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Investigation Study of the Cloud Supply Chain Management System

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ABSTRACT

This study aims to build a model that statistically examines the advantages of cloud computing that can affect supply chain management challenges and the opinions of the companies that have switched to cloud supply chain management. In addition, this study seeks to classify the benefits of cloud computing according to their impact on supply chain management challenges. The study has adopted a descriptive and analytic approach. A questionnaire was used for collecting the data. The data analysis was done via SPSS and PLS path modeling. The study has summarized the cloud supply chain management features under one broad spectrum, including cost efficiency, simplification, flexibility, visibility, scalability, resource pooling, on-demand self-service, connected, intelligent models, and sustainability. The outcomes indicated that all the studied advantages affect all challenges somehow. Moreover, the study proved 10 main hypotheses. The internal consistency and the extent of their statistical correlation were examined. However, an inconsistency was observed between the strength of the impact and the outcomes of the determination coefficient R2.

1. INTRODUCTION

The rapid development of web networks, communication technology, the spread of the Internet, and the low cost of its use were among the reasons that made software providers provide their applications via the Internet to expand the scope of their use [1]. Therefore, these companies make their products available in the form of web services in order to save the user time, effort, and money by managing the systems perfectly. This helped many companies that suffered from problems such as the availability of the appropriate infrastructure for their software and the provision of continuous maintenance as well. Cloud computing is a type of distributed computing, which means to decomposing huge data computing processing programs into countless small programs through the network "cloud", and then processing and analyzing them through a system composed of multiple servers and returning the results to the users. The early stage of cloud computing can be simply regarded as distributed computing, which solves task dispatching and then merging the computing results [2].

Swanson and Ezell [1] said that cloud computing would affect all business operations, such as enterprise resource planning (ERP), financial management, data analytics, and training for the workforce. In the 21st century, the complexity of supply chains has increased due to the need for a rapid life cycle of services and products. In addition, there are many reasons such as globalization, competition, product diversity, and economic issues that have led to the need for re-innovation and creativity in building new strategies for managing supply chains to achieve cooperation between their participants [3].

Cloud application providers have proposed solutions to the challenges that systems management faces; these companies have provided supply chain management with a set of services such as providing supply chain management functions to any user in an efficient, scalable, and secure manner via a device connected to the Internet from anywhere and at any time. These application providers provide many options with high flexibility through user selection of packages, best solutions, databases, and simple integration software. This enables organizations to invest the time, effort, and cost savings provided by cloud supply chains in their core business [4].

Armstrong [5] said that supply chain management is the process of managing the flows of materials, finished goods, and information that add value between suppliers, organizations, vendors, and customers. It also includes various aspects of improving the supply chain and coordinating with suppliers in order to eliminate obstacles in order s to achieve a balance between transportation, the lowest material cost, and the most appropriate time [6].

Long periods of trust and information sharing are essential to supply chain success. Therefore, supply chain management strives to achieve a smooth flow of all information related to the chain. Every company in the supply chain can seek to help improve the entire supply chain rather than working independently. This will lead to improved products and planned distribution that can reduce costs and attract more customers, resulting in better sales and better overall results for companies within the chain. The faster access to the market reduced the time required to complete tasks, the speed of

response to the customer, heading to new markets, and these systems helped companies share information and do many activities with other units in the supply chain [7].

Supply chain management systems are complex systems that face many challenges that affect their performance and success. Many previous studies classified and divided these challenges into external and internal challenges (such as natural disasters, economic risks, corruption, crime, and piracy) and internal challenges (such as choice of partners, opportunistic behavior, security risks, lack of coordination, strategic challenges) [8].

Business macro-environment challenges (such as Business process integration, Culture and change, Supplier competence requirement, Business transformation oriented to globalization, Effect of globalization) and technical challenges (such as Data and information integration, Application integration, Extranet adoption) [9].

One of the foundations of the success of the supply chain is the cooperation between the members of the chain, and this cooperation must be at the level of systems, technologies, and individuals. Supply chain management systems help integrate the chain because they are a set of software solutions that manage the flow of data, goods, and financial issues caused by the exchange of products and services from one place to another [10]. The adoption of large supply chain management systems on the Internet in exchanging information and reports, providing consulting services, market analysis, and others, made them keep pace with the developments that occurred in the Internet environment, so the terms "digital supply chain management" or "cloud supply chain management" have appeared, where the supply chain has turned into a group of Web pages that interact with each other. In MHI's 2017-field study, it was proven that 80% of supply chains would shift to cloud management before 2022 [11].

