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The role of cloud computing in supporting decision making: Evidence from banking industry

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C H R O N I C L E	A B S T R A C T
	Current study aimed at examining the influence of cloud computing characteristics and attributes (on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service) on decision making process within commercial banks in Jordan. Quantitative approach was used, and a questionnaire was distributed on a sample of (104) managers within commercial banks in Jordan. SPSS was employed to process and analyze primary data, depending on multiple and linear regression; results of study accepted the main hypothesis, and it appeared that cloud computing attributes support organizational efforts for better decision making process. Study recommended examining the role of cloud computing in the field of accounting, in other meanings; investigate the role of cloud accounting in supporting financial decision making process.

1. Introduction

The concept of cloud computing is treated as the buzzword of the modern century, where the idea of cloud computing emerged to facilitate computing operations as a result of technological development that led to the emergence of a huge volume of data that was difficult to store with time (Sadeeq et al., 2021). Srivastava and Khan (2018) confirm that the idea of cloud computing has contributed greatly to simplifying the technological processes of individuals and organizations, and has become an integral part of individuals' lives, whether on a personal level or on a practical level. On the other hand, Dang et al. (2019) and Sunyaev (2020) confirm that the concept of cloud computing came as a result of digital development, which led to an increase in information outputs, and thus the need to deal with these outputs in a way that serves the process of controlling and storing data, in addition to increasing efficiency and flexibility faster and easier, which led to it being the cornerstone of the digital development process. Alam (2020) indicates that cloud computing contributed to providing a work environment that is scalable, specifically by developing access to all the computerized resources of the organization when needed, and the idea of cloud computing provided instant self-service on demand, which facilitated the decision-makers' access to all resource's organization at any time and quickly. On the other hand, Subramanian and Jeyaraj (2018) argue that cloud computing provided flexibility in organizational processes, reducing the need to create additional infrastructure, which made peak work easier and more automated. The cloud offers organizations more flexibility in general versus hosting on an on-premises server. In the event that an organization needs additional bandwidth, a cloud-based service can meet that demand right away, rather than undergoing a complex (and costly) upgrade of its information technology (IT) infrastructure. This improved freedom and flexibility can make a huge difference to an organization's overall efficiency (Bello et al, 2021).

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Launching from the argument above; current study sought to examine the role of cloud computing in supporting decision making among decision makers of commercial banks in Jordan. The study took into perspective characteristics of cloud computing that included "on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service".

2. Hypotheses Development

Study by Cheng (2017) tried to identify the role of cloud computing in improving decision-making processes in organizations, in addition to trying to determine the technical and technical dimensions of cloud computing and its relationship to the decision-making mechanism. Through the quantitative approach, and by applying a questionnaire to a sample of 847 organizations in 7 countries within the continents of Asia, Europe, and America, the study concluded that cloud computing served decision-making processes with reference to the high level of perceived benefit and ease of use for decision makers, which made it led to facilitating decision-making processes and reaching better and more efficient decisions. Study by Araujo (2018) examined the role of cloud computing in facilitating decision-making processes for organizations, and found that cloud computing is able to support big data analysis processes and gives it exceptional value and flexibility by facilitating the mechanism of access to information and data, and important documents and their sharing to make decisions strategic business, in addition to supporting the foundations of avoiding human errors and accelerating decision-making by increasing productivity and focusing on essential tasks. Youssef and Mostafa (2019) aimed to show the extent of the success of cloud computing adoption processes and their impact on decision-making processes in organizations. Expenditures for analyzing data and converting it into information, in addition to accessing unlimited resources with the least possible effort and cost, since relying on cloud computing eliminates the importance of creating additional infrastructure for organizations. Based on above previous studies, and launching from main aim of current study; researcher was able to develop a model from which a set of hypotheses was developed:
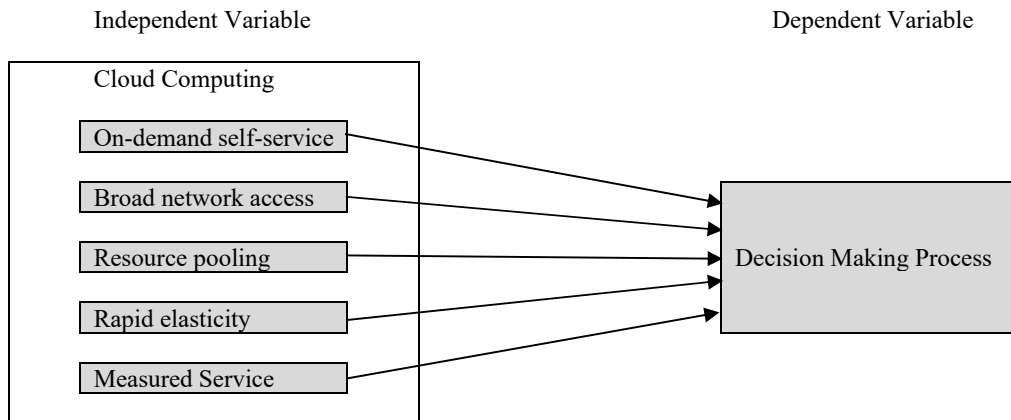
Fig. 1. The proposed study (Ahmad & Afzal, 2017; Sohaib et al., 2019; Sharma & Acharya, 2020)

