC's role in the IT transformation [51,56] as an enabler of business value. Furthermore, the authors have findings that guide current business strategies towards a more centric customer to use C-ERP services, and new business leads. Table 2 lists the opportunities perceived by CC adoption, including C-ERP opportunities.

Table 2. Adoption factors–opportunities and literature review sources.

Adoption Factors-Opportunities	Literature Review Sources
Cost Saving (lower the Total Cost of Ownership (TCO), cost structure change and transparency cost)	[16,18–21,36,55,57–59]
Flexibility	[12,15,16,19–21,60]
Efficiency	[12,55,60,61]
Scalability	[12,15,16,19–21,60,61]
Independence of infrastructure	[15,19–21,61,62]
Agility	[12,19–21,60,62]
New business models	[51,62]
IT transformation	[36,62]
Operations improvement	[55,60,62]
Ease of use/Implementation	[16,19–21,60,62,63]

2.1.6. C-ERP Concerns

In CC, one person can access other's personal data by accessing their credentials, so it is challenging to remove all security threats altogether. The CSP wants their administrative access to be tested regularly. The security assessment assumes a crucial part in arranging and creating security in cloud implementation. Similarly, companies also notice that CC brings some concerns such as security, data privacy, vendor lock-in, regulatory compliance and interoperability issues [56,64].

Security

Security is the factor that most hampers CC adoption [65,66]. According to Sanchez et al. [67], security is the major impediment in CC and data security and data privacy. The characteristics of security such as confidentiality, integrity and availability are considered

sub-characteristics that most influence the decision-making process. There is a risk of security and integrity for large organisations, and these need to be addressed before CC. However, According to Cole et al. [65], “the current security concerns are over-rated”. Different countries have different types of security and privacy laws. These laws exist at various levels such as location, country, and national standards, creating a complex problem for cloud adoption. The risk involved in SME companies and large companies may vary. A large company has its own legal team that assists the company in doing the right thing diligence before entering into an agreement with a cloud vendor. Cloud computing makes the app look like shared service for all companies that use service data extraction can be a major challenge to slow down ERP implementation. Larger companies have more data transfers and outputs compared to SMEs [40,68].

Privacy

Data privacy is often mentioned in the literature as a concern for executives before moving to CC [56]. The dangers of privacy and security are among the most important concerns regarding cloud-based ERP solutions. In the ERP application model, sensitive data such as the financial and customer details of each business are kept within or below the company physical control area, security and access control policies. On the contrary cloud ERP model, organisation data is stored on servers available on outside company's premises. Companies will place greater emphasis on data and information security. They will do it make the appropriate process of choosing a vendor to meet their requirements. This can cost the company higher registration costs. SME prices sensitive and not aware of safety-related risks [40,68].

Vendor Lock-In/Dependency

Vendor lock-in is one of the perceived risks by most organisations as the risk of not being satisfied with a provider is substantial [18]. The concerns reside in safeguarding the data in a format that can be used with another vendor [56].

Regulatory and Legal Consequences

Regulatory and legal implications are perceived as enablers of CC adoption [69–71].

Interoperability Issues

According to Gholami et al. [34], migrating legacy systems to the cloud brings several concerns in interoperability, security and vendor lock-in. The fact is that legacy systems were not developed upon CC characteristics of elasticity, interoperability, cloud service model options and multi-tenancy. Another concern is the possibility that an organisation would like to move from one vendor to another. Thus, interoperability is perceived as a concern due to the lack of standards regarding applications and platforms.

2.1.7. Cloud ERP (C-ERP) in the Consumer Goods Industry

CC Enabling Agility

Enabling technologies in the consumer goods industry such as CC and in-memory utilization can avail organisations in three ways: firstly, companies are more agile and able to analyse mass data; secondly, companies can respond quickly to consumer behaviour; and thirdly, organisations are more connected with real-time information between customers and consumers [72]. CC enables technologies and differentiators to deliver the agility required by the changing demands of the market while being ahead of the competitors [73].

Paradigm Shift

Furthermore, CC represents a paradigm shift since it constitutes a business model innovation [74] where CC is a new opportunity to do business [54] as well as seeing it as virtualisation of IT provisioning and management of services [28]. Moreover, CC is a new paradigm as data are accessible to users anywhere, anytime, from any location via

a thin browser. Due to this, CC has the strength to become the next primary enabler of business innovation and serve a multitude of new services and models present in almost all industries [56].

Hybrid Cloud for Large Companies

Grubisic [1] has researched C-ERP's area with SMEs to conclude that the C-ERP hybrid model is not appealing to them as it would result in more costs. Furthermore, large companies are willing to embrace the hybrid cloud as companies find it an excellent strategy to lower costs while maintaining critical data safe. The decision model analytical hierarchy process (AHP) using a pairwise method shows that SMEs take cost-effectiveness, data and security, and service availability into consideration as the most common decision items.

Organisational Size

Although CC is an enabler of new business, the SMEs embrace this technology rapidly while large companies are slowly adhering to it [56]. The study of Johansson [18] investigated that C-ERP is related to organisational size. The study highlighted those inherent characteristics of the organisation, such as geographical activities and dispersion, might impact the perception of CC adoption. Moreover, it underlined that benefits are reaped by SMEs, whereas large companies may face other factors interfering with this such as a conservative mentality and issue with sensitive data in the cloud. SMEs can focus more on core business activities and business continuity, while large companies with many users may have more costs in the cloud than with ERP on premises. As a result, C-ERP allows SMEs to access advanced technology and a prompt answer to business-level volatility.

Current Research in One Industry

Additional research on CC [75] investigated the effects of organisation characteristics on infrastructure, personnel skill sets, strategy, size and external environment in the manufacturing industry from cement, glass, and ceramic sectors. Conversely, the research concludes that size is not a relevant factor in adopting CC, and organisations with more advanced infrastructures have more propensity to adopt CC. It is pertinent to note that both studies have different starting points. One from Johansson et al. [18] focuses on C-ERP and the organisation as a factor influencing CC adoption. In contrast, the other from Loukis et al. [75] focuses on CC in general. Although there are numerous benefits in adopting CC, the adoption is influenced by several factors such as political, economic, technical, organisational, cultural, and social. In the view of He et al. [56], the elements to move to CC need to consider the business, people, processes, technology, and organisation instead of considering to move an application to the cloud simply.

Industry Matters

Companies in different industries or operating in various markets may perceive C-ERP opportunities and concerns differently. Johansson et al. [18] recommended additional research on the number of ERP users. There might be a correlation between the number of users and CC adoption factors influencing the decision. According to Salim et al. [76], there is less complexity for small or medium-size companies to adhere to C-ERP.

C-ERP Competitive Pressure

According to Loukis et al. [75], high price competition leads to a reduction of operational and maintenance costs, which can be easily achieved with CC. C-ERP can be adapted easily in a company with modules that are standards (e.g., finance, purchase to pay, human resources, Customer Relationship Management (CRM)). The competitive pressure of price and quality competition is a hypothesis that has been tested, showing a direct correlation between competitive pressure and CC adoption.

2.1.8. Smart Manufacturing System for Industry 4.0

Information and communication technology both are developing rapidly, and many disruptive technologies, such as cloud computing, Internet of Things (IoT), big data, and artificial intelligence, have emerged. These technologies are pervasive in manufacturing industry and enable the integration of real and virtual worlds using cyber-physical systems (CPS), with the arrival of Industry 4.0. Extensive use of CPS in reduction facilities offer production and manufacturing to smart extent [9]. Industry Concept 4.0 in the manufacturing sector includes a variety of applications from product design to material management. The authors of [9] have developed a conceptual framework for the smart production industry system through intelligent design concepts, intelligent monitoring, intelligent machinery, intelligent control and smart planning.

The authors of [77] proposed a framework to meet the requirements of industry 4.0. The conceptual framework model is made up of five essentials business management ideas such as technology, sustainable development, co-operation and management strategy. The proposed model provides conditions that can be evaluated by companies in order to see readiness for industry 4.0. Extensive use of CPS in reduction facilities offer production and manufacturing to a smart extent [9]. Industry Concept 4.0 in the manufacturing sector includes a variety of applications from product design to material management. The authors of [9] have developed a conceptual framework for the smart production industry system through intelligent design concepts, intelligent monitoring, intelligent machinery, intelligent control and smart planning. Figure 4 below shows the benefits of combining cloud computing, ERP, Industry 4.0 and the fast moving consumer goods (FMCG) industry.

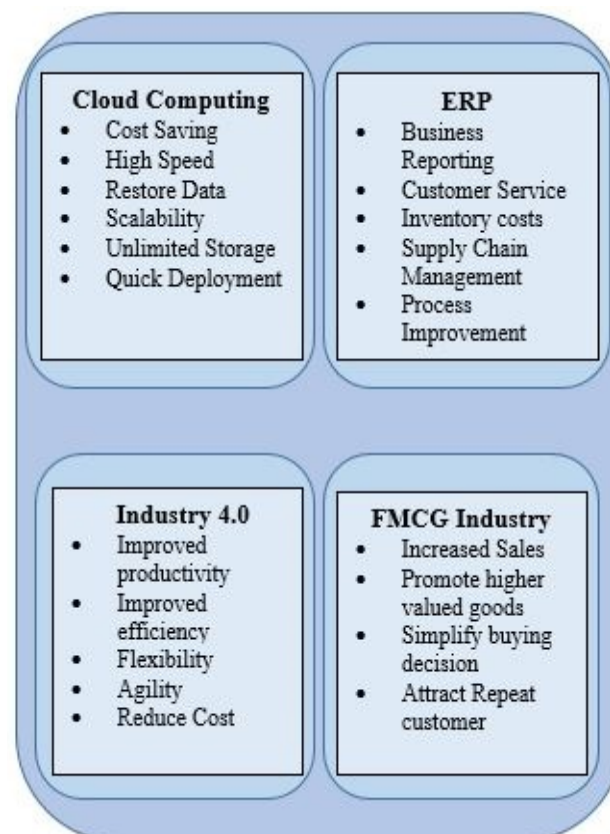


Figure 4. Benefits of combining cloud computing, ERP, Industry 4.0 and FMCG Industry.

Based on the structure outlined in Figure 4, the main motive of this study is to highlight the benefits of combining cloud computing, ERP, Industry 4.0 and the FMCG industry. In the subsequent Sections 2.1.1–2.1.8 the key aspects of the cloud paradigm shift, ERP and Industry 4.0 has been thoroughly discussed in terms of several aspects such as

cloud ERP service deployment models, opportunities and concerns, and cloud ERP in the consumer goods industry along with a smart manufacturing process in Industry 4.0. In the following sections, theories behind adoption factors for cloud computing along with popular adoption theories such as DOI and TOE have been discussed.

2.2. Theory

2.2.1. Theories behind Adoption Factors for CC

Several frameworks, such as TOE and DOI, have attempted to explain the factors that influence a decision to move to CC. These two theories are the basis for understanding this research for the adoption factor for cloud regarding innovation. The determination of the variables that influence the decision will be used to design the decision support tool.

Diffusion of Innovation (DOI)

The diffusion of innovation from Rogers [24] is a vital innovation theory utilised in information technology. It suggests five characteristics, as depicted in Figure 5 to explain the organisation's innovation model [45].

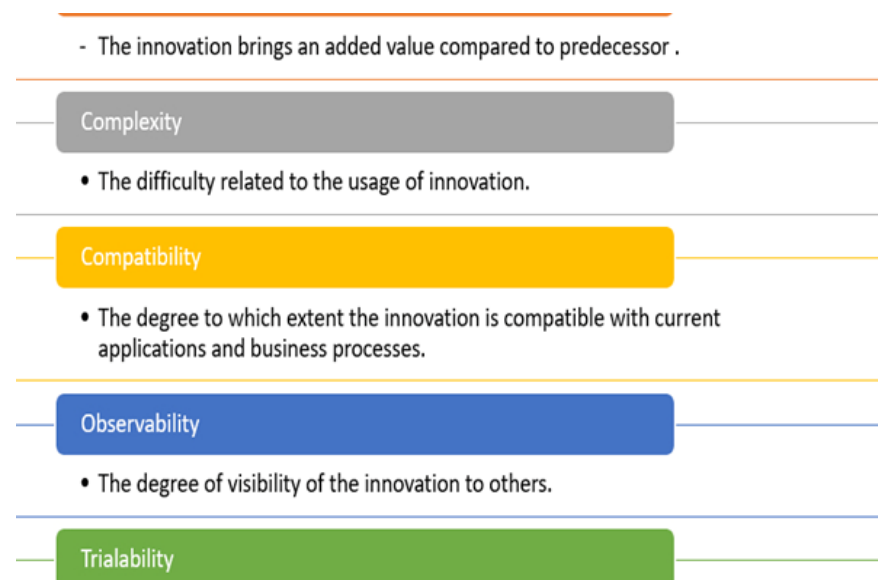


Figure 5. Diffusion of innovation (DOI) characteristics.

Rogers implies that innovation follows the communication process deplete in several channels within the social organisation. Three elements are subject to influence the adoption, due to leadership, internal and external traits of individuals from the organisation [17].

Technology Organisation Environment (TOE) Framework

The TOE framework from Tornatzky and Fleischer [13] refers to three elements of an enterprise that exert influence on the acceptance of innovation such as technology, organisation and environment instances. The technology instance refers to the internal and external technology available to the organisation and technologies that can be used for eventual adoption. The organisation element refers to the organisation's attributes qua structure, composition, resources and the communication process amongst employees [17].

The environment context refers to the external influence that an organisation may have related to competition, vendor support and regulations [78]. TOE is exempt from industry and organisation size restrictions [79] thus constituting a reference framework in the innovation research topic. Most of the research has been using a TOE framework or DOI to analyse the factors that influence CC. Martins et al. [80] recommended adoption of more than one theory to apprehend IT adoption. Hence, this research is based on two theories such as the DOI and TOE. Although available, other frameworks were not

taken into account as they focus more on the user level, which is not relevant for C-ERP decision-making process.

Research Model Construct

The research model construct has been elaborated upon a literature review on CC adoption factors using TOE [51,75,81] DOI [24,82] and in combined theories [12,17,60,83]. The main objective is to perform an analysis at the organisational level, hence TOE and DOI theories previously validated in the innovation arena. TOE and DOI factors provide the theoretical framework to build the research model. Each research construct is contributing as an opportunity or a concern in the C-ERP adoption model.

Table 3 lists the studies area and supportive theories in CC adoption factors, narrowed when possible to the research topic C-ERP and per industry. The topics C-ERP highlighted with an asterisk (*) do not have much research compared to CC. Most of the researches are related to TOE/DOI [12,60,81] and the Theory of Planned Behaviour (TPB) [7,44,76,87]. According to Albar and Hoque [60], TOE/DOI is the chosen model to investigate the C-ERP adoption factors and defines a quantitative research method where 12 variables are identified along with 39 measurement items. Security is considered an independent variable that is part of the research model's technology context due to CC concerns in this area. The 12 variables are:

1. Relative advantage.
2. Compatibility.
3. Complexity.
4. Observability.
5. Trialability (first five (1–5) attributes are part of DOI characteristics).
6. ICT infrastructure.
7. Security.
8. ICT expertise (next three (6–8) are part of technology).
9. Organisation culture.
10. Top management support (9–10 are part of organisational context).
11. Competitive pressure.
12. Vendor support (11–12 are part of environment context).

Table 3. Cloud ERP (C-ERP) adoption factors in theories and industries.

Study Topic	Theory Construct	Industry	Methodology	Literature Reference
Cloud ERP determinants *	Technology Organisation Environment (TOE)/ Diffusion of Innovation (DOI)	Not Specified	Quantitative	[12,19–21,60,84]
ERP SaaS *	TOE	Not Specified	Qualitative	[7,81]
Cloud Computing adoption Factor	TOE/DOI	Glass manufacturing firms, ceramic and cement sector	Quantitative and Qualitative	[19–21,63,75,85]
Cloud Computing determinants	TOE/DOI	Manufacturing and Services	Quantitative	[7,80,85]
Drivers of Cloud ERP from the institutional perspective *	Theory Planned Behaviour (TPB)	Not mentioned	Quantitative	[44,84]

Table 3. Cont.

Study Topic	Theory Construct	Industry	Methodology	Literature Reference
Knowledge management based Cloud Computing adoption decision-making framework	TOE/DOI	Retail, telecommunication and ICT	Quantitative and Qualitative	[7,86]
Determinants of Cloud Computing adoption using a TAM-TOE model	Technology Acceptance Model (TAM) /TOE	IT, Manufacturing and Services	Quantitative	[7,70,79,85]
SMEs adoption Cloud ERP *	TPB	Electrical, Financial Services, design consultancy, manufacturing, construction and others	Quantitative	[19–21,63]
Cloud ERP * adoption	TPB	Not mentioned	Qualitative	[7,19–21,84]
Adoption of SaaS	TOE/DOI	Not mentioned	Quantitative	[63,83,85]
SaaS Diffusion	TOE/DOI/Industrial Theory	Services, manufacturing, commerce, construction, health and ICT	Quantitative	[80,85]

Conversely, Seethamraju [81] performs research in ERP as SaaS based on a qualitative research method and the TOE model along with nine variables. The variables influencing the adoption are the benefits in the costs change the structure, vendor support, vendor reputation, and co-create value. Finally, according to TOE and DOI, there is not so much academic research on C-ERP adoption factors; hence, the research model of the selection of operational variables is extended to CC TOE and DOI research. Combining these two theories for CC innovation employs the predictors that may also influence C-ERP adoption. The proposed research model regarding variables is depicted in Figure 6.

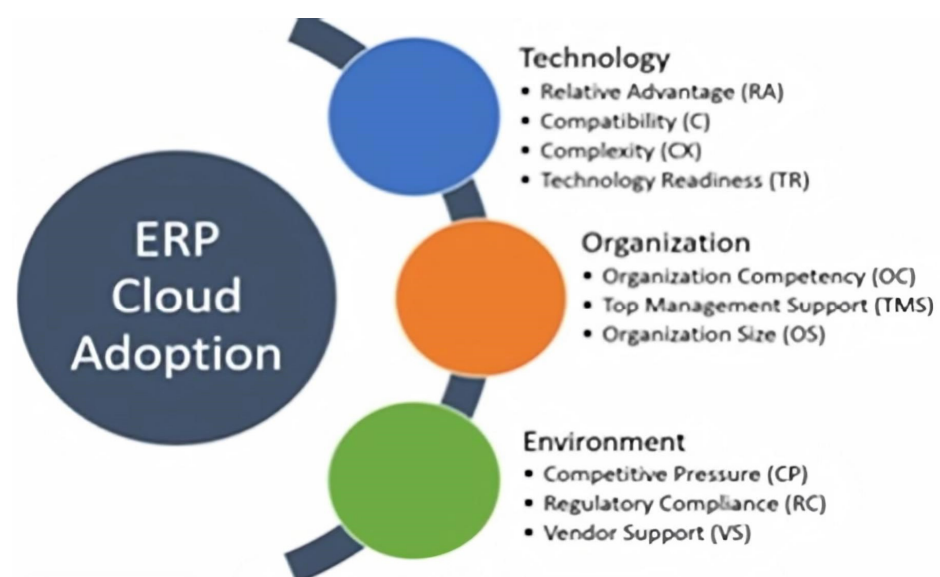


Figure 6. Research model factors.

The technology factors relevant to this study are:

1. **Relative Advantage (RA):** relative advantage innovation brings in terms of efficiency, agility, scalability of resources as well as economic [17,88]. It can also be seen as an advantage compared to competitors [81]. This variable is often determined in the literature as having a positive effect on the adoption of CC [12,17,26,78].
2. **Compatibility (C):** this is related to the degree of compatibility with the existing infrastructure system in terms of data, process and vendor compatibility [78,82]. This variable is also having a positive effect on the adoption of CC [17,26].
3. **Technology Complexity (CX):** this may hinder the C-ERP adoption in opposition to the rest of the variables [17,26,60,82].
4. **Technology Readiness (TR):** this is defined as the required infrastructure and knowledge available in the organisation to implement C-ERP [17]. This variable is also having a positive effect on the adoption of CC [26].

The organisation factors include the following:

1. **Organisation Competency (OC):** this is also known as organisation readiness [12,60,75] which is defined as the technical and managerial skills required to adopt C-ERP [26].
2. **Top Management Support (TMS):** this is defined as a predictor or support and commitment from management regarding the innovation [17]. According to Hsu and Lin [51] should also be taken into account for adoption in future.
3. **Organisation Size (OS):** this is defined as a variable that positively influences the C-ERP adoption. This variable brings some controversy as some authors have identified OS as a predictor influencing the CC decision [17] whereas Hsu and Lin [51] have rejected it.

The environmental factors are described as following:

1. **Regulatory Compliance (RC):** this is a predictor of government and regulation policies that safeguard organisations' interest in adopting CC [26,51].
2. **Competitive Pressure (CP):** this is a predictor in the consumer goods industry facing price competition and seeking a continuous competitive advantage. Technology such as CC can help to reduce operational costs or provide the opportunity to set up a new business without increasing cost [75].
3. **Vendor Support (VS):** the vendors support a company to adopt C-ERP [26].

Table 4 illustrates the variables according to TOE and DOI adoption theories that directly affect the intention of CC.

Table 4. Theories and variables.

Construct Theory	Variable	References
DOI	V01. Relative Advantage (RA)	[12,17,26,51,60,78–81]
DOI	V02. Compatibility (C)	[17,26,74,75,78,80,81,89]
TOE	V03. Technology Complexity (CX)	[17,26,67,78–80,82,89]
DOI	V04. Technology Readiness (TR)	[17,26,51,81,90]
TOE	V05. Organisation Competency (OC)	[12,60,75]
TOE	V06. Top Management Support (TMS)	[12,17,60,79]
TOE	V07. Organisation Size (OS)	[17,18,51,75]
TOE	V08. Regulatory Compliance (RC)	[12,17,51,60]
TOE	V09. Competitive Pressure (CP)	[12,17,60,75,79]
TOE	V10. Vendor Support (VS)	[26,59,91]

The statistical significance of the variables may differ per technology context, organisation size and country study. Thus, Gangwar et al. [79] recommend research to incorporate variables that may have been rejected in a determined set of research topics and/or circum-

stances. Next, ERP CC adoption factors have also been an interest in the decision-making process to understand whether it would make sense for an organisation to adhere to C-ERP from the organisational perspective.

2.2.2. Decision-Making Process Theories

The decision-making process varies between an SME to a large enterprise. The SMEs tend to adopt a quick and straightforward decision as the ownership lies in one person's hands. In comparison, the complexity of ERP in a large company requires a more in-depth analysis supported by an analysis of different options and choosing the best alternative. The decision-making process is very similar to a problem-solving process. The first point is to understand the organisation's problem, then search for solutions or develop alternative scenarios before choosing predefined criteria. The rationale is that the size of a company is directly related to the complexity of the decision. For an SME, an intuition model might be developed. In comparison, for a large company, a structured decision-making process might take place supported by Herbert Simon's model and the theory of bounded rationality [92].

Intuition model: this model is commonly used in SMEs, where the manager recognises the problem and consults internal and external stakeholders to reach out a decision [92]. Simultaneously, this intuition model may be used in a large organisation when it requires a drastic change of strategy.

Herbert Simon theory: in opposition to the intuition model, Herbert's Simon theory (1960), requires a three-stage approach: intelligence, choice and design. The first stage of intelligence consists of collecting data, identifying the problem, classifying the problem, and defining the "problem statement" [92]. The second stage refers to a design that includes criteria selection, searching for solutions, and predicting events. The choice phase relates to the selection of the best option possible to a sensitivity analysis. The outcome of choice, if unsatisfactory may lead to a design phase to explore other options. According to Elragal et al. [93], more than 50% of the decisions on average made by individual choice makes employing a decision-making process a failure. Thus, Elragal et al. [94] suggest a to embed crowdsourcing in ERP to improve the decision-making process as it would improve the phases of intelligence and choice.

Analytic hierarchy process methodology: Grubisic [1] researched the decision-making process, where he used the AHP to calculate the recommended service deployments upon 18 decision elements. For this research, following construct research on the factors that hinder or influence CC adoption, the AHP process will be used in the DSS tool.

The literature review performed in this section on perceived opportunities and concerns constitutes the pillars for developing a DSS tool to enable decision-makers to understand the variables that influence a decision to adopt C-ERP. The consumer goods industry faces the pressure of quality of service and/or low prices, thus adopting technology such as CC to gain competitive advantage. This discussion is the foundation for analysis and design to comprehend the elements that incite decision-makers to adopt C-ERP in the consumer goods industry and define the variables necessary to design the decision support tool. The next section depicts the analysis and design of the research and a data plan analysis of the results.

3. Analysis and Design

This study's research process comprehends a systematic approach to planned activities to determine the factors influencing the C-ERP decision. The aim is to collect the factors that serve as a basis for diverse stakeholders' decision-making process. The ultimate goal is to design the DSS tool shaped for the consumer goods industry. The research method involves quantitative data and the strategy to collect data through an online survey questionnaire. The TOE framework theory laid the foundations to formulate the variables and hypotheses. This section outlines the research method and design, target population, research data strategy collection, statistical analysis, assumptions and limitations.

3.1. Research Method and Design

The research method is based on quantitative research. The data generation method is the survey questionnaire using theoretical foundations such as TOE and DOI [12,60].

3.1.1. Quantitative Research

In scientific research, the most known research methods amongst academia are quantitative and qualitative research. Quantitative research is conducted to gather data for the project in opposition to qualitative research that is typically based on understanding their own experiences. Quantitative research aims to measure one reality under targeted measurement, concisely analyse data, determine relationships between variables and understand differences and similarities for the targeted population. The sample needs to represent the targeted population, and the reliability and validity of measurement are relevant items. The survey questionnaire aimed to detect further issues related to the factors that influence C-ERP adoption and understand the decision-making process. The number of respondents was 200 initially, but only 109 responses were considered as valid.

3.1.2. Research Model Adoption

The research model based on the TOE and DOI [12,60] identified 10 independent variables and one dependent variable where the independent variables were: relative advantage, complexity, compatibility, technology readiness, organisation competency, organisation size, regulatory compliance, competitive pressure and vendor support. The dependent variable was C-ERP adoption. Figure 7 represents the research model diagram.

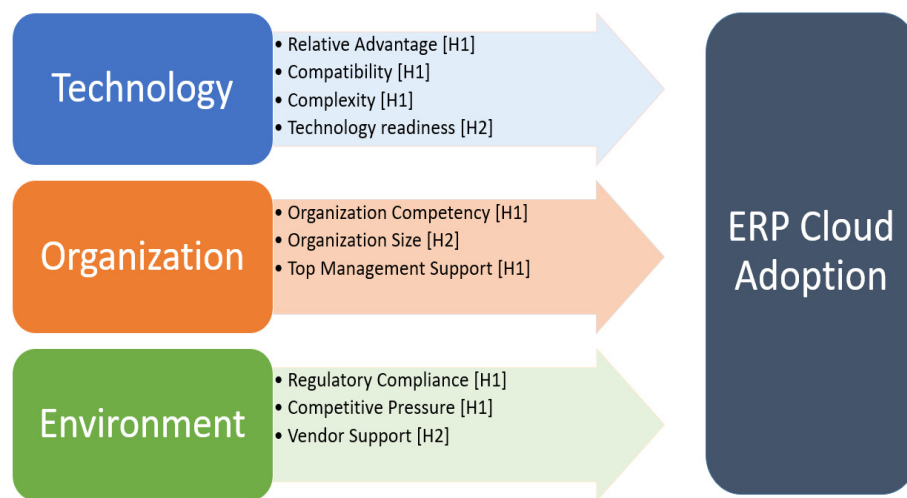


Figure 7. Research model.

3.2. Research Setting

This research aims to collect data from decision-makers and staff within the consumer goods industry in the United States.

3.2.1. Target Population

Panel services were requested to Survey Gizmo to have decision-makers participating in the survey. The objective was to use the panel services to gather data mainly from decision-makers in the consumer goods industry in the United States. The online survey questionnaire was sent to collect the adoption factors that influence C-ERP and understand the decision-making characteristics to elaborate a decision support tool that can support decision-makers in migrating ERP to the cloud within the consumer goods industry.

3.2.2. Sample Size

The number of participants was defined to a minimum of 100 respondents to ensure statistical significance. The research adheres to the characteristics of non-probability sampling, which is depicted in Figure 8.

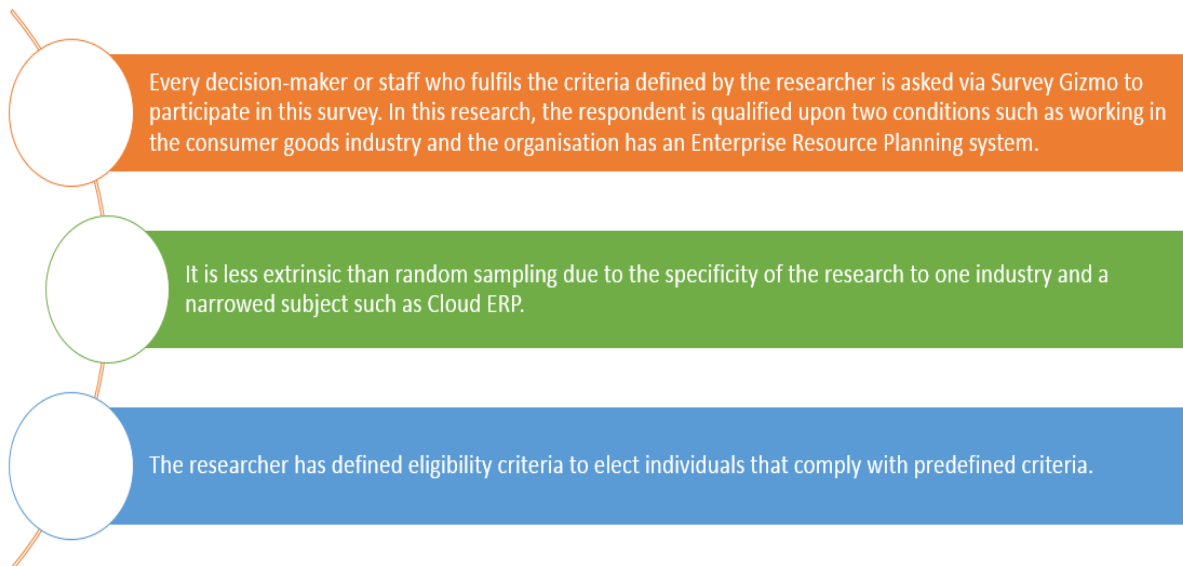


Figure 8. Research sampling.

3.3. Research Data Collection Instrument

3.3.1. Questionnaire Characteristics

The questionnaire allows gathering data from a variety of decision-makers and professionals during a limited period. Moreover, the data collected have been treated anonymously, allowing respondents to provide answers without fear of being identified.

3.3.2. Questionnaire Development

Table 5 below illustrates the variables based on the adoption theories of TOE and DOI that have a direct impact on the CC adoption intention and the references.

Table 5. Hypothesis design.

Survey Item	Hypothesis	References
H1.01. Relative Advantage (RA)	H1.01. Higher Levels of Relative Advantage will be positively related to the adoption of Cloud ERP.	[12,17,26,51,60,78–81]
H1.02. Compatibility(C)	H1.02. Higher Levels of Compatibility will be positively related to the adoption of Cloud ERP.	[17,26,74,75,78,80,81,89]
H1.03. Technology Complexity (CX)	H1.03. Higher Levels of Technology Complexity will be negatively related to the adoption of Cloud ERP.	[17,26,67,78–80,82,89]
H2.04. Technology Readiness (TR)	H2.04. Technology Readiness has a direct positive impact on the adoption of Cloud ERP.	[17,26,51,81,90]
H1.05. Organisation Competency (OC)	H1.05. Higher Levels of Organisation Competency will be positively related to the adoption of Cloud ERP.	[12,60,75]
H1.06. Top Management Support (TMS)	H1.06. Top Management Support will have a positive impact when adopting Cloud ERP.	[12,17,60,79]
H2.07. Organisation Size (OS)	H2.07. Organisation Size has a direct positive impact on the adoption of Cloud ERP.	[17,18,51,75]

Table 5. Cont.

Survey Item	Hypothesis	References
H1.08. Regulatory Compliance (RC)	H1.08. Higher Levels of RC will be positively related to the adoption of Cloud ERP.	[12,17,51,60]
H1.09. Competitive Pressure (CP)	H1.09. External Competitive Pressure has a direct positive impact on the adoption of Cloud ERP.	[12,17,60,75,79]
H2.10. Vendor Support (VS)	H2.10. Vendor Support has a direct positive impact on the adoption of Cloud ERP.	[26,59,91]

3.3.3. Questionnaire Measurement

The research was elaborated to employ an online questionnaire to gather data from the panel services. The survey items for the project research were retrieved from preceding research. Table 6 indicates the sources of the measurement items considered for the survey. The measurement items in the questionnaire are shown in Figure 9 and the survey structure in Figure 10.

Table 6. Survey item measurement.

Construct	Survey Item	References
Relative Advantage (RA)	<p>RA1—the adoption of cloud ERP brings cost saving to our organisation.</p> <p>RA2—the adoption of cloud ERP improves our operations in terms of business continuity and disaster recovery plan.</p> <p>RA3—the adoption of cloud ERP increases the ability to perform tasks.</p> <p>RA4—the adoption of cloud ERP contributes to scalability and flexibility of resources.</p>	[12,17,26,51,60,78–81]
Compatibility (C)	<p>C1—current infrastructure in terms of hardware and software is compatible with cloud ERP.</p> <p>C2—the adoption of cloud ERP is in line with the values from our organisation</p> <p>C3—the adoption of cloud ERP is compatible with the operations from the organisation.</p>	[17,26,74,75,78,80,81,89]
Technology Complexity (CX)	<p>CX1—the migration of existing ERP to cloud ERP is too complex.</p> <p>CX2—the skills required to adopt cloud ERP is too complex for the organisation.</p> <p>CX3—the cloud ERP is frustrating the users when using the system</p> <p>CX4—data security and confidentiality are a major concern when adopting cloud ERP.</p>	[17,26,67,78–80,82,89]
Technology Readiness (TR)	<p>TR1—a mature ICT infrastructure is an incentive to cloud ERP.</p> <p>TR2—the organisation has required managerial and technical skills to adopt cloud ERP.</p>	[17,26,51,81,90]
Organisation Competency (OC)	<p>OC1—the adoption of cloud ERP is influenced by the cloud ERP knowledge available in the organisation.</p> <p>OC2—the culture of the organisation is pro-innovation and supports the adoption of cloud ERP.</p>	[12,60,75]
Top Management Support (TMS)	<p>TMS1—the organisation’s management supports the implementation of cloud ERP.</p> <p>TMS2—top management provides strong leadership and engages the necessary resources for the adoption of cloud ERP.</p> <p>TMS3—top management is willing to accept the financial and operational risks involved in the adoption of cloud ERP.</p>	[12,17,60,79]
Organisation Size (OS)	<p>OS1—the larger is the organisation; the higher is the adoption of cloud ERP.</p> <p>OS2—larger organisations are more likely to make a financial investment in the adoption of cloud ERP.</p>	[17,18,51,75]

Table 6. Cont.

Construct	Survey Item	References
Regulatory Compliance (RC)	<p>RC1—government policies are providing incentives to your organisation for the adoption of cloud ERP.</p> <p>RC2—current law and regulations are sufficient to protect the adoption of cloud ERP.</p>	[12,17,51,60]
Competitive Pressure (CP)	<p>CP1—our organisation believes that the price competition pressure to reduce operation and maintenance cost is an incentive to adopt cloud ERP.</p> <p>CP2—quality competition in delivering better products and services is an incentive to adopt cloud ERP.</p> <p>CP3—the competition in our sector has already been adopted cloud ERP.</p>	[12,17,60,75,79]
Vendor Support (VS)	<p>VS1—our vendors provide the technical support for the adoption of cloud ERP.</p> <p>VS2—our vendors contribute with skilled professional for the adoption of cloud ERP.</p> <p>VS3—our vendors provide skilled training to our staff adoption of cloud ERP.</p>	[26,59,91]

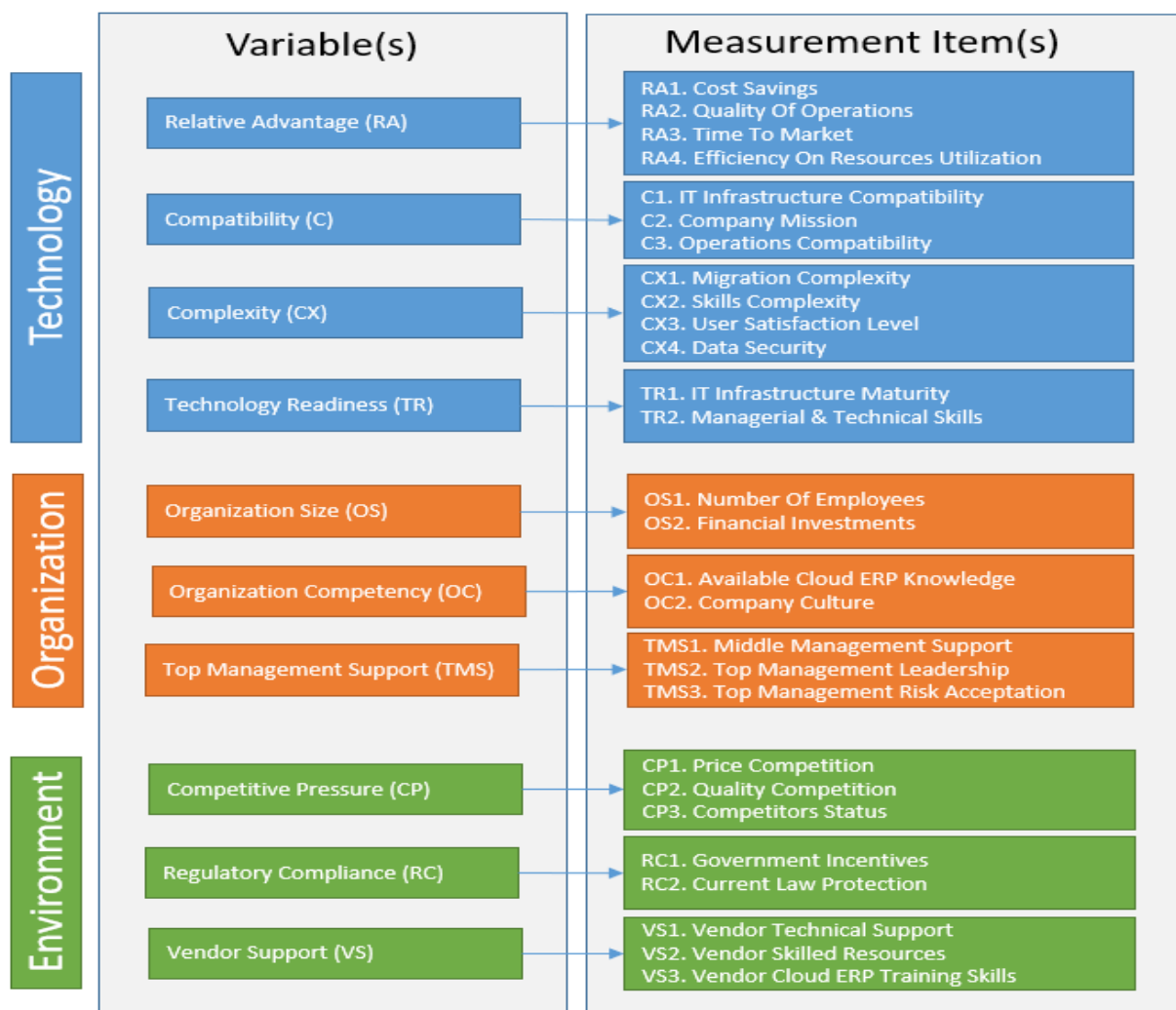


Figure 9. Measurement item.

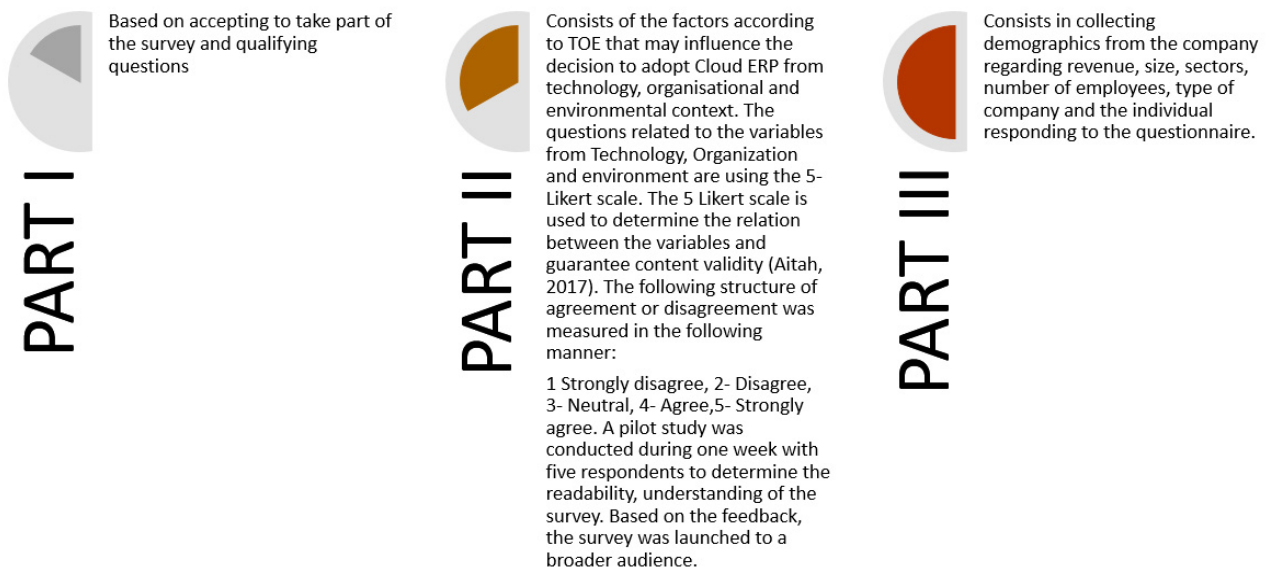


Figure 10. Survey structure.

3.4. Research Instrument Analysis

The reliability analysis is a statistical measure that assesses the internal consistency of data collected from a survey questionnaire. Cronbach's alpha measure is a statistical measure that aims to collect the value of the construct. If the value is more than 0.7, it is considered as reliable.

According to Chen [95], a regression analysis permits understanding the relationships between the dependent variable and independent variables. Each survey requests the informed consent of each participant. Moreover, the data gathered from the survey questionnaire were stored in Survey Gizmo with a secure password. Downloading of the data from Survey Gizmo was executed securely and loaded into SPSS. The storage of the data is located on a secure drive.

4. Implementation

The quantitative research process was based on TOE and DOI, the theoretical model to support the research of factors influencing C-ERP decisions. The project implementation consisted of gathering data from the consumer goods industry's decision-makers in the United States. Survey Gizmo identified the decision-makers via eligibility criteria on the consumer goods industry, ERP within the company and job role. A pilot test was conducted before the launch of the survey to identify any significant roadblocks. The data collected served as input to build the decision support tool based on the Analytic hierarchy process.

4.1. Research Participants Selection

The research participants were selected via panel services from Survey Gizmo. The researcher defined the decision-makers' eligibility criteria as part of the consumer goods industry, decision-makers, and being close to the ERP system purchasing. In total, 200 respondents participated in the survey, and 109 respondents were considered as valid responses.

4.2. Research Data Collection

Before collecting data, decision-makers were asked to give their consent via the Personal Information Sheet to participate in the survey. For the collected data, anonymity and confidentiality were guaranteed as survey gizmo does not collect personal information. The data gathered from the survey questionnaire were initially located in the Survey Gizmo application.

4.3. Research Data Analysis

The data were extracted from Survey Gizmo in format SPSS and loaded into SPSS v.24. A test on the reliability was performed to check the internal consistency of the measurement. The measurement used was Cronbach’s alpha as a value higher than 0.7 signifies that the measurement is reliable. Next, regression analysis was done to check the relationships between the dependent and ten independent variables where the confidence interval was researched.

4.4. IT Artefact Realisation

The IT artefact was developed under the spiral methodology to allow short and frequent releases. The theoretical model used was a multi-criteria decision named AHP to determine the service model and service deployment model based on pairwise comparisons. The judgements were then evaluated where the answers’ consistency was established to determine the main priorities amongst all elements [96]. Based on the AHP elements, the following goals, criteria and alternatives were defined for both models as depicted in Figures 11 and 12.

The DSS was built in Microsoft Excel following the AHP analysis. Each criterion was defined in sub-criterion and compared through a wise pair comparison using the Saaty (1991) comparison scale described in Table 7.

Table 7. Comparison scale [97].

Scale	Degree of Preference
1	Equal importance
3	Moderate importance of one factor over others
5	The strong or essential importance
7	Very strong importance
9	Extreme importance
2, 4, 6, 8	Values for inverse comparison

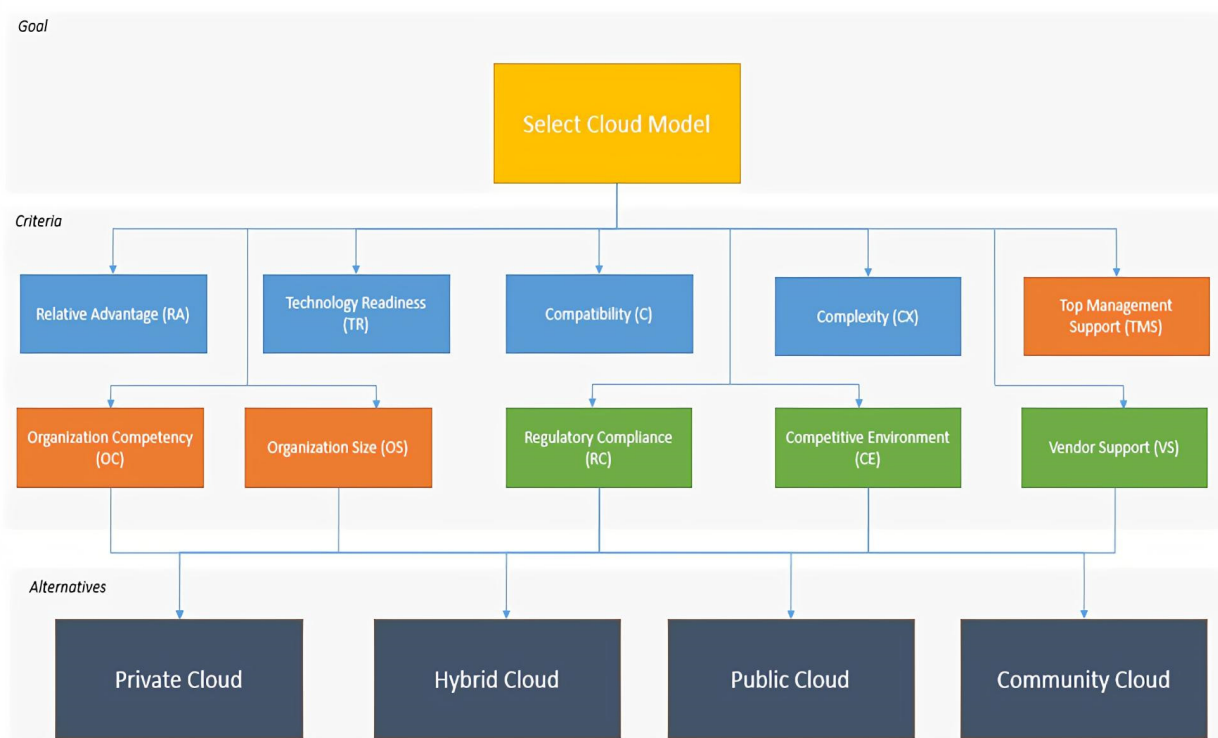


Figure 11. Cloud deployment model.

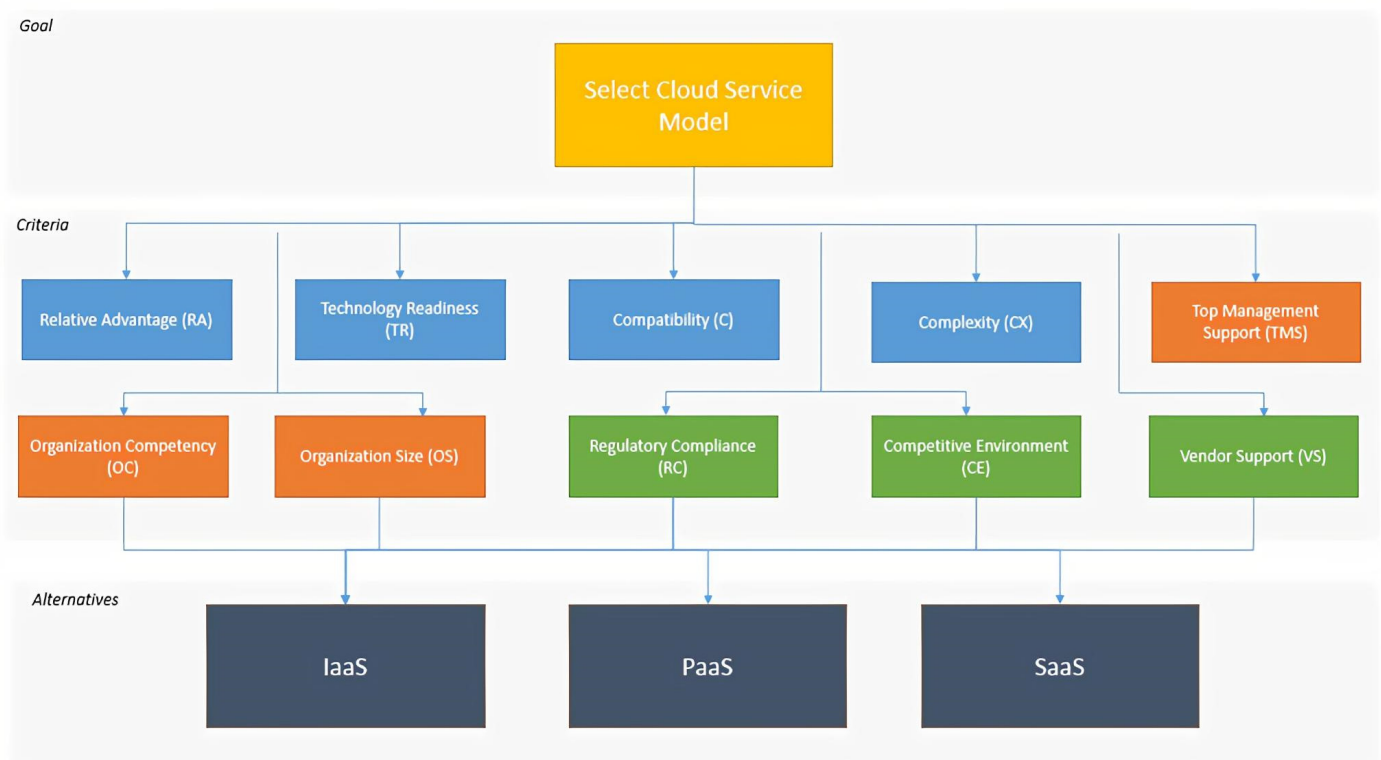


Figure 12. Cloud service model.

Since not all the criteria have the same weight, to calculate each criterion's weights, the AHP approximate method was used where the comparison tables were normalised to obtain the final weights. Nevertheless, because subjective preferences determine the criteria's importance, there will always be some level of inconsistency measured by AHP through the consistency ratio which compares the consistency index to the consistency index of a random-like matrix [97]. The consistency ratio is defined and made available for every factor used in the decision support tool. Its value would show the user on the level obtained and the possible need to re-evaluate the comparisons to optimise the final value.

5. Results and Evaluations

The designation of the opportunities and concerns influencing C-ERP as an effective resource in the consumer goods industry was one of this research's objectives. The research framework identified 10 independent variables ranging from relative advantage, compatibility, complexity, technology readiness, organisation competency, organisation size, competitive pressure and vendor support. The dependent variable was defined as C-ERP adoption. The second research question was based on demographics to understand the current situation and plans regarding adopting C-ERP service and deployment models. The last research question was related to the decision-making process with IT artefact to deliver a decision support tool towards decision-makers to support them in deciding whether to adopt C-ERP. The decision tool aimed to provide output regarding the service model and deployment for the decision-makers.

5.1. Statistical Analysis of Survey Population Demographics

The data were downloaded from Survey Gizmo and loaded into the tool SPSS v20 to perform statistical analysis. In total, 200 respondents participated, and, 109 responses were validated against completeness and eligibility criteria. The margin of error was 9%, taking into account the total population of 43.1 million small and medium businesses/companies in the United States (Worldbank, 2020).

5.1.1. Sector Industry

The industry sector analysis attempted to analyse fast-moving consumer companies versus slow-moving consumer goods companies. The fast-moving consumer goods represented 63.3% of the population’s respondents. In comparison, the slow-moving consumer goods represented 36.7%. The fast-moving consumer goods comprised all items except for furniture and home improvement as depicted in Figure 13.

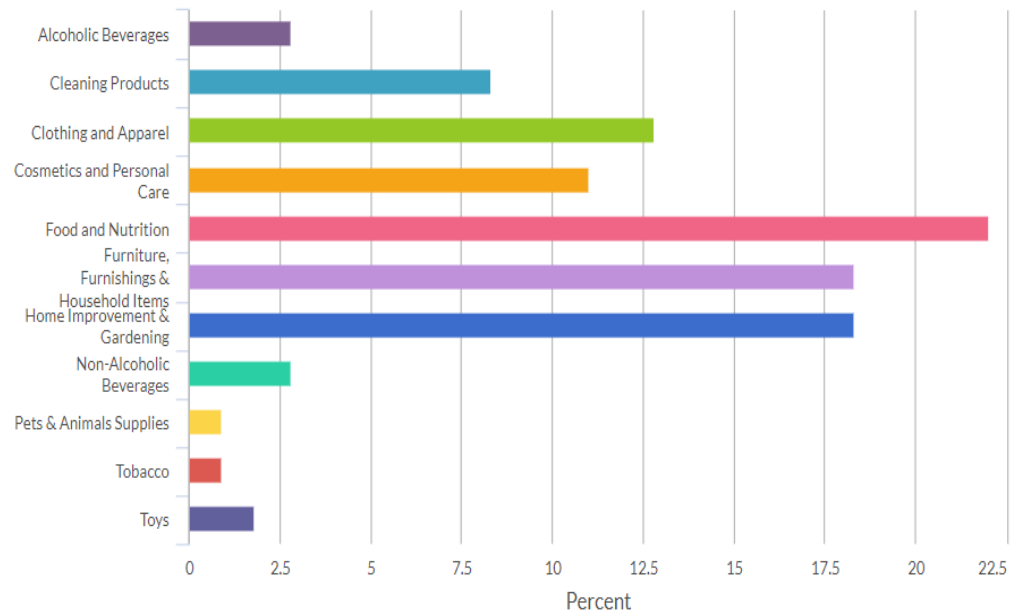


Figure 13. Demographics of Organisations’ sector.

5.1.2. Geographic Footprint

The graph indicates that most organisations were mainly located in North America with 78%, followed by a global presence with 22% and Europe with 22% as depicted in Figure 14.

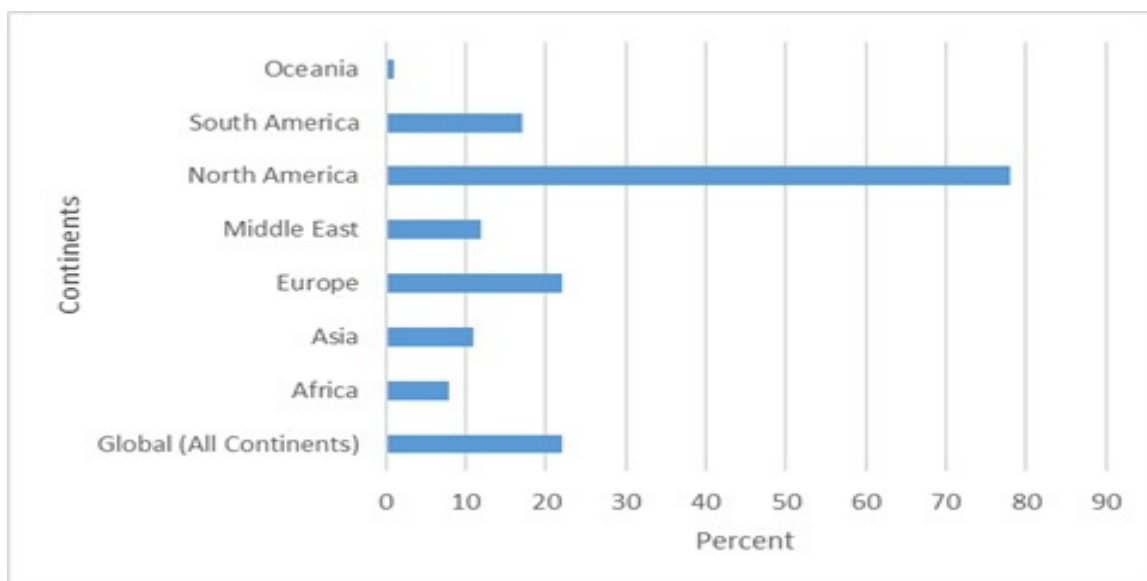


Figure 14. Demographics of geographic footprint.

5.1.3. Organisation Size

Figure 15 indicates that the population mainly included mid-size companies with 50.5%, followed by large companies with 46.8%, while small companies represent only 2.8%.

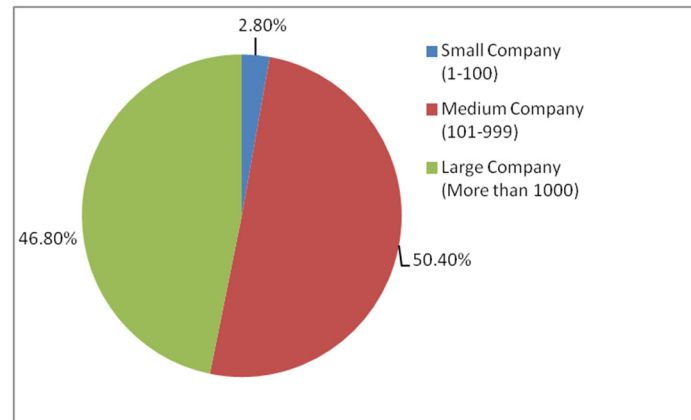


Figure 15. Organisation size.

5.1.4. Organisation Revenue

Figure 16 shows that the respondents' organisations had 62.4% of revenue between 50 million and 1 billion dollars, followed by 24.8% with more than 1 billion and 12.8% less than 50 million dollars.

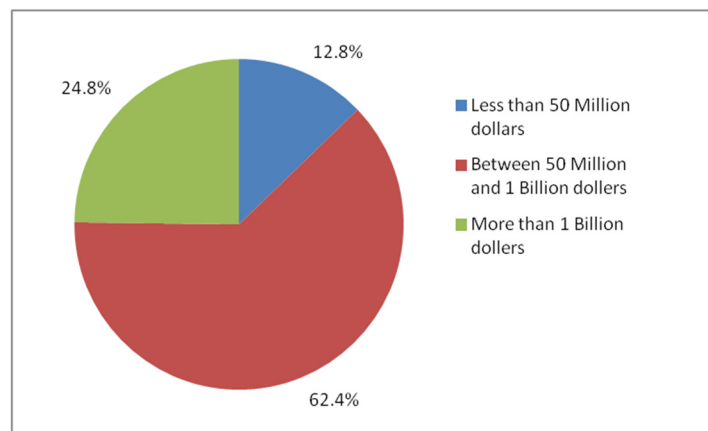


Figure 16. Organisation revenue.

5.1.5. Job Profile

Figure 17 indicates the respondents' job profile was 98.2% part of the decision-making process, which shows a good quality of data. The respondent's part of the strategic decision was 45.9% (Top Level Executive, Senior Vice President, Vice President, and Owner), 35.8% at the tactical level (Director) and 18.3% at the operations level (Manager and Professional).

5.1.6. Service Models

Figure 18 indicates that decision-makers had mainly adopted infrastructure as a service in C-ERP with 73.4% of responses, followed by platform as a service and software as a service with 68.8% respectively. The findings align with ERP IaaS and SaaS, where decision-makers can benefit from CC while maintaining their own ERP or merely using ERP SaaS in midsize companies.

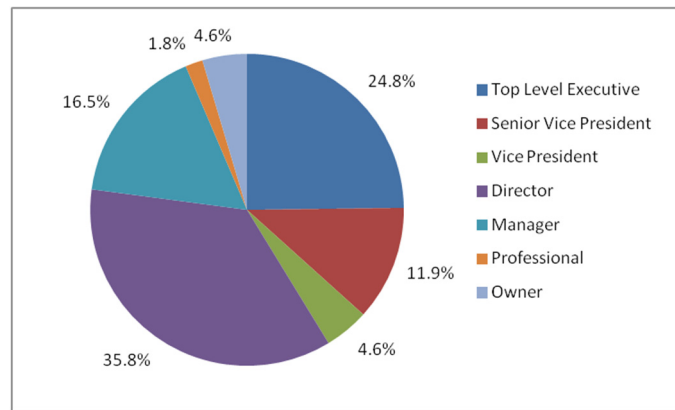


Figure 17. Respondents' Job Profile.

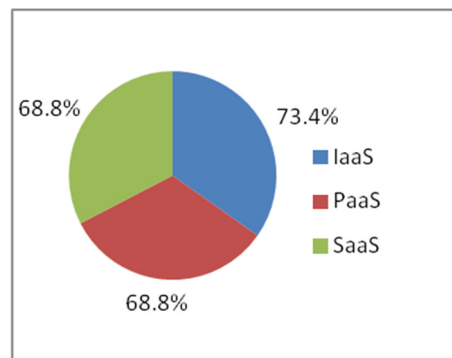


Figure 18. Cloud ERP (C-ERP) service models adoption.

5.1.7. Service Deployment Models

Figure 19 indicates that decision-makers in the consumer goods industry had mainly adopted or plan to adopt private deployment with 73.4%, followed by hybrid deployment with 45%, 33% with public and 11.9% with the community. The findings align with the literature where large companies tend to adopt a private cloud for mission-critical systems. The hybrid model (45%) is often used for large companies to balance costs and security.

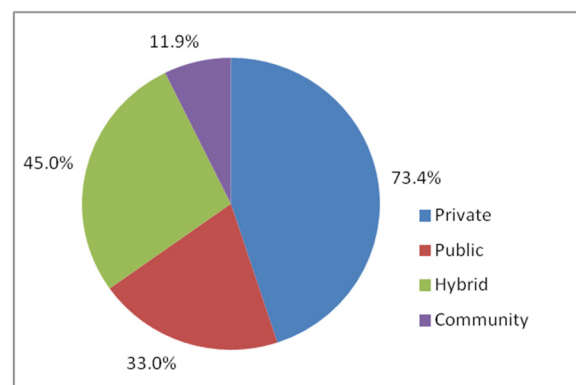


Figure 19. Cloud ERP (C-ERP) service models deployment adoption.

5.2. C-ERP Factors Statistical Analysis

5.2.1. Relative Advantage (RA)

The four items considered for relative advantage (RA1-RA4) are listed in Table 6. As depicted in Table 8, the total respondents to RA1 item identified C-ERP as a cost-saving were 93.5% where 2.7% disagreed, and 3.8% remained neutral. The results align with the

academic literature where cost savings is often one of the opportunities mentioned to adopt CC [33]. The respondents to RA2 item expressed their agreement with 93.6%, 3.7% were neutral, and 2.7% in disagreement. The results are in line with the academic literature where adopting C-ERP allows an improvement in the operations' effectiveness by ensuring business continuity and improved disaster recovery plans [55,98].

Table 8. Analysis of the effect of research factors considered for the survey.

Research Factors		Strongly Disagree (1) (%)	Disagree (2) (%)	Neutral (3) (%)	Agree (4) (%)	Strongly Agree (5) (%)
Relative Advantage (RA)	RA1	1.8	0.9	3.8	55.0	38.5
	RA2	1.8	0.9	3.7	45.0	48.6
	RA3	0.9	0.9	6.4	47.7	44.1
	RA4	0.9	0	6.4	49.6	43.1
Technology Complexity (CX)	CX1	3.7	21.1	12.8	36.7	25.7
	CX2	7.3	20.2	11.9	33.9	26.6
	CX3	5.5	20.2	13.8	32.1	28.4
	CX4	1.8	10.2	12.8	39.4	35.8
Technology Compatibility (TC)	TC1	0	0	6.4	55.0	38.6
	TC2	0	0	6.4	41.3	52.3
	TC3	0	0	4.6	42.1	52.3
Technology Readiness (TR)	TR1	0	0	8.3	50.4	41.3
	TR2	0	1.8	6.5	44.0	47.7
Organisation Competency (OC)	OC1	0.9	0	10.1	59.6	29.4
	OC2	0	0.9	8.3	50.4	40.3
Top Management Support (TMS)	TMS1	0	0.9	10.1	45.9	43.1
	TMS2	0	0	11.0	46.8	42.2
	TMS3	0	0	9.2	55.0	35.8
Organisational Size (OS)	OS1	0	2.8	13.8	53.2	30.3
	OS2	0	0	9.2	54.1	36.7
Regulatory Compliance (RC)	RC1	0.9	4.6	16.6	33.9	44
	RC2	0.9	1.8	11.9	48.9	36.7
Competitive Pressure (CP)	CP1	0	0.9	5.5	61.5	32.1
	CP2	0	0	9.2	45.0	45.8
	CP3	0	2.8	11.0	53.2	33.0
Vendor Support (VS)	VS1	0	0	9.2	57.8	33.0
	VS2	0	0.9	6.4	50.5	42.2
	VS3	0	0	15.6	49.5	34.9

The respondents to the RA3 item expressed their agreement with 91.8% whereas 6.4% were neutral and 1.8% disagreed. The results align with the academic literature where C-ERP allows to release faster new functionality [81]. The respondents to RA4 item expressed their agreement massively with 92.7%, 6.4% were neutral, and 0.9% in disagreement. The results are in line with the academic literature where CC is often associated with the possibility of infrastructure scalability, allowing optimum resource usage [31,33,36,50].

The findings confirm the hypothesis H1.01 that C-ERP brings a relative advantage in efficiency terms when organisations adopt C-ERP.

5.2.2. Compatibility (C)

The three items considered for Technology Compatibility (C1–C3) are listed in Table 6. As depicted in Table 8, the respondents to C1 item expressed their agreement with 93.6% whereas 6.4% were neutral. The results are in line with the academic literature where the compatibility of innovation is a factor that influences the adoption of C-ERP [20,64]. The respondents to C2 item expressed their agreement with 93.6% whereas 6.4% were

neutral. The results are in line with the academic literature, where the compatibility of the technology is relevant to be compatible with the organisation's mission and values [74]. The respondents to C3 item expressed their agreement with 95.4% whereas 4.6% remained neutral. The results align with the academic literature where adopting a new technology compatible influences the adoption.

The findings confirm the verification of the hypothesis H1.02 that C-ERP is compatible with organisations operations.

5.2.3. Technology Complexity (CX)

The four items considered for Technology Complexity (CX1-CX4) are listed in Table 6. As depicted in Table 8, the respondents to CX1 item expressed their agreement with 62.4%, 12.8% remained neutral, and 24.8% were in disagreement. The results are in line with the academic literature where academia refers to migration risks and complexity. The technology complexity can be perceived as an attitude in the innovation process [99]. The respondents to the CX2 item expressed their agreement with 60.5%, 11.9% neutral, and 27.6% in disagreement. The results illustrate that the respondents do not perceive C-ERP as a complex technology for the staff [99].

Of the respondents to CX3 item 60.5% expressed their agreement, 13.8% remained neutral, and 25.7% were in disagreement. The results indicate that C-ERP is not perceived massively as a complex technology which is also in line with the technology due to simple utilisation and time needed to understand it [99]. The respondents to CX4 survey item expressed their agreement with 75.2%, 12.8% remained neutral and 12% in disagreement. The results are in line with the academic literature, where the views on data security and confidentiality are mixed. In the view of Wilson et al. [100], security is still perceived as a significant barrier to SMEs in India for CC adoption.

The findings confirm the rejection of the hypothesis H1.03 that complexity influences negatively C-ERP adoption.

5.2.4. Technology Readiness (TR)

The two items considered for Technology Readiness (TR1-TR2) are listed in Table 6. As depicted in Table 8, 91.7% of respondents to TR1 item expressed their agreement whereas 8.3% remained neutral. The results align with the academic literature where an infrastructure mature is a predictor of innovation adoption [75].

Of the respondents to the TR2 item 91.7% expressed their agreement, 6.5% remained neutral and 1.8% in disagreement. The results align with the academic literature where CC knowledge regarding technical and managerial skills is a predictor of innovation adoption.

The findings confirm the hypothesis H2.04 that technology readiness is an incentive to adopt C-ERP.

5.2.5. Organisational Competency (OC)

The two items considered for Organisational Competency (OC1-OC2) are listed in Table 6. As depicted in Table 8, 89% of the respondents to OC1 item expressed their agreement, 10.1% were neutral and 0.9% in disagreement. The results are in line with the academic literature where knowledge about innovation is a positive predictor. Organisation readiness regarding financial, technology and human resources play a fundamental role in innovation adoption [83,101].

Of the respondents to OC2 item 90.7% expressed their agreement, 8.4% remained neutral and only 0.9% in disagreement. The results align with the academic literature where a positive pro-innovation organisational culture influences CC adoption [8,45]. The findings confirm the hypothesis H1.05 that organisation competency is an incentive to adopt C-ERP.

5.2.6. Top Management Support (TMS)

The three items considered for Top Management Support (TMS1–TMS3) are listed in Table 6. As depicted in Table 8, 89% of the respondents to TMS1 item expressed their agreement, 10.1% were neutral, and 0.9% disagree. The results align with the academic literature where top management support plays a role in innovation adoption [12,60]. The respondents to TMS2 item expressed their agreement by 89% whereas 11% remained neutral. The results are in line with the academic literature where top management support is a positive predictor of CC [12,60,102]. The respondents to TMS3 item expressed their agreement by 90.8% whereas 9.2% remained neutral. The results align with the academic literature where C-ERP adoption involves risks [12,60]. The findings confirm the hypothesis H1.06 that Top Management support is an incentive to adopt C-ERP.

5.2.7. Organisational Size (OS)

The two items considered for Organisational Size (OS1–OS2) are listed in Table 6. As depicted in Table 8, the respondents to OS1 item expressed their agreement by 83.5%, 13.8% remained neutral and 2.8% were in disagreement. The results align with the academic literature where the size is a predictor of C-ERP adoption. Large organisations tend to adopt more CC than small organisations as they have more financial means. The respondents to OS2 item expressed their agreement by 90.8% whereas 9.2% remained neutral. The results are in line with the academic literature where the large organisations have a more financial budget for innovation; hence, CC adoption [17]. The findings confirm the hypothesis H2.07 that organisation size is an incentive to adopt C-ERP.

5.2.8. Regulatory Compliance (RC)

The two items considered for Regulatory Compliance (RC1–RC2) are listed in Table 6. As depicted in Table 8, the respondents to RC1 item expressed their agreement by 77.9%, 16.6% remained neutral and 5.5% were in disagreement. The results are in line with the academic literature where government policy supports CC adoption. The respondents to RC 2 item expressed their agreement by 85.4%, 11.9% remained neutral and 2.7% in disagreement. The results align with the academic literature where the support of regulations and laws is an incentive for CC adoption [51]. The findings confirm the hypothesis H1.08 that regulatory compliance is an incentive to adopt C-ERP.

5.2.9. Competitive Pressure (CP)

The three items considered for Competitive Pressure (CP1–CP3) are listed in Table 6. As depicted in Table 8, the respondents to CP1 item expressed their agreement by 93.6%, 5.5% remained neutral, and 0.9% were in disagreement. The results align with the academic literature where the competition regarding price is a positive factor in adopting C-ERP. The respondents to CP2 item expressed their agreement by 90.8% whereas 9.2% remained neutral. The results align with the academic literature where quality competition is a factor that incentivises C-ERP adoption [75].

The respondents to CP3 item expressed their agreement by 86.2%, 11% remained neutral and 2.8% were in disagreement. The results align with the academic literature where the competition induces organisations to adopt innovation to gain competitive advantage [75].

The findings confirm the hypothesis H1.09 that competitive pressure is an incentive to adopt C-ERP.

5.2.10. Vendor Support (VS)

The three items considered for Vendor Support (VS1–VS3) are listed in Table 6. As depicted in Table 8, the respondents to VS1 item expressed their agreement by 90.8% whereas 9.2% remained neutral. The results align with the academic literature where technical support is an incentive to adopt C-ERP [91]. The respondents VS2 item expressed their agreement by 92.7%, 6.4% remained neutral, and 0.9% were in disagreement. The

results align with the academic literature where the vendor support with technical staff supports C-ERP adoption. The respondents to this survey item expressed their agreement by 84.4% whereas 15.6% remained neutral. The results align with the academic literature where the skills training is an incentive to adopt CC. The findings confirm the hypothesis H2.10 that Vendor Support is an incentive to adopt C-ERP.

5.3. Reliability Test

The Cronbach alpha measure aims to measure the scale's reliability, and a measure higher than 0.7 seems to indicate that the measure is reliable. According to Tavakol and Dennick [103], a high value of Cronbach alpha may be misleading if several assumptions are violated. In this particular case, the value is 0.885, as shown in Figure 20. Thus, it needs further investigation to conclude on reliability as it might be using several dimensions.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.885	.892	28

Figure 20. Cronbach's alpha.

The recommendation is to investigate the equivalent tau measurement and proceed to factor analysis to elaborate on the test's dimensions or merely develop the Cronbach's alpha per construct. In this particular case, Table 9 indicates the construction of the Cronbach's alpha per construct.

Table 9. Cronbach measurement per item.

Measurement Item	Cronbach Value
Relative Advantage (RA)	0.808
Technology Complexity (CX)	0.883
Technology Compatibility (TC)	0.458
Technology Readiness (TR)	0.446
Organisation Competency (OC)	0.207
Top Management Support (TMS)	0.493
Organisational Size (OS)	0.564
Regulatory Compliance (RC)	0.635
Competitive Pressure (CP)	0.526
Vendor Support (VS)	0.512

According to Cronbach's alpha, the table indicates that the constructs Complexity, Relative advantage and Regulatory compliance are reliable constructs.

5.4. Regression Analysis

The regression analysis of variable dependent towards independent variables aims to identify the correlations. In this particular case, the dependent variable is not binary. Hence, logistic regression testing needs to be applied. The dependent variable is the service model or service deployment model against each predictor. The research variables' predictors were assessed to ascertain the significant value and compare the research hypothesis value against p -value to measure the dependent variable's influence level.

5.4.1. Overview

Under this topic, only the tables with significance values are displayed. All the tables with non-significance values are available in the Supplementary Materials.

Service Model

Table 10 indicates the predictors that are accepting the hypothesis of C-ERP adoption. All predictors influence C-ERP adoption hypothesis positively, except complexity. Complexity influences negatively C-ERP adoption hypothesis.

Table 10. Hypothesis testing results per service.

Predictor	IaaS	PaaS	SaaS
Relative Advantage (RA)	✓		
Technology Complexity (CX)		✓	
Technology Compatibility (TC)		✓	
Technology Readiness (TR)	✓		
Organisation Competency (OC)		✓	
Top Management Support (TMS)	✓		
Organisational Size (OS)	✓	✓	
Regulatory Compliance (RC)	✓	✓	
Competitive Pressure (CP)	✓	✓	
Vendor Support (VS)	✓	✓	

Service Model Deployment

Table 11 indicates the predictors that influence cloud service model deployment. Complexity and regulatory compliance are predictors of private C-ERP, whereas technology readiness is a predictor of community service deployment.

Table 11. Hypothesis testing per service deployment.

Predictor	Public	Private	Hybrid	Community
Relative Advantage (RA)				
Technology Complexity (CX)		✓		
Technology Compatibility (TC)				
Technology Readiness (TR)				✓
Organisation Competency (OC)		✓		
Top Management Support (TMS)				
Organisational Size (OS)				
Regulatory Compliance (RC)		✓		
Competitive Pressure (CP)				
Vendor Support (VS)				

5.4.2. Relative Advantage: (IaaS)

The regression test of the factor under Relative Advantage (RA) has a significance value of 0.005, which is lower than the p -value of 0.05, as depicted in Table 12. This result indicates that there is statistical significance in influencing C-ERP adoption positively as IaaS. The Confidence Interval (C.I) is significant as it does not include value 1. The following terms are used as abbreviations from Table 12 and Table 29.

- df**—Degree of Freedom
- Sig.**—Significance
- C.I.**—Confidence Interval

Table 12. Relative advantage: regression analysis for IaaS.

	B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
							Lower	Upper
Step 1 ^a								
RA	1.508	0.537	7.885	1	0.005	4.518	1.577	12.947
Constant	−5.448	2.308	5.572	1	0.018	0.004	-	-

^a Variables entered on step 1: RA.

5.4.3. Compatibility (PaaS)

The compatibility construct has the value 0.003 as depicted in Table 13, which is lower than p value = 0.05, thus significant. Similarly, the confidence interval contains one, which is also not relevant. This result indicates that there is statistical significance in influencing C-ERP adoption positively as PaaS. The confidence interval is significant as it does not include value 1.

Table 13. Compatibility: regression analysis for PaaS.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	C	1.632	0.548	8.885	1	0.003	5.116	1.749	14.966
	Constant	−6.301	2.370	7.066	1	0.008	0.002	-	-

^a Variables entered on step 1: C.

5.4.4. Technology Complexity

Platform as a Service (PaaS)

The complexity construct has the value 0.042 as depicted in Table 14, which is lower than p value = 0.05, thus significant. Similarly, the confidence interval contains one, which is also not relevant. This result indicates that there is statistical significance in influencing C-ERP adoption positively as PaaS. The confidence interval is significant as it does not include value 1.

Table 14. Technology complexity: regression analysis for PaaS.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	CX	0.409	0.201	4.121	1	0.042	1.505	1.749	14.966
	Constant	−0.679	0.742	0.837	1	0.360	0.507	-	-

^a Variables entered on step 1: CX.5.4.4.2. Private.

The compatibility construct has the value 0.001 as depicted in Table 15, which is lower than p value = 0.05, thus significant. Similarly, the confidence interval contains one, which is also not relevant. This result indicates that there is statistical significance in influencing C-ERP adoption model positively as Private. The confidence interval is significant as it does not include value 1.

Table 15. Technology complexity: regression analysis for private cloud.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	CX	0.724	0.220	10.861	1	0.001	2.062	1.341	3.712
	Constant	−1.528	0.778	3.858	1	0.050	0.217	-	-

^a Variables entered on step 1: CX.

5.4.5. Technology Readiness

Infrastructure as a Service (IaaS)

The technology readiness construct has the value 0.003 as depicted in Table 16, which is lower than p value = 0.05, thus significant. Similarly, the confidence interval contains one, which is also not relevant. This result indicates that there is statistical significance in influencing C-ERP adoption positively as IaaS. The confidence interval is significant, as it does not include value 1.

Table 16. Technology readiness: regression analysis for IaaS.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	TR	1.309	0.442	8.794	1	0.003	3.704	1.509	8.801
	Constant	−4.596	1.884	5.950	1	0.015	0.010	-	-

^a Variables entered on step 1: TR.

Community

The technology readiness construct has the value 0.031 as depicted in Table 17, which is lower than p value = 0.05, thus significant. This result indicates that there is statistical significance in influencing C-ERP adoption model positively as a community. The confidence interval is relevant, as it does not contain value 1.

Table 17. Technology readiness: regression analysis for community.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	TR	1.732	0.804	4.635	1	0.031	5.651	1.168	27.343
	Constant	−9.799	3.731	6.897	1	0.009	0.000	-	-

^a Variables entered on step 1: TR.

5.4.6. Organisation Competency

PaaS

The organisation competency construct has the value 0.017 as depicted in Table 18, which is lower than p value = 0.05, thus significant. Similarly, the confidence interval contains one, which is also not relevant. This result indicates that there is statistical significance in influencing C-ERP adoption positively as PaaS. The confidence interval is significant, as it does not include value 1.

Table 18. Organisation competency: regression analysis for PaaS.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	OC	1.041	0.436	5.693	1	0.017	2.833	1.204	6.664
	Constant	−3.576	1.830	3.821	1	0.051	0.028	-	-

^a Variables entered on step 1: OC.

5.4.7. Organisation Size

IaaS

The organisation size construct has the value 0.014 as depicted in Table 19, which is lower than p value = 0.05, thus significant. Similarly, the confidence interval contains one, which is also not relevant. This result indicates that there is statistical significance in influencing C-ERP adoption positively as IaaS. The confidence interval is significant as it does not include value 1.

Table 19. Organisation size: regression analysis for IaaS.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	OS	0.986	0.402	6.012	1	0.014	2.680	1.219	5.892
	Constant	−3.048	1.646	3.428	1	0.064	0.047	-	-

^a Variables entered on step 1: OS.

Public

The organisation size construct has the value 0.080 as depicted in Table 20, which corresponds to a higher p value = 0.05. Thus, it is considered not significant. Similarly, the confidence interval contains one, which is also not relevant.

Table 20. Organisation size: regression analysis for public cloud.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	OS	−0.644	0.367	3.075	1	0.080	0.525	0.256	1.079
	Constant	1.970	1.529	1.660	1	0.198	7.169	-	-

^a Variables entered on step 1: OS.

5.4.8. Top Management Support

IaaS

The top management support construct has the value 0.001 as depicted in Table 21, which is lower than p value = 0.05, thus significant. Similarly, the confidence interval contains one, which is also not relevant. This result indicates that there is statistical significance in influencing C-ERP adoption positively as IaaS. The confidence interval is significant as it does not include value 1.

Table 21. Top management support: regression analysis for IaaS.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	TMS	1.669	0.518	10.401	1	0.001	5.309	1.925	14.642
	Constant	−6.035	2.166	7.770	1	0.005	0.002	-	-

^a Variables entered on step 1: TMS.

PaaS

The top management support construct has the value 0.037 as depicted in Table 22, which is lower than p value = 0.05, thus significant. Similarly, the confidence interval contains one, which is also not relevant. This result indicates that there is statistical significance in influencing C-ERP adoption positively as PaaS. The confidence interval is significant as it does not include value 1.

Table 22. Top management support: regression analysis for PaaS.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	TMS	0.959	0.460	4.359	1	0.037	2.610	1.060	6.424
	Constant	−3.297	1.955	2.844	1	0.092	0.037	-	-

^a Variables entered on step 1: TMS.

5.4.9. Regulatory Compliance

IaaS

The Regulatory Compliance construct has the value 0.046 as depicted in Table 23, which is lower than p value = 0.05, thus significant. Similarly, the confidence interval contains one, which is also not relevant. This result indicates that there is statistical significance in influencing C-ERP adoption positively as IaaS. The confidence interval is significant as it does not include value 1.

Table 23. Regulatory compliance: regression analysis for IaaS.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	RC	0.590	0.295	3.988	1	0.046	1.803	1.011	3.216
	Constant	−1.404	1.214	1.337	1	0.248	0.246	-	-

^a Variables entered on step 1: RC.

PaaS

The Regulatory Compliance construct has the value 0.045 as depicted in Table 24, which is lower than p value = 0.05, thus significant. Similarly, the confidence interval contains one, which is also not relevant. This result indicates that there is statistical significance in influencing C-ERP adoption positively as PaaS. The confidence interval is significant as it does not include value 1.

Table 24. Regulatory compliance: regression analysis for PaaS.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	RC	0.574	0.286	4.017	1	0.045	1.775	1.013	3.110
	Constant	−1.572	1.186	1.756	1	0.185	0.208	-	-

^a Variables entered on step 1: RC.

Private

The Regulatory Compliance construct has the value 0.008 as depicted in Table 25, which is lower than p value = 0.05, thus significant. Similarly, the confidence interval contains one, which is also not relevant. This result indicates that there is statistical significance in influencing C-ERP adoption model positively as Private. The confidence interval is significant as it does not include value 1.

Table 25. Regulatory compliance: regression analysis for private.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	RC	0.816	0.307	7.041	1	0.008	2.261	1.238	4.129
	Constant	−2.315	1.254	3.409	1	0.065	0.099	-	-

^a Variables entered on step 1: RC.

5.4.10. Competitive Pressure

IaaS

The competitive pressure construct has the value 0.043 as depicted in Table 26, which is lower than p value = 0.05, thus significant. Similarly, the confidence interval contains one, which is also not relevant. This result indicates that there is statistical significance in

influencing C-ERP adoption positively as IaaS. The confidence interval is significant as it does not include value 1.

Table 26. Competitive pressure: regression analysis for IaaS.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	CP	0.939	0.465	4.082	1	0.043	2.557	1.028	6.357
	Constant	−2.944	1.955	2.267	1	0.132	0.053	-	-

^a Variables entered on step 1: CP.

PaaS

The competitive pressure construct has the value 0.001 as depicted in Table 27, which is lower than p value = 0.05, thus significant. Similarly, the confidence interval contains one, which is also not relevant. This result indicates that there is statistical significance in influencing C-ERP adoption service positively as PaaS. The confidence interval is significant as it does not include value 1.

Table 27. Competitive Pressure: Regression Analysis for IaaS.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	CP	1.697	0.514	10.897	1	0.001	5.460	1.993	14.958
	Constant	−6.355	2.160	8.658	1	0.003	0.002	-	-

^a Variables entered on step 1: CP.

5.4.11. Vendor Support

IaaS

The vendor support construct has the value 0.019 as depicted in Table 28, which is lower than p value = 0.05, thus significant. Similarly, the confidence interval contains one, which is also not relevant. This result indicates that there is statistical significance in influencing C-ERP adoption positively as IaaS. The confidence interval is significant as it does not include value 1.

Table 28. Vendor support: regression analysis for IaaS.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	VS	1.156	0.493	5.491	1	0.019	3.177	1.208	8.353
	Constant	−3.846	2.065	3.470	1	0.063	0.021	-	-

^a Variables entered on step 1: VS.

PaaS

The vendor support construct has the value 0.026, which, as depicted in Table 29, is lower than p value = 0.05, thus significant. Similarly, the confidence interval contains one, which is also not relevant. This result indicates that there is statistical significance in influencing C-ERP adoption positively as PaaS. The confidence interval is significant as it does not include value 1.

Table 29. Vendor support: regression analysis for PaaS.

		B	Std. Error	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
								Lower	Upper
Step 1 ^a	VS	1.050	0.472	4.945	1	0.026	2.858	1.133	7.212
	Constant	−3.641	1.990	3.348	1	0.067	0.026	-	-

^a Variables entered on step 1: VS.

5.5. IT Artefact Evaluation

An evaluation of the IT artefact Decision Support System (DSS) in the form of a qualitative interview to understand whether the DSS would support the decision-makers in the C-ERP adoption decision was performed by six people with experience in handling C-ERP. Out of the six persons, 1 was Director, 1 was Owner, 2 were managers of goods industry, and 2 were another professional working in the goods industry.

A series of questions were raised towards the different users to apprehend their testing and evaluation comments. The feedback retrieved using the 5-points Likert scale ranging from higher to lower regarding decision where the scale will be: 1-Strongly disagree, 2 Disagree, 3-Neutral, 4-Agree, 5-Strongly agree. At the same time, the expert was asked to contribute with his feedback regarding suggestions and improvement. The Likert scale feedback contained an overall average of 3.94, which means that the initial hypothesis has been accepted. The following questions with the response of evaluators are listed as follow:

1. Is the decision support tool provides a framework to support a knowledge-based decision on C-ERP adoption? All evaluators agreed that the DSS is a tool that provides a framework to support a knowledge-based decision on C-ERP adoption.
2. Is the Use of decision support tool would save time, cost, and the effort involved in the decision-making process towards C-ERP? In response, 33.3% (2 responses) respondents were neutral, 50% (3 responses) were agreed, whereas 16.7% (1 response) strongly disagreed. Hence, an average score of 3.8 was obtained.
3. Is the proposed decision support tool comprehensive coverage of the factors involved in the cloud deployment model selection (public, private, hybrid, community)? In response, 33.3% (2 responses) respondents were neutral, whereas 66.7% (4 responses) agreed. Hence, an average score of 3.7 was obtained.
4. Is the proposed decision support tool a useful tool to support the decision on Service models for ERP (IaaS, PaaS, SaaS)? In response, 33.3% (2 responses) respondents disagreed, whereas 66.7% (4 responses) agreed. Hence, an average score of 3.7 was obtained.

5.6. IT Artefact Suggestions

The evaluators responded to two open questions where they were asked, which additional factors they would like to see added to the DSS, and suggestions on improving the DSS tool as shown in Figure 21.

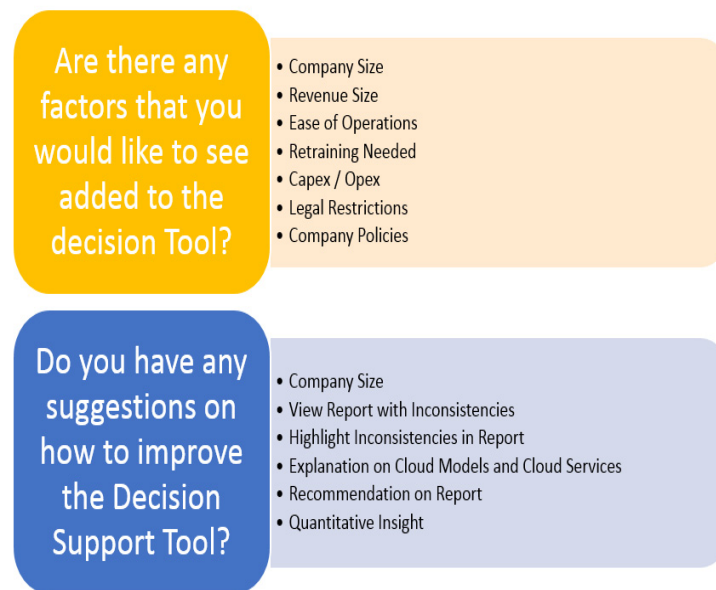


Figure 21. Evaluator's suggestions.

6. Conclusions and Future Scope

Adopting Cloud ERP is part of a strategic decision within an organisation. ERP's competitive advantage results from its integration with newer technologies (Industry 4.0) concealing the continuous organisations business need to change. The research on the decision-making process in the consumers' goods industry has started by analysing the factors that influence cloud ERP adoption. The model to determine the predictors has been individuated in the Technology, Organisation and Environment (TOE) framework, complemented by the theory of Diffusion of innovation (DOI). A survey questionnaire has been used to gather the data to validate the decision-makers' predictors within the consumer goods industry.

The findings of the research have been used as input to elaborate on the decision support tool. The research results indicated that the predictors of Cloud ERP adoption Service Models IaaS and PaaS are: variables' relative advantage, compatibility, complexity, technology readiness, organisation competency, organisation size, top management support, competitive pressure, vendor support and regulatory compliance are. The predictor's complexity and regulatory influence positively the adoption of Private Cloud, whereas technology readiness influences Community Cloud Service deployment. Six experts have assessed the decision tool, where they have concluded that such a tool tailored to the consumer goods industry would be helpful in the decision-making process. Recommendations on the tool have been also implemented to improve the decision-making process, and the research hypothesis have been confirmed.

Other consumer research in the consumer goods industry using the concepts of industry 4.0 can also use the research model based on TOE. The limitations of this research reside in the exclusively usage of ERP adopters. However, non-adopters could have different perceptions regarding opportunities and concerns towards Cloud ERP. The research findings append academic literature that assesses cloud computing in finance, high tech, manufacturing, supply chain, logistics and government. The study has illustrated that the enclosing TOE framework and DOI constitutes a holistic approach to Cloud ERP, delivering insights to researchers and practitioners.

The organisations within the consumer goods industry can use the decision support tool to understand their priorities and, accordingly, select the Cloud service model and deployment. Cloud ERP adoption predictors can be analysed in other industries that require a supply chain without any disruption as well as the tool can be extended to other industries and functionalities requiring for a benefit, cost, opportunities and risk analysis.

Thus, it is recommended to have research in other countries (e.g., European ones) as well as in developing economies, beyond the United States that represent a developed economy, prone to innovation adoption. Indeed, the consumer goods industry is rapidly evolving and the landscape of ICT technology can greatly support it.

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References

1. Grubisic, I. ERP in clouds or still below. *J. Syst. Inf. Technol.* **2014**, *16*, 62–76. [CrossRef]
2. Johansson, A.; Alajbegovic, B.; Alexopoulos, A.; Desalermos, V. Cloud ERP adoption opportunities and concerns: A comparison between SMES and large companies. In Proceedings of the ECIS 2014 Workshop, Tel Aviv, Israel, 9–11 June 2014; pp. 1–13.
3. Fauscette, M. ERP in the Cloud and the Modern Business. 2013. Available online: http://www.virtualization.co.kr/reference/AST-0111292_ERP_US_EN_WP_IDCERPInTheCloud.pdf (accessed on 13 January 2021).
4. Gupta, S.; Kumar, S.; Singh, S.K.; Foroapon, C.; Chandra, C. Role of cloud ERP on the performance of an organization: Contingent resource-based view perspective. *Int. J. Logist. Manag.* **2018**, *29*, 659–675. [CrossRef]
5. Shuaib, M.; Samad, A.; Alam, S.; Siddiqui, S.T. Why Adopting Cloud Is Still a Challenge?—A Review on Issues and Challenges for Cloud Migration in Organizations. In *Advances in Intelligent Systems and Computing*; Springer: Singapore, 2019; pp. 387–399.
6. Vasiljeva, T.; Shaikhulina, S.; Kreslins, K. Cloud Computing: Business Perspectives, Benefits and Challenges for Small and Medium Enterprises (Case of Latvia). *Procedia Eng.* **2017**, *178*, 443–451. [CrossRef]
7. Mezghani, K. From on-Premise ERP to Cloud ERP. *Adv. Methodol. Technol. Bus. Oper. Manag.* **2019**, 816–826.
8. Smart Manufacturing Leadership Coalition. Implementing 21st Century Smart Manufacturing; Pfizer IBM Summit, Workshop Summary Report, 9 Nov 2011. Available online: <https://www.academia.edu/download/28748242/smlcpfizer11911presv2.pdf> (accessed on 9 November 2020).
9. Zheng, P.; Wang, H.; Sang, Z.; Zhong, R.Y.; Liu, Y.; Liu, C.; Mubarak, K.; Yu, S.; Xu, X. Smart manufacturing systems for Industry 4.0: Conceptual framework, scenarios, and future perspectives. *Front. Mech. Eng.* **2018**, *13*, 137–150. [CrossRef]
10. Mittal, S.; Khan, M.A.; Romero, D.; Wuest, T. A critical review of smart manufacturing & Industry 4.0 maturity models: Implications for small and medium-sized enterprises (SMEs). *J. Manuf. Syst.* **2018**, *49*, 194–214.
11. Frank, A.G.; Dalenogare, L.S.; Ayala, N.F. Industry 4.0 technologies: Implementation patterns in manufacturing companies. *Int. J. Prod. Econ.* **2019**, *210*, 15–26. [CrossRef]
12. AlBar, A.M.; Hoque, M.R. Determinants of Cloud ERP Adoption in Saudi Arabia: An Empirical Study. In Proceedings of the 2015 International Conference on Cloud Computing, ICC3 2015, Riyadh, Saudi Arabia, 26–29 April 2015; pp. 1–4.
13. Drazin, R. *The Processes of Technological Innovation*; Lexington Books: Lanham, MD, USA, 1991; Volume 16.
14. Zhong, M.E.; Rohde, F. Cloud computing and ERP: A framework of promises and challenges. In Proceedings of the 25th Australasian Conference on Information Systems, Auckland, New Zealand, 8–10 December 2014.
15. Salleh, S.M.; Teoh, S.Y.; Chan, C. Cloud Enterprise Systems: A Review of Literature and Its Adoption. In Proceedings of the 16th Pacific Asia Conference on Information Systems, Ho Chi Minh City, Vietnam, 11–15 July 2012; p. 76.
16. Saa, S.; Moscoso-Zea, P.; Costales, O.; Luján-Mora, A.C. Data security issues in cloud-based Software-as-a-Service ERP. In Proceedings of the 12th Iberian Conference on Information Systems and Technologies (CISTI), Lisbon, Portugal, 14–17 June 2017; pp. 1–7.
17. Oliveira, T.; Thomas, M.; Espadanal, M. Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. *Inf. Manag.* **2014**, *51*, 497–510. [CrossRef]
18. Johansson, B.; Alajbegovic, A.; Alexopoulo, V.; Desalermos, A. Cloud ERP adoption opportunities and concerns: The role of organizational size. In Proceedings of the 48th Hawaii International Conference on System Sciences, Kauai, HI, USA, 5–8 January 2015; pp. 4211–4249.
19. Huang, Q.; Rahim, M.; Foster, S.; Anwar, M. Critical Success Factors Affecting Implementation of Cloud ERP Systems: A Systematic Literature Review with Future Research Possibilities. In Proceedings of the 54th Hawaii International Conference on System Sciences, Maui, HI, USA, 5–8 January 2021; p. 4683.

20. Mahraz, M.-I.; Benabbou, L.; Berrado, A. A Compilation and Analysis of Critical Success Factors for the ERP Implementation. *Int. J. Enterp. Inf. Syst.* **2020**, *16*, 107–133. [[CrossRef](#)]
21. Miller, J.G. Factors that Influence the Public Sector’s Adoption of a Cloud-Based ERP System: A Quantitative Study. Ph.D. Thesis, Capella University, Minneapolis, Minnesota, MN, USA, 2020.
22. Bazi, H.R.; Hassanzadeh, A.; Moeini, A. A comprehensive framework for cloud computing migration using Meta-synthesis approach. *J. Syst. Softw.* **2017**, *128*, 87–105. [[CrossRef](#)]
23. Zaman, M.S. Impact of Perceived Ease of Use and Perceived Usefulness of Enterprise Resource Planning System Adoption on End User Acceptance. Ph.D. Thesis, Capital University, Islamabad, Pakistan, 2020.
24. Rogers, E.M. *Diffusion of Innovations*, 4th ed.; Simon and Schuster: New York, NY, USA, 2010.
25. vom Brocke, J.; Simons, A.; Niehaves, B.; Reimer, K.; Plattfaut, R.; Cleven, A. Reconstructing the giant: On the importance of rigour in documenting the literature. In Proceedings of the 17th European Conference on Information Systems ECIS 2009, Verona, Italy, 8–10 June 2009.
26. Njenga, K.; Garg, L.; Bhardwaj, A.K.; Prakash, V.; Bawa, S. The cloud computing adoption in higher learning institutions in Kenya: Hindering factors and recommendations for the way forward. *Telemat. Inform.* **2019**, *38*, 225–246. [[CrossRef](#)]
27. Alkhalil, A.; Sahandi, R.; John, D. A Review of the Current Level of Support to Aid Decisions for Migrating to Cloud Computing. In Proceedings of the International Conference on Internet of Things and Cloud Computing, Cambridge, UK, 22–23 March 2016; pp. 1–8.
28. Singh, B.; Dhawan, S.; Arora, A.; Patail, A. A View of Cloud Computing. *Int. J. Comput. Technol.* **2013**, *4*, 387–392. [[CrossRef](#)]
29. Ali, A.; Warren, D.; Mathiassen, L. Cloud-based business services innovation: A risk management model. *Int. J. Inf. Manag.* **2017**, *37*, 639–649. [[CrossRef](#)]
30. Carter, U.; Dan, H.; Michael, H.; Muthu, M. *ERP in the Cloud—Is It Ready? Are you?* Booz&Co.: New York, NY, USA, 2013; pp. 1–9.
31. Navaneethakrishnan, C.M. A Comparative Study of Cloud based ERP systems with Traditional ERP and Analysis of Cloud ERP implementation. *Int. J. Eng. Comput. Sci.* **2013**, *2*, 2866–2869.
32. Sturm, J.; Pollard, R.; Craig, C. The NIST Definition of Cloud Computing. In *Application Performance Management (APM) in the Digital Enterprise*; Elsevier: San Leandro, CA, USA, 2017.
33. Lenart, A. ERP in the cloud—Benefits and challenges. In Proceedings of the EuroSymposium on Systems Analysis and Design, Gdansk, Poland, 29 September 2011; pp. 39–50.
34. Gholami, M.F.; Daneshgar, F.; Low, G.; Beydoun, G. Cloud migration process—A survey, evaluation framework, and open challenges. *J. Syst. Softw.* **2016**, *120*, 31–69. [[CrossRef](#)]
35. Katuu, S. Enterprise Resource Planning: Past, Present, and Future. *New Rev. Inf. Netw.* **2020**, *25*, 37–46. [[CrossRef](#)]
36. Purohit, G.N.; Jaiswal, M.P.; Pandey, S. Challenges Involved in Implementation of ERP on Demand Solution: Cloud Computing. *Int. J. Comput. Sci. Issues* **2012**, *9*, 481.
37. Al-Ghofaili, A.A.; Al-Mashari, M.A. ERP system adoption traditional ERP systems vs. cloud-based ERP systems. In Proceedings of the 4th International Conference on Innovative Computing Technology, INTECH 2014 and 3rd International Conference on Future Generation Communication Technologies, FGCT 2014, Luton, UK, 13–15 August 2014; pp. 135–139.
38. Boillat, T.; Legner, C. From on-premise software to cloud services: The impact of cloud computing on enterprise software vendors’ business models. *J. Theor. Appl. Electron. Commer. Res.* **2013**, *8*, 39–58. [[CrossRef](#)]
39. Gozukara, S.S.; Tekinerdogan, B.; Catal, C. Obstacles of On-Premise Enterprise Resource Planning Systems and Solution Directions. *J. Comput. Inf. Syst.* **2020**, *31*, 1–12. [[CrossRef](#)]
40. Gupta, S.; Misra, S.C.; Singh, A.; Kumar, V.; Kumar, U. Identification of challenges and their ranking in the implementation of cloud ERP: A comparative study for SMEs and large organizations. *Int. J. Qual. Reliab. Manag.* **2017**, *34*, 1056–1072. [[CrossRef](#)]
41. Hustad, E.; Sørheller, V.U.; Jørgensen, E.H.; Vassilakopoulou, P. Moving enterprise resource planning (ERP) systems to the cloud: The challenge of infrastructural embeddedness. *Int. J. Inf. Syst. Proj. Manag.* **2020**, *8*, 5–20.
42. Lee, Y.-C.; Tang, H.N.; Sugumaran, V.D. A deployment model for cloud computing using the analytic hierarchy process and BCOR analysis. In Proceedings of the 18th Americas Conference on Information Systems 2012, AMCIS 2012, Seattle, WA, USA, 9–12 August 2012.
43. Razaq, A.; Asmai, S.A.; Talib, M.S.; Ibrahim, N.; Mohammed, A.A. Cloud ERP in Malaysia: Benefits, challenges, and opportunities. *Int. J. Adv. Trends Comput. Sci. Eng.* **2020**, *9*, 7510–7516.
44. Al-Ma’Aitah, M.A. The drivers of ERP cloud computing from an institutional perspective. *J. Theor. Appl. Inf. Technol.* **2017**, *95*, 5142–5157.
45. Ruivo, P.; Rodrigues, J.; Oliveira, T. The ERP Surge of Hybrid Models—An Exploratory Research into Five and Ten Years Forecast. *Procedia Comput. Sci.* **2015**, *64*, 594–600. [[CrossRef](#)]
46. Gómez, B.; Scholtz, J.M. Information technology in environmental engineering. In Proceedings of the 7th International Conference on Information Technologies in Environmental Engineering (ITEE 2015), Port Elizabeth, South Africa, 15 July 2015.
47. Hofmann, P.; Woods, D. Cloud computing: The limits of public clouds for business applications. *IEEE Internet Comput.* **2010**, *14*, 90–93. [[CrossRef](#)]
48. Abdullah, P.Y.; Zeebaree, S.R.M.; Shukur, H.M.; Jacksi, K. HRM system using cloud computing for small and medium enterprises (SMEs). *Technol. Rep. Kansai Univ.* **2020**, *62*, 4.

49. Khayer, A.; Jahan, N.; Hossain, M.N.; Hossain, M.Y. The adoption of cloud computing in small and medium enterprises: A developing country perspective. *VINE J. Inf. Knowl. Manag. Syst.* **2020**, *51*, 64–91. [[CrossRef](#)]
50. Raihana, G.F.H. Cloud erp—A solution model. *Int. J. Comput. Sci. Inf. Technol. Secur.* **2012**, *2*, 76–79.
51. Hsu, C.L.; Lin, J.C.C. Factors affecting the adoption of cloud services in enterprises. *Inf. Syst. E-Bus. Manag.* **2016**, *14*, 791–822. [[CrossRef](#)]
52. Brender, N.; Markov, I. Risk perception and risk management in cloud computing: Results from a case study of Swiss companies. *Int. J. Inf. Manag.* **2013**, *33*, 726–733. [[CrossRef](#)]
53. Krishna, B.H.; Kiran, S.; Murali, G.; Reddy, R.P.K. Security Issues in Service Model of Cloud Computing Environment. *Procedia Comput. Sci.* **2016**, *87*, 246–251. [[CrossRef](#)]
54. Chandrakumar, T.; Parthasarathy, S. *Continued Rise of the Cloud*; Springer: London, UK, 2014.
55. Jain, D.; Sharma, Y. Cloud Computing with ERP—A Push Business Towards Higher Efficiency. *Ann. Res. J. SCMS Pune* **2016**, *4*, 140–155. [[CrossRef](#)]
56. He, W.; Wang, F.-K. A Hybrid Cloud Model for Cloud Adoption by Multinational Enterprises. *J. Glob. Inf. Manag.* **2015**, *23*, 1–23. [[CrossRef](#)]
57. Elmonem, M.A.A.; Nasr, E.S.; Geith, M.H. Benefits and challenges of cloud ERP systems—A systematic literature review. *Futur. Comput. Inform. J.* **2016**, *1*, 1–9. [[CrossRef](#)]
58. Saini, S.K.; Khanna, I.; Peddoju, A. Cloud and traditional ERP systems in small and medium enterprises. In Proceedings of the International Conference on Information Systems and Computer Networks (ISCON), Mathura, India, 1–2 March 2014; pp. 138–141.
59. Du Plessis, J.J.; Mwalemba, G. Adoption of emerging technologies into ERP systems landscape: A South African study. In Proceedings of the 2016 IEEE International Conference on Emerging Technologies and Innovative Business Practices for the Transformation of Societies, EmergiTech 2016, Balaclava, Mauritius, 3–6 August 2016; pp. 395–399.
60. AlBar, A.M.; Hoque, M.R. Factors affecting cloud ERP adoption in Saudi Arabia: An empirical study. *Inf. Dev.* **2019**, *35*, 150–164. [[CrossRef](#)]
61. Muslmani, B.K.; Kazakzeh, S.; Ayoubi, E.; Aljawarneh, S. Reducing integration complexity of cloud-based ERP systems. In Proceedings of the First International Conference on Data Science, E-learning and Information Systems, Madrid, Spain, 1–2 October 2018; pp. 1–6.
62. Meghana, H.L.; Mathew, A.O.; Rodrigues, L.L.R. Prioritizing the factors affecting cloud ERP adoption—An analytic hierarchy process approach. *Int. J. Emerg. Mark.* **2018**, *13*, 1559–1577.
63. Mohammed, M.A.; Burhanuddin, G.J. Cloud-Based ERP Implementation in SME's: A Literature Survey. *Int. J. Eng. Technol.* **2018**, *7*, 753–755.
64. Angamuthu, D.; Pandian, N. A Study of the Cloud Computing Adoption Issues and Challenges. *Recent Adv. Comput. Sci. Commun.* **2018**, *13*, 313–318. [[CrossRef](#)]
65. Cole, T.; Bhardwaj, A.K.; Garg, L.; Shrivastava, D.P. Investigation into Cloud Computing Adoption within the Hedge Fund Industry. *J. Cases Inf. Technol.* **2019**, *21*, 1–25. [[CrossRef](#)]
66. Rai, R.; Sahoo, G.; Mehruz, S. Exploring the factors influencing the cloud computing adoption: A systematic study on cloud migration. *Springerplus* **2015**, *4*, 1–12. [[CrossRef](#)]
67. Sánchez, A.; Yagüe, J.L. Competitive advantages of the ERP: New perspectives. In Proceedings of the 11th International Conference on Product Focused Software, Limerick, Ireland, 21–23 June 2010; pp. 108–109.
68. Alsmadi, D.; Prybutok, V. Sharing and storage behavior via cloud computing: Security and privacy in research and practice. *Comput. Hum. Behav.* **2018**, *85*, 218–226. [[CrossRef](#)]
69. Marston, S.; Li, Z.; Bandyopadhyay, S.; Zhang, J.; Ghalsasi, A. Cloud computing—The business perspective. *Decis. Support Syst.* **2011**, *51*, 176–189. [[CrossRef](#)]
70. Chang, V.; Kuo, Y.H.; Ramachandran, M. Cloud computing adoption framework: A security framework for business clouds. *Futur. Gener. Comput. Syst.* **2016**, *57*, 24–41. [[CrossRef](#)]
71. Assante, D.; Castro, M.; Hamburg, I.; Martin, S. The Use of Cloud Computing in SMEs. *Procedia Comput. Sci.* **2016**, *83*, 1207–1212. [[CrossRef](#)]
72. Renner, B. 2017 Consumer Products Industry Outlook. Deloitte US. 2017. Available online: <https://www2.deloitte.com/us/en/pages/consumer-business/articles/consumer-products-industry-outlook.html#> (accessed on 18 January 2021).
73. Martin, R. Transforming the Enterprise to the Cloud. 2017. Available online: <https://consumergoods.com/transforming-enterprise-cloud> (accessed on 26 January 2021).
74. Kauffman, R.J.; Ma, D.; Yu, M. A metrics suite of cloud computing adoption readiness. *Electron. Mark.* **2018**, *28*, 11–37. [[CrossRef](#)]
75. Loukis, E.; Arvanitis, S.; Kyriakou, N. An empirical investigation of the effects of firm characteristics on the propensity to adopt cloud computing. *Inf. Syst. E-bus. Manag.* **2017**, *15*, 963–988. [[CrossRef](#)]
76. Salim, S.A.; Sedera, D.; Sawang, S.; Alarifi, A.H.E.; Atapattu, M. Moving from evaluation to trial: How do SMEs start adopting cloud ERP? *Australas. J. Inf. Syst.* **2015**, *19*. [[CrossRef](#)]
77. Manavalan, E.; Jayakrishna, K. A review of Internet of Things (IoT) embedded sustainable supply chain for industry 4.0 requirements. *Comput. Ind. Eng.* **2019**, *127*, 925–953. [[CrossRef](#)]

78. Borgman, H.P.; Bahli, B.; Heier, H.; Schewski, F. Cloudrise: Exploring cloud computing adoption and governance with the TOE framework. In Proceedings of the 46th Annual Hawaii International Conference on System Sciences, Maui, HI, USA, 7–10 January 2013; pp. 4425–4435.
79. Gangwar, H.; Date, H.; Ramaswamy, R. Understanding determinants of cloud computing adoption using an integrated TAM-TOE model. *J. EnterInf. Manag.* **2015**, *28*, 107–130. [[CrossRef](#)]
80. Martins, R.; Oliveira, T.; Thomas, M.A. An empirical analysis to assess the determinants of SaaS diffusion in firms. *Comput. Hum. Behav.* **2016**, *62*, 19–33. [[CrossRef](#)]
81. Seethamraju, R. Adoption of Software as a Service (SaaS) Enterprise Resource Planning (ERP) Systems in Small and Medium Sized Enterprises (SMEs). *Inf. Syst. Front.* **2015**, *17*, 475–492. [[CrossRef](#)]
82. Stieninger, M.; Nedbal, D.; Wetzlinger, W.; Wagner, G.; Erskine, M.A. Impacts on the Organizational Adoption of Cloud Computing: A Reconceptualization of Influencing Factors. *Procedia Technol.* **2014**, *16*, 85–93. [[CrossRef](#)]
83. Mangula, I.S.; van de Weerd, I.; Brinkkemper, S. The adoption of Software-As-a-Service: An Indonesian Case Study. In Proceedings of the Pacific Asia Conference on Information Systems (PACIS), Chengdu, China, 24–28 June 2014; p. 385.
84. Sørheller, V.U.; Høvik, E.J.; Hustad, E.; Vassilakopoulou, P. Implementing cloud ERP solutions: A review of sociotechnical concerns. *Procedia Comput. Sci.* **2018**, *138*, 470–477. [[CrossRef](#)]
85. Raut, R.D.; Priyadarshinee, P.; Gardas, B.B.; Jha, M.K. Analyzing the factors influencing cloud computing adoption using three stage hybrid SEM-ANN-ISM (SEANIS) approach. *Technol. Forecast. Soc. Chang.* **2018**, *134*, 98–123. [[CrossRef](#)]
86. Mohammed, F.; Ibrahim, O.; Nilashi, M.; Alzurqa, E. Cloud computing adoption model for e-government implementation. *Inf. Dev.* **2017**, *33*, 303–323. [[CrossRef](#)]
87. Mezghani, K. From on-Premise ERP to Cloud ERP. In *Encyclopedia of Information Science and Technology*, 4th ed.; IGI Global: Hershey, PA, USA, 2017; pp. 816–826.
88. Lin, A.; Chen, N.C. Cloud computing as an innovation: Perception, attitude, and adoption. *Int. J. Inf. Manag.* **2012**, *32*, 533–540. [[CrossRef](#)]
89. Rajan, C.A.; Baral, R. Adoption of ERP system: An empirical study of factors influencing the usage of ERP and its impact on end user. *IIMB Manag. Rev.* **2015**, *27*, 105–117. [[CrossRef](#)]
90. Senyo, P.K.; Addae, E.; Boateng, R. Cloud computing research: A review of research themes, frameworks, methods and future research directions. *Int. J. Inf. Manag.* **2018**, *38*, 128–139. [[CrossRef](#)]
91. Arnesen, S. Is a Cloud ERP Solution Right for You? *Strateg. Financ.* **2013**, *94*, 45–51.
92. Wang, H. Decision Models for Cloud Computing. In *Grid, Cloud, and Cluster Computing. In the 2016 WorldComp International Conference Proceeding*; Stylus Publishing: Sterling, VA, USA, 2016.
93. Elragal, A.; El-Telbany, O. Decision 2.0: An exploratory case study. In Proceedings of the 45th Annual Hawaii International Conference on System Sciences, Maui, HI, USA, 4–7 January 2012; pp. 432–443.
94. Elragal, A.; Haddara, M. The Future of ERP Systems: Look backward before moving forward. *Procedia Technol.* **2012**, *5*, 21–30. [[CrossRef](#)]
95. Chen, H.X.; Flanagan, K.; Hooper, D.; Maciocha, A.; McCarthy, S.; O'Brien, D. *Approaches to Quantitative Research: A Guide for Dissertation Students*; Oak Tree Press: Oxfordshire, UK, 2012.
96. Khwanruthai, B. How to Do AHP Analysis in Excel; University of Tsukuba, Japan 2012. Available online: http://giswin.geo.tsukuba.ac.jp/sis/gis_seminar/How%20to%20do%20AHP%20analysis%20in%20Excel.pdf (accessed on 1 March 2021).
97. Saaty, L.G.; Vargas, T.L. *Prediction, Projection, and Forecasting: Applications of the Analytic Hierarchy Process in Economics, Finance, Politics, Games, and Sports*; Springer: Berlin/Heidelberg, Germany, 1991.
98. Khajeh-Hosseini, A.; Greenwood, D.; Sommerville, I. Cloud migration: A case study of migrating an enterprise IT system to IaaS. In Proceedings of the 2010 IEEE 3rd International Conference on Cloud Computing, CLOUD 2010, Miami, FL, USA, 5–10 July 2010; pp. 450–457.
99. Palos-Sánchez, P.R.; Arenas-Márquez, F.J.; Aguayo-Camacho, M. Determinants of adoption of cloud computing services by small, medium and large companies. *J. Theor. Appl. Inf. Technol.* **2017**, *95*, 1–13.
100. Wilson, B.M.R.; Khazaei, B.; Hirsch, L.; Kannan, S.T. CMDSSI: A decision support system for cloud migration for SMEs in India. In Proceedings of the 2014 IEEE International Conference on Computational Intelligence and Computing Research, IEEE ICCIC 2014, Coimbatore, India, 18–20 December 2014; pp. 1–6.
101. Peng, C.; Gala, G.C.A. Cloud ERP: A new dilemma to modern organisations? *J. Comput. Inf. Syst.* **2015**, *54*, 22–30. [[CrossRef](#)]
102. Ratten, V. Continuance use intention of cloud computing: Innovativeness and creativity perspectives. *J. Bus. Res.* **2016**, *69*, 1737–1740. [[CrossRef](#)]
103. Tavakol, M.; Dennick, R. Making sense of Cronbach's alpha. *Int. J. Med. Educ.* **2011**, *2*, 53. [[CrossRef](#)] [[PubMed](#)]