On the other hand, the world is now experiencing the Fourth Industrial Revolution, which seeks to integrate the physical environment with the digital environment to become one world where all parties interact electronically. Cloud computing is one of the most essential pillars of this revolution. Cloud computing represents one of the most important developments that has been achieved in the field of computing in our time. The idea of cloud computing began to appear in the late twentieth century and then began to expand and spread with the emergence of sites that allow you to create a free email account and storage capacity to save your files in the cloud. After that, Microsoft announced its interest in cloud computing since it released the operating system VISTA [12].

The cloud has several types: a public cloud whose resources are used by everyone, such as Google App Engine; a private cloud owned by a specific organization through which it seeks to control and manage its data centrally; and the hybrid cloud, which is a mixture of the previous types where the organization relies on the public cloud for part of its work and the other part is done through the private cloud. There are also several models in which the cloud computing service is provided, which depend on the nature of the service, which is as follows: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) are all examples of cloud computing. Choosing one depends on who will manage each application, data, operating system, server, database, and network [13].

In highlighting the latest developments in terms of benefiting from cloud computing in various sectors and the role it plays in changing the ways of operations in companies, which contributes to enhancing the competitive advantage of the company and the services it provides to the public in light of the changes in the digital economy [14].

Cloud computing provides business and software models, operations and capabilities, management APIs, analytics techniques, reference architectures, and delivery models that help CSPs discover, operate, and scale business platforms in various aspects of the digital environment. Saini, Khanna, and Saini et al. provide customers with an Internet experience that meets their needs for real-time, on-demand, and integrated electronic services [15].

Additionally, business models and ways of completing operations have changed from what they were in the last century, including supply chain management, as the supply chain has shifted to the so-called open or community supply chain that has become based on the internet ECO-system, on platforming, virtual business, crowdsourcing and cloud computing [16].

The supply chain has transformed from just a chain to a set of web pages that gather all of the individuals, processes, and technologies used in supply chain management that enable the customer to carry out his requests and follow them until they reach him. For the supply chain to continue and maintain its viability, it must be more dynamic, more profitable, and less costly to achieve a competitive advantage, so the management of warehouses, customers, intermediaries, and employees must be rethought. Therefore, supply chain management requires a connection between all parts of the organization in the warehouse, distribution center, storefront, and e-commerce portal. The information must be exchanged between parts and orders redirected as needed to ensure customers get what they want anywhere, anytime. It starts to think about how cloud computing could be used to manage supply chains [17, 18].

In this study, the researcher seeks to study the impact of the advantages of cloud computing on supply chain challenges from the point of view of organizations that have shifted from the traditional supply chain to the cloud supply chain.

2. STUDY MODEL AND METHODOLOGY

In this part of the study, the researcher wants to put forward a model developed from previous studies. This model depends on two main variables: the first, the advantages of cloud computing; and the second, the challenges of supply chains as shown in Figure 1.

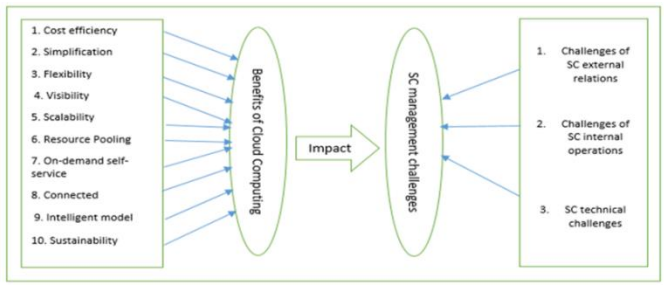


Figure 1. Study model

The descriptive and analytical approaches were used for the variables of this study by analyzing the data and revealing the nature of the existing relationships between the study variables due to their relevance to the objectives of the current study. Questionnaires were used as a means of data collection.

The study community consists of employees of companies that transferred supply chain management from the traditional situation to cloud supply chain management in three Arab countries, namely, the United Arab Emirates, the Kingdom of Saudi Arabia, and the Kingdom of Jordan, in an effort by the researcher to expand the size of the community so that the results of the study are more comprehensive, and the three countries are considered The selected commercial points link many commercial relations between countries, and also one of the other reasons for choosing the community is the cooperation of companies providing cloud computing services to provide lists of companies that deal with them and transfer their operations to take place through cloud applications.

The sample size in this study was determined based on the companies that responded to the distributed questionnaire, which included 43 companies from different fields, and 400 completed questionnaires were collected from various companies in the three countries.

In preparing the questionnaire, the researcher adopted the closed questionnaire, which determines the possible responses to each question. The researcher will use SPSS and PLS path modeling to check the validity and reliability of the proposed model and confirm the hypotheses of the study.

3. STUDY HYPOTHESES

In this investigation, the following hypothesis have been considered:

H1: There is a statistically significant impact of cost efficiency on supply chain management challenges.

H2: Simplification has a statistically significant impact on supply chain management challenges.

H3: Flexibility has a statistically significant effect on supply chain management challenges.

H4: There is a statistically significant effect of Visibility on supply chain management challenges.

H5: There is a statistically significant effect of Scalability on supply chain management challenges.

H6: Resource Pooling has a statistically significant impact on supply chain management challenges.

H7: There is a statistically significant effect of on-demand self-service on supply chain management challenges.

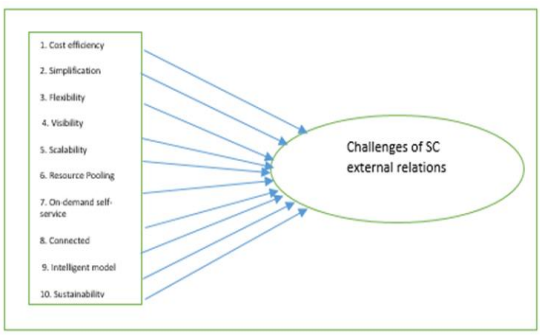
H8: Connection has a statistically significant effect on supply chain management challenges.

H9: There is a statistically significant effect of the intelligent model on the challenges of supply chain management.

H10: There is a statistically significant effect of Sustainability on the challenges of supply chain management.

Figure 2 represent the challengers of the SC of external relations, internal operations, and also technical challenges.

(a)



(b)

(c)

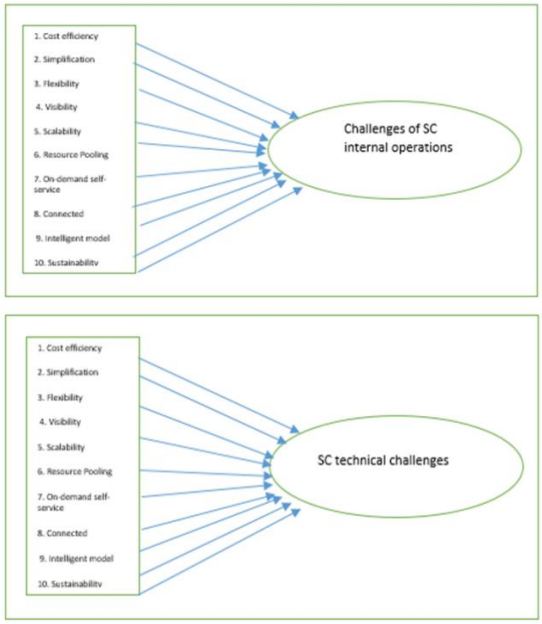


Figure 2. (a) Challenges of SC external relations; (b) Challenges of SC internal operations; and (c) SC technical challenges

4. RESULTS AND DISCUSSION

In order to identify the extent of the validity of the questionnaire in measuring what it was designed to measure, it was presented to 15 specialists in the field of information systems in four universities, 13 of whom responded, and their observations were taken into account in building the final version of the questionnaire.

To examine the internal consistency and the extent of the correlation of the elements of the independent variable (the advantages of cloud computing), the correlation coefficient between the elements of the variable and the total sum of the variable was extracted at a significance level of 0.01 or less, which also indicates the existence of a positive relationship between the two variables. Cronbach's alpha was taken out to see if the independent variable's parts were stable.

All of the elements of the variable contribute to the stability of the independent variable because the value of Cronbach's alpha for the elements is less than their value for the same variable, which was equal to 0.801, which is an excellent percentage because it is higher than the acceptable percentage of 6%.

A multiple regression test was used, in which we found that the calculated F value in all hypotheses was greater than the tabulated F value. We reject the null hypothesis H0 (which says there is no effect between the dependent variable and the independent variable) if the calculated F value is greater than the tabulated F value of the same element when the significant value SIG F is less than 0.05. We accept hypothesis H1 with an effect.

According to the Table 1, all the calculated F values for all the features of cloud computing were greater than the tabulated F values for each of them, which means that there is a statistically significant effect of the features added by cloud computing and which cloud computing service providers refer to, on the challenges faced by traditional supply chain management.

Table 1. Statistical results of the current investigation

#	Elements of the independent variable	R	R2 Determination Coefficient	Elements of the dependent variable	R2	Cronbach alpha	SIG F	F tabular	Calculated F
1	Cost efficiency	0.673	0.668	Challenges of SC external relations Challenges of SC internal operations SC technical challenges	0.311 0.605 0.247	0.712	0.000	2.420	44..211
2	Simplification	0.619	0.603	Challenges of SC external relations Challenges of SC internal operations SC technical challenges	0.187 0.278 0.583	0.734	0.000	2.758	51.125
3	Flexibility	0.553	0.541	Challenges of SC external relations Challenges of SC internal operations SC technical challenges	0515 0.198 0.539	0.773	0.000	2.135	36.926
4	Visibility	0.571	0.552	Challenges of SC external relations Challenges of SC internal operations SC technical challenges	0.169 0.535 0.293	0.789	0.000	2.459	29.134
5	Scalability	0.567	0.561	Challenges of SC external relations Challenges of SC internal operations SC technical challenges	0.548 0.315 0.557	0.743	0.000	2.245	48.026
6	Resource Pooling	0.799	0.643	Challenges of SC external relations Challenges of SC internal operations SC technical challenges	0.265 0.187 0.594	0.789	0.000	2.286	32.468
7	On-demand self-service	0.693	0.544	Challenges of SC external relations Challenges of SC internal operations SC technical challenges	0.274 0.512 0.538	0.788	0.000	2.832	46.174
8	Connected	0.611	0.587	Challenges of SC external relations Challenges of SC internal operations SC technical challenges	0.302 0.290 0.551	0.751	0.000	2.853	39.456
9	Intelligent model	0.727	0.711	Challenges of SC external relations Challenges of SC internal operations SC technical challenges	0.377 0.669 0.3.81	0.769	0.000	2.193	23.915
10	Sustainability	0.781	0.749	Challenges of SC external relations Challenges of SC internal operations SC technical challenges	0.725 0.709 0.236	0.753	0.000	2.973	50.242

The Determination Coefficient R2 was also used to determine where the most potent influence is on the three challenges, by comparing the detailed R2 of each feature and its impact on each class of challenges with the general R2 calculated for the feature and the challenges in general, according to the previous table. How close is the detailed R2 score to the overall R2 score?

In this study, many statistical indicators were used to make

it more useful for both researchers and businesses that want to try out cloud supply chain management.

The advantages offered by cloud computing institutions for supply chain management were compiled from a group of studies on the same subject. The first contribution of this study is to summarize the advantages into 10 main advantages of one model. The internal consistency and the extent of their statistical correlation were examined. These results are consistent with previous studies that mentioned each of them has a set of advantages offered by cloud computing for supply chains such as Zhou et al. [19]; Tiwari and Jain [20]; Grzybowska et al. [21]; and Swanson and Ezell [1].

The second contribution to the study is that it took this view of the institutions that went to cloud technology in managing their supply chains in determining the extent to which they benefit from cloud computing through a questionnaire that was statistically examined by examining the impact of cloud computing on the challenges of supply chains that were summarized through previous studies such as Patil [22]; and Karpova et al. [8]. Ten main hypotheses have been proven, each of which is related to one of the features added by cloud computing. The sample agreed that they felt these advantages when they switched to managing supply chains via the cloud. This agrees with all previous studies for example Zhou et al. [19]; Tiwari and Jain [20]; Chaudhri et al. [23]; and Swanson and Ezell [1] that mentioned these advantages. Still, this study proved the existence of these advantages and studied them statistically.

The third contribution to this study is that by putting forward sub-hypotheses showing the effect of each cloud-computing feature on each type of supply chain challenge and examining these hypotheses statistically, it was found that all advantages affect all challenges. However, there was a discrepancy between the strength of the impact and the result of the determination coefficient R2, where the features were divided over the challenges based on the strength of the effect, and this was statistically proven. The distribution was as shown in Table 2.

By using the results of the statistical methods proposed in this research in the future, the results of the models proposed in this research to figure out the benefits of cloud supply chain management will be proven to be correct.

Table 2. Effect of cloud computing feature on supply chain challenges

SC challenges	Cloud computing benefits
Challenges of SC external relations	Flexibility, scalability, and sustainability
Challenges of SC internal operations	Cost efficiency, visibility, on-demand self-service, intelligent model, and sustainability
SC technical challenges	Simplification, flexibility, scalability, resource pooling, on-demand self-service, and connection

5. CONCLUSIONS

This study, which relied on statistical analysis through Smart PLS and SPSS tools for the results of the questionnaire in the field of cloud supply chain management features, contributed to compiling the advantages in one study and summing them up with ten advantages, namely cost efficiency, simplification, flexibility, visibility, scalability, resource pooling, on-demand self service, connectivity, and an intelligent model.

The study has divided these advantages from the point of view of the institutions that manage their business via the cloud in the study community. The findings show that the advantages are divided into three sections according to their impact on the types of challenges in traditional supply chain management (SC external relations, SC internal operations, and SC technical challenges).

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