Main Hypothesis:

H: *Cloud computing attributes supports organizational efforts for better decision making process.*

Sub-Hypotheses:

H$_1$: *On-demand self-service supports organizational efforts for better decision making process.*

H$_2$: *Broad network access supports organizational efforts for better decision making process.*

H$_3$: *Resource pooling supports organizational efforts for better decision making process.*

H$_4$: *Rapid elasticity supports organizational efforts for better decision making process.*

H$_5$: *Measured service supports organizational efforts for better decision making process.*

3. Literature review

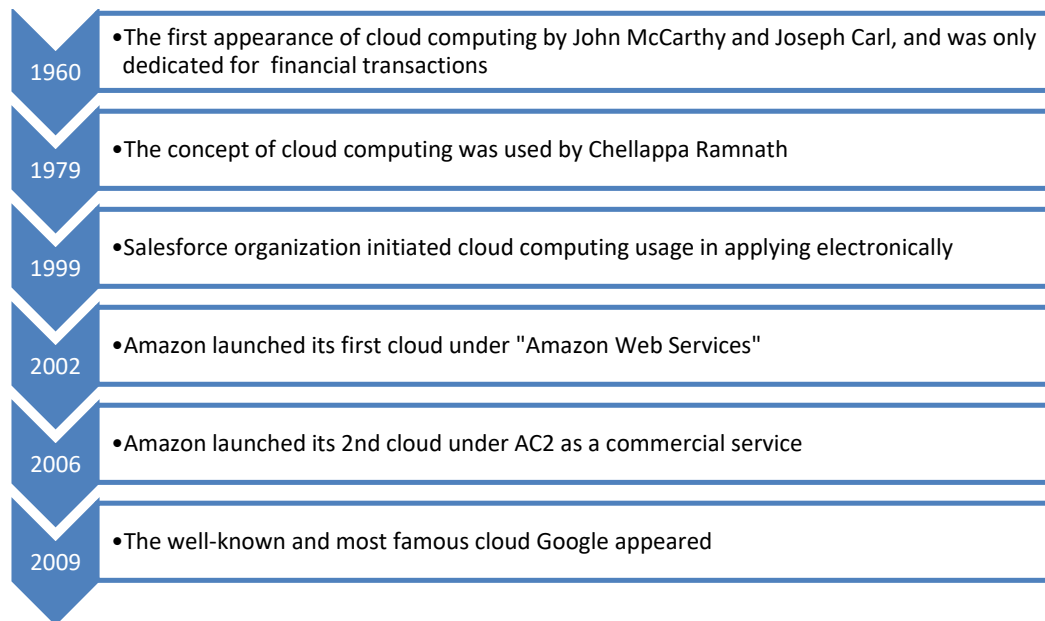### 3.1 Cloud computing

The world is undergoing many changes all the time, and it cannot be said that the changes are over, and that the world is now stable. On the contrary, the idea of stability is far from humanity today, and the world will keep moving from one development to another all the time. Globalization and continuous technological development have imposed the need for innovation and

creativity to make the most of technology and achieve the distinctive performance and the required dynamism. Technology, and specifically cloud computing, has affected many organizational processes and individual intellectual trends which led to the arrival of an era known today as the era of cloud computing (Hassan et al., 2020; Shukur et al., 2020; Abid et al., 2020; Kumar et al., 2019).

Catching up with development and keeping pace with global competition cannot be a reality without organizations relying on modern technology in all their internal and external operations, as the technology has dominated many human activities in many areas such as education, trade, health and many others, and it has become impossible for organizations to stay away from adopting modern technological foundations without falling behind other systems in their development and competitiveness (Gai et al., 2020).

Cloud computing appeared and constituted a qualitative leap in the management of activities and organizational processes and was able to create faster and more effective communication processes (Tabrizchi & Kuchaki Rafsanjani, 2020). Cloud computing is defined as the resources and systems available on demand through the network by providing a set of computing services without being restricted to local resources, including storage spaces, applications and various computer servers (Abdulqadir et al., 2021). Rashid and Chaturvedi (2019) define cloud computing as a model that enables the user to quickly access data and resources through the network from anywhere instantly.

1960	• The first appearance of cloud computing by John McCarthy and Joseph Carl, and was only dedicated for financial transactions
1979	• The concept of cloud computing was used by Chellappa Ramnath
1999	• Salesforce organization initiated cloud computing usage in applying electronically
2002	• Amazon launched its first cloud under "Amazon Web Services"
2006	• Amazon launched its 2nd cloud under AC2 as a commercial service
2009	• The well-known and most famous cloud Google appeared

Fig. 2. The history of cloud computing (Kratzke, 2018)

3.2 Characteristics of Cloud Computing

Cloud computing is of great importance for organizations and individuals, as the benefit of it is not specific to a certain party, such as large organizations or operating companies, but rather its benefit is for individuals even on a personal level (Kumar et al., 2019). Among the most important characteristics of cloud computing are what was mentioned by Abdel-Basset et al. (2018), Khayer et al. (2020) and Arunarani et al. (2020):

On-demand self-service

This is done by giving the user the ability to access data and resources on the cloud when needed and automatically without the need for human interaction.

Broad network access

In broad network access resources are located on the network and accessed via different computing platforms and tools such as tablets, smartphones, laptops, and various types of computers.

Resource pooling

Resource pooling refers to the computing resources that are pooled to serve multiple consumers through a multi-tenant model, with different virtual and physical resources that are allotted and reallocated dynamically according to consumer demand.

Rapid elasticity

Elasticity in cloud computing refers to the level of system ability to cope with changes presented by workload via provisioning and de-provisioning in an automated manner, based on that, resources can be available on demand. Elasticity is an essential characteristic that differs cloud computing from other computing paradigms like grid computing.

Measured Service

It is widely known that depending on cloud service is quantifiable; in other meaning, usage is able to be quantified via various metrics such as time used, bandwidth used, and data used. Measured service is what enables the cloud service provider to activate the pay as you go feature, for example, and once the appropriate scale is determined, the price rate is determined. According to Kumar and Jelciana (2018), measured service is used to determine how much the User will be charged for using the Services, in this way; the user is charged only according to the consumption levels. If there is a service that was not used at a certain time, the customer does not bear anything during that time.

3.3. Types of cloud computing deployment models

According to Zhang et al. (2020) and Sun (2020), cloud computing differs in model and deployment, the most famous models of cloud computing are:

Private cloud

The private cloud refers to the resources on the cloud that organizations use exclusively for the purposes of their internal and external operations.

Public cloud

It is that cloud that an organization builds by combining hardware and software, and the infrastructure is usually owned by the service provider and provided through the Internet exclusively and can be accessed through a web browser.

Community cloud

This model combines the public and private clouds in order to share data, information and applications, and it is linked to the resources available on the cloud with the resources that are not available on it, which gives more flexibility to organizations

3.4 Types of cloud computing services

The architecture or types of cloud computing differ according to organizational needs, for that reason, there appeared – over the years – many types of cloud computing models and architecture which included – Ali et al. (2018); Schleier-Smith et al. (2021); Odun-Ayo et al. (2018); Amani et al. (2020) and Rashid et al. (2018):

Infrastructure as a service (IaaS)

This model is a cloud-based building block where the infrastructure components are in the data centers, such as servers, storage devices and virtual simulators, therefore, the service can be purchased without the need to purchase the infrastructure

Platform as a service (PaaS)

This model is based on IaaS but is defined by the different hardware tools and software required to develop applications, in addition to infrastructure components and operating systems, and is a pre-paid model.

Software as a service (SaaS)

With SaaS, the service provider hosts an entire infrastructure in the cloud and manages it for the end user. When the organization chooses a particular model, it virtually does not need to install any applications. Users will be able to log in and immediately start using the service provider's application in the cloud that runs on their infrastructure.

3.5 Decision Making Process

Decision-making is one of the basic skills that an individual must possess, as it is a skill that an individual uses in all stages of life, and the decision-making skill is not limited to stakeholders in organizations but includes individuals of all ages at the level of personal life (Khorsand & Ramezanpour, 2020). In organizations, the decision-making process requires considering the interest of the organization, working individuals and customers at the same time, and one aspect cannot be overlooked during this process, so many stakeholders are keen to make decisions based on correct information and accurate in order to ensure follow-up and its positive impact on the organization as a whole (Sharma et al., 2020).

Accessing correct, accurate and reliable information is not easy, as it is necessary to keep the data appropriately, and then ensure that it is analyzed, classified and sorted in a way that makes it easier for decision-makers to retrieve it. From here, it was found that cloud computing with its services may have a great impact dealing with big data, sorting it, classifying it, and presenting it as information that serves decision makers (Trabay et al., 2022).

4. Methods

4.1 Methodological Approach

The current study adopted the quantitative approach to collect the primary data, as the quantitative method was chosen because of the possibility of adopting a large sample and collecting larger primary data, thus stabilizing the phenomenon and facilitating the possibility of reading it.

4.2 Population and Sample

The study population was represented by the managers of Jordanian commercial banks, where a sample of (120) managers was selected for the application process and the collection of primary data.

4.3 Tool of Study

The questionnaire was adopted as the main tool for data collection. The questionnaire consisted of two parts.

Table 1
Paragraphs distribution according to variables

Variable	Number of statements
On-demand self-service	6
Broad network access	5
Resource pooling	5
Rapid elasticity	4
Measured Service	5
Decision Making Process	6
Total	31

In line with the instructions of COVID 19 based on social distancing, the questionnaire was uploaded to Google Forms and the link was sent via e-mail to the study sample for the purpose of filling out the questionnaire. The data collection process continued for 6 consecutive weeks, after which an excel file containing the responses of the sample members was withdrawn for the purposes of analysis, and (104) correctly filled out questionnaires were used for analysis.

4.4 Data Screening and Analysis

SPSS was relied on for the purposes of classification, reading, and analysis of the data collected, and the reliability and consistency of the study tool through measuring Cronbach's alpha which appeared that alpha= 0.943 ensuring the consistency of the study tool.

5. Results and Discussion

5.1. Demographic Results

Table 2 presents descriptive statistics according to sample demographics, table showed that most of the sample individuals were males forming 72.1% of total sample, who held PhD degrees forming 58.7% of the sample, and who had an experience in the field of 9-11 years forming 46.2%.

Table 2
Personal characteristics of the participants

		Frequency	Percentage
Gender	Male	75	72.1
	Female	29	27.9
Education	BA	19	18.3
	MA	24	23.1
	PhD	61	58.7
Experience	3-5	16	15.4
	6-8	32	30.8
	9-11	48	46.2
	+12	8	7.7
	Total	104	100.0

5.2 Questionnaire Analysis

Table 2 below presents the mean and standard deviation of sample's responses to paragraphs of questionnaire. It was seen that respondents had positive attitudes towards the paragraphs given that they all scored higher than mean of scale 3.00 which was statistically positive. The highest paragraph scored 4.24/5.00 and was articulated "Tools over the cloud are pooled to serve multiple demands" compared to the least paragraph which scored 3.42/5.00 and was articulated "Reclaiming information is easy and accessible all the time" however it was seen positive since it was higher than mean of scale.

As for responses towards variable of study, it was seen that all variables scored higher than mean of scale 3.00 which was statistically acceptable, the highest variable scored 4.01/5.00 which was "measured service" compared to the least variable which was On-demand self-service and scored 3.78/5.00. However, all variables were statistically positive.

Table 3
The summary of the descriptive statistics

	$\bar{x}$	σ
An individual can unilaterally use computing capabilities	3.59	1.02
An individual has the ability to reach network storage as needed automatically	3.72	1.28
There is no need for human interaction with service providers	3.88	.98
Cloud computing is a web-based self service	3.78	1.13
Using cloud computing is simple and flexible	4.10	1.00
It doesn't require a lot of time and it is instant	3.60	1.13
On-demand self-service	**3.78**	**.79**
All services can be reached through standard mechanism	3.87	1.02
It depends on heterogeneous thin or thick client platforms	3.89	.98
All services can be accessed from any device over the network	4.01	.94
Any authorized user can have access from any where	3.89	.98
It is reliable since it supports OSI and TCP/IP protocols	3.86	1.08
Broad network access	**3.90**	**.85**
Tools over the cloud are pooled to serve multiple demands	4.24	1.01
There are multiple physