

# Cloud Computing Model for E-Commerce in Saudi Arabia

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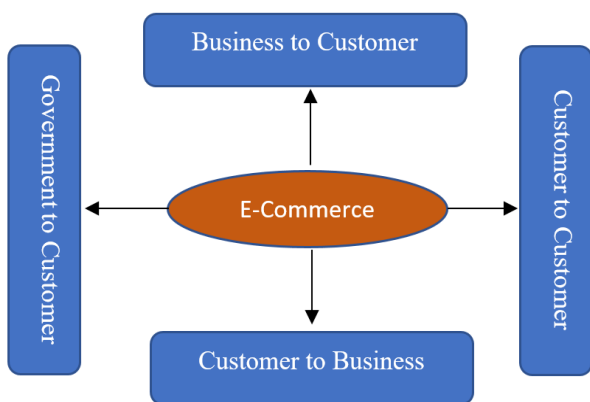
**Abstract:** The impact of cloud computing can be seen in several industries, including e-learning, healthcare and education. It offers customer service lives with high productivity and minimal cost, producing a high financial value. In contrast to developed countries, the use of cloud computing is still relatively new and is not widely accepted in developing countries like Saudi Arabia (SA). In essence, implementing a modern approach to the cloud is dependent on a number of factors that may affect the Saudi Arabian government's preference to do so. Therefore, it is critical to comprehend why some companies are better equipped than others to transition to cloud computing in order to support the application of cloud knowledge. Accordingly, this article aims to present a cloud computing model for E-commerce in SA that integrates the E-commerce as a service business and cloud computing. The proposed model also offers several internal services, including security services, Platform as a Service (PaaS), Infrastructure as a Service (IaaS), Hardware as a Service (HaaS), Software as a Service (SaaS) and Data as a Service (DaaS). Throughout this, it is anticipated that the suggested model will work with reliable management, server and business modules in addition to sources of hardware and software.

**Keywords:** E-commerce, Cloud Computing, Saudi Arabia

## Introduction

The next generation of computing technology, known as cloud computing, enables users to run complex computations on expensive cloud provider service cloud's high-end computing infrastructure while also extending the usefulness of assets that were previously inaccessible to them. Organization of information systems is a common practice among businesses to provide the best presentation to customers (Qwaider, 2020). Cloud computing is ideal for accessibility and scalability due to higher cost of high performing information systems and the challenges in enabling them to build and increase these processes over time (Falatah and Batarfi, 2014). The idea of "cloud computing" is a skill that is based on moving computer-related data to the available cloud for management and storage. When a server is accessed via the Internet, or when IT systems are converted from producing goods to providing services, it is described by resolving application maintenance and improvement issues to facilitate user in using these services efficiently (Zanoon *et al.*, 2017). E-commerce is a topic of the numerical economy, which is founded on two facts: Information Technology (IT), or the information industry in the age of computing. E-commerce was made possible

by communication and it depends on these two factors as well as a variety of other technical implementation and management techniques (Al-Dhaqm *et al.*, 2020). E-commerce refers to the practice of conducting and managing commercial operations involving the sale of goods and services via the Internet or alternative technical systems for data transfer. Three types of events are typically mentioned when discussing E-commerce: An obvious example of services offered by Internet Service Providers (ISPs), is its ability of connecting to or entering the internet and the connectivity services with technical content. The second is the delivery of services or their technical provision. Third, the non-technical delivery of goods and services using the internet as a tool or method of distribution (physical delivery). The terms "e-business," "E-commerce," and "technology exploitation in traditional commercial operations" are all used interchangeably in this concept (Al-Dhaqm *et al.*, 2014). In South Africa, cloud computing for E-commerce is still a relatively new concept that needs more research. Most of the E-commerce cloud computing models currently in use in South Africa are still in their infancy compared to developed countries. The decision to adopt the cloud by a Saudi Arabian organization may be influenced by a number of factors, such as the need to migrate an existing system to the cloud.



**Fig. 1:** Types of E-commerce

Therefore, it is crucial to comprehend why some businesses are better equipped than others to make the switch to the cloud to promote the adoption of cloud technology. There are numerous E-commerce models that offer a range of services, in Fig. 1. These models include business to customer, customer to customer, customer to business and government to customer.

Thus, this study proposed a cloud computing model for E-commerce in SA utilizing the design science method to enable users to use and manage services online efficiently (Al-Dhaqm *et al.*, 2020). The proposed model is composed of four layers: User layer, security layer, cloud middleware layer and E-commerce layer. It offers a massive data centre scale, with mass data storage, high-speed computation, data mining capacity and cost efficiency for growing E-commerce businesses. The proposed model was developed by incorporating elements of access control, identification, authentication, authorization, resource management, software management, hardware management, Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS) and business services that have not yet been examined in any prior studies as major factors since it may influence the decision for cloud services adoption.

According to the risk perspective, potential customers are aware of the security and risk associated with online shopping. These risks include, but are not limited to, identity theft, the theft of credit card numbers and social security numbers, as well as the occasionally occurring non-delivery of goods that have been ordered and paid for. The risks of e-crime have been captured and analysed in a number of works proposed for this purpose (Al-Dhaqm *et al.*, 2014; 2021a-b; 2020a-b; 2017; 2018; Ghabban *et al.*, 2021; Ngadi *et al.*, 2012; Alhussan *et al.*, 2022).

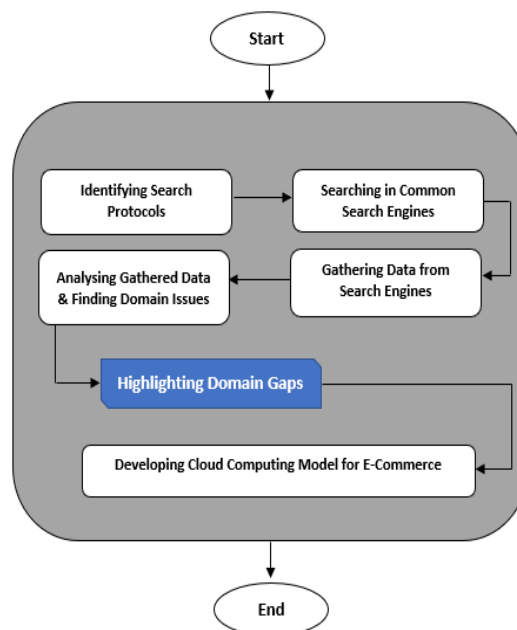
## Materials and Methods

The objective of this study is to examine the impact of cloud computing and E-commerce in Saudi Arabia using the design science method and an e-literature review process (Webster and Watson, 2022; Hevner *et al.*, 2010). There are five stages, Fig. 2:

1. Identifying search protocols
2. Searching in common search engines
3. Gathering data from search engines
4. Analysing data gathered and finding the domain issues
5. Results and finding
6. Developing cloud computing model for E-commerce

Identifying search protocol to narrow down the search of relevant articles as in Fig. 3, the author focused on a set of keywords such as "cloud computing," "E-commerce," and "Saudi Arabia".

Searching in common search engines using the keywords and search strings defined in step 1, this process will select relevant articles about cloud computing adoption for E-commerce in Saudi Arabia. The research was carried out using five academic databases: Scopus, IEEE explorer, web of science, springer, and google scholar. The search is limited to English-language journal and conference papers published between 2015 and 2022. The eight-year period was chosen to ensure sufficient publication trend information could be identified. Table 1 summarizes the results of common search engine searches.



**Fig. 2:** Research methodology

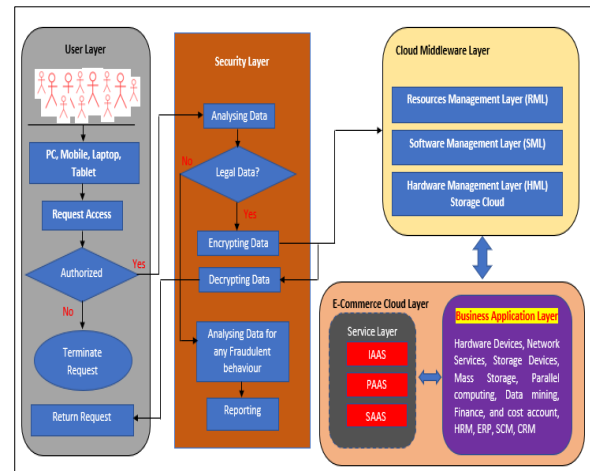
The articles selected were filtered based on research objectives outlined. First screening aimed at the titles and abstracts of the articles, then the conclusions and eventually the entire article content. For this purpose, a selection of inclusion/exclusion criteria were adhered to as follows:

- a) Inclusion criteria include articles on cloud computing adoption for E-commerce in developing countries such as the proposed architecture framework, its adoption level, benefits and challenges associated with it
- b) Exclusion criteria exclude articles that focused solely on cloud computing or E-commerce without delving into the proposed architecture framework, its adoption level, benefits and challenges associated with it

Upon completion of four iterations, 40 articles (17 journal papers and 43 conference papers) were selected.

Analysing gathered data and finding domain issues following the selection of relevant articles, the author conducted an analysis of these articles using the analysis process proposed by Saldaña (2021). A matrix is used to organize the concepts derived based on the requirement analysed in previous literature. The selected articles were analysed using fourteen criteria: Company size and type, cost-effectiveness, security perspective, client service enhancement, transportation, company process enhancement, cloud processing structure, governing framework, user approval, participant assistance, usability of model, performance of model, reliability of model, and productivity of model.

model. Table 2 illustrates the findings of an analysis of existing cloud computing models in E-commerce based on the criteria outlined.



**Fig. 3:** Cloud computing model for E-commerce in SA

**Table 1:** The summary of results for the common search engine searches

Search engines	Results
Scopus	5
IEEE explorer	5
Web of science	300
Springer	1378
Google scholar	3550

**Table 2.** Existing cloud computing models in E-commerce

ID	Refs	Size and type of the company	Cost-effective	Security perspective	Client service enhancement	Transportation	Company process enhancement	Cloud processing structure	Governing framework	User approval	Participant assistance	Usability of model	Performance of model	Reliability of model	Productivity of model
1	Cai et al. (2009)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
2	Sim (2009)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
3	Neumann et al. (2010)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
4	Yang et al. (2010)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
5	Cai et al. (2011)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
6	Al-Jaberi et al. (2015)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
7	Busalim and Hussin (2015)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
7	Budiono et al. (2018)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
8	Shaikh and Patil (2014)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
9	Shankararaman and Kit (2014)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
10	Xiao et al. (2015)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
11	Yao et al. (2015)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
12	Aulkemeier et al. (2016)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
13	Goel and Goel (2016)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
14	Han (2016)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
15	Jiang (2016)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
16	Guo et al. (2017)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
17	Khan et al. (2016)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
18	Wang and Jiang (2016)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
19	Al-Dwairi et al. (2018)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
20	Almazroi et al. (2019)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
21	Qasbi et al. (2021)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
22	Almasri and Alshareef (2019)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
23	Albelaihi and Khan (2020)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
24	Alyoubi (2021)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
25	Albugmi (2018)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
26	Alshahrani (2021)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
27	Alghushami et al. (2018)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
28	Alghamdi (2019)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
29	Adiyasa et al. (2018)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
30	Shukur et al. (2019)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
31	Alkhunaizan and Ali (2022)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
32	Salem et al. (2020)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
33	Al Mudawi et al. (2022)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
34	Kang et al. (2022)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
35	Aldhyani and Alkahtani (202)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
36	Hamed and Bohari (2022)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
37	AlHudaib and Al-Shammari (2022)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
38	Binsaif (2022)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
39	Al Mudawi (2021)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
40	Alsulaimany and Almaktoom (2021)	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

**Table 3:** The extracted common terminologies

Refs	Extracted terminologies (common layers, processes, concepts, tasks)
Cai <i>et al.</i> (2009); Sim (2009); Neumann <i>et al.</i> (2010); Yang <i>et al.</i> (2010); Cai <i>et al.</i> (2011); Al-Jaberi <i>et al.</i> (2015); (Busalim and Hussin (2015); Budiono <i>et al.</i> (2018); Shaikh and Patil (2014); Shankaraman and Kit (2014); Xiao <i>et al.</i> (2015); Yao <i>et al.</i> (2015); Aulkemeier <i>et al.</i> (2016); Goel and Goel (2016); Han (2016); Jiang (2016); Guo <i>et al.</i> (2017); Khan <i>et al.</i> (2016); Wang and Jiang (2016); Al-Dwairi <i>et al.</i> (2018); Almazroi <i>et al.</i> (2019); Qasem <i>et al.</i> (2021); Almasri and Alshareef (2019); Albelaihi and Khan (2020); Alyoubi (2021); Albugmi (2018); Alshahrani (2021); Alghushami <i>et al.</i> (2018); Alghamdi (2019); Adiyasa <i>et al.</i> (2018); Shukur <i>et al.</i> (2019); Alkhunaizan and Ali (2022); Salem <i>et al.</i> (2020); Al Mudawi <i>et al.</i> (2022) Kang <i>et al.</i> (2022); Aldhyani and Alkahtani (2022); Hamed and Bohari (2022); AlHudaib and Al-Shammari (2022); Binsaif (2022); Al Mudawi (2021); Alsulaimany and Almaktoom (2021)	Reduce equipment needs, maintainability, connectivity, lack of infrastructure in the rural area, limited internet access, sustainability, cost reduction, cost of implementation, cost predictability, increase purchasing opportunity, shipping cost, faster service, market segment/stock analysis, customer tracking, customer need analysis, transaction risk, application security, authentication, cryptography, poor cyber security infrastructure, fraudulent behaviour, customer trust, SAAS, deceptive activity, illegal transaction, CRM, SME, RML, SML, HML, IAAS, PAAS, data security, data confidentiality, brute force attack, Denial of Service (DOS) attack, SLA related framework and architecture, integrated service model, lack of regulation, lack of standardization, lack of awareness, lack of education

According to the survey findings, the following are the challenges associated with cloud computing for E-commerce:

- a) Infrastructure: Limited infrastructure in rural areas
- b) Security: Lack of trust, transaction security, and data privacy, fraudulent behaviour, false activity
- c) Stakeholders' support: SME limited adoption, lack of the involvement of cloud computing providers, limited logistic services
- d) Regulatory framework: Limited regulation
- e) User acceptance: Low of literacy rate, lack of education, language barrier, lack of training

#### *Developing Cloud Computing Model for E-Commerce*

This step focuses on the E-commerce cloud computing model development process. There are several cloud computing models that are best suited for E-commerce. The extracted terminologies include common layers, processes, concepts, tasks and activities based on the identified models as presented in Table 3. The extracted terminologies are then synchronized and merged based on semantic similarities (Al-Dhaqm *et al.*, 2017). As a result of the harmonisation and reconciliation, the cloud computing models for E-commerce in SA are shown in Table 2.

The proposed model provides a trusted and secure environment for customers to deal with online data. The architecture is comprised of four layers: (1) User layer, (2) security layer, (3) cloud middleware layer and (4) E-commerce cloud layer. The security layer is used to secure the integrity of the customer data against any fraudulent behaviour. The data received from the customer/user layer will be validated to ensure that it is free of fraud. If the data is truthful, it will be encrypted and sent to the cloud middleware layer; otherwise, it will be sent to be analysed for any fraudulent behaviour and reported if such cases exist. The cloud middleware layer oversees resource management, task management, mobility management, failure management and communication management. It is

situated between the operating system and the application. It offers the client a variety of functionalities. It aids in the development of business applications, promotes concurrences, threading, messaging, transactions as well as service component architecture framework for developing Service Oriented Architecture (SOA) applications. Examples of cloud middleware includes web servers, application server and databases. In general, middleware programs provide communication services and fulfil the need for a messenger by allowing different applications to connect as well as send and receive messages in different physical locations via cloud middleware. The E-commerce cloud layer oversees resource sharing; additionally, it serves as an interface between various service providers astounding framework and unites them all to provide services. Through the proper use of the equipment layer, it enables safe and adaptive information access, as well as the sharing of equipment and assets. It provides three main layers of services: IaaS, PaaS and SaaS. The business application layer is in charge of providing various types of services by application software to enable real-time data sharing. It is unique from the other components of cloud-based E-commerce architecture because it serves as the fundamental business logic of E-commerce and facilitate in grouping the E-commerce elements. The variety of SAAS services provided a set of expertise that enable business at cloud stages such as deal tracking management, goods construction and assessment, self-service customer portal, Customer Relationship Management (CRM), Human Resource Management (HRM), finance and Cost Accounting, Supply Chain Management (SCM) and Enterprise Resource Management (ERP). There is a set of components that correlate with the development of EC improvement; it requires adjusting to its limitations due to the disadvantages of enterprise size, financial stability and technological capacity, which are primarily visible in the following aspects.

The importance of the proposed model for the SA is due to the SA E-commerce market being the base of the

Islamic area with the biggest budget (\$168 billion) amongst the Arab territories with nearly no immediate charges. With a high revenue ranked at 9000 buying power equivalence (associated to the local and international means of 6167 and 7416) and a great yearly people increase rate of 3.4%, Saudi culture offers a possibly wide customer base for business and knowledge driven enterprises. More, the major youth people and the existence of huge IT businesses in the Sa provide E-commerce a main benefit and a reasonable edge locally.

### Comparative Analysis

According to the analysis and discussion in point 6, Table 2, no model considers the security layer explicitly. Thus, the proposed model addressed this gap clearly and introduced a security layer for the cloud computing model. This layer has several purposes as follow:

- i) Analysing data: The data which sent by customer/client will analyse through this layer. This data will be classified as legitimate or nonlegitimate based on some trusted patterns. The system will send nonlegitimate data to the check fraudulent section for further examination. Conversely, the system will send the data for encryption if the data is legitimate
- ii) Encrypting data: In this stage, the aim is to make the sending data more secure and prevent exposure
- iii) Decrypting data: Encrypted data must be opened by a key before it can be sent back to the customer
- iv) Check fraudulent: Deep analysis for malicious activities which marked as a nonlegitimate actions
- v) Reporting: During this stage, whole logs are documented to the system and may later be used for investigation in case of crime/incident

Accordingly and based on the above analysis, the suggested model can run efficiently at the same level as other operating models in cloud computing and be more safe than other models. Table 2 displays the comparative analysis for existing cloud computing models in E-commerce from the security perspective. Clearly, none of the existing cloud computing models in E-commerce covered the security perspective, whereas the proposed model covers this perspective in detail.

### Conclusion

The remarkable benefit of cloud computing is that it actively provides supplies to many customers at any time while still adapting to client needs. Furthermore, consumers are charged only for services that they use or subscribed. Even though the cloud provides numerous benefits to businesses, including cost savings, migrating data from a local database to the

cloud is a difficult task. Thus, this study proposed a cloud computing model for E-commerce in Saudi Arabia with four main layers: (1) User layer, (2) security layer, (3) cloud middleware layer and (4) E-commerce that will be evaluated in the future work.

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### Ethics

This article is original and contains unpublished material. The corresponding author confirms that all of the other authors have read and approved the manuscript and no ethical issues involved.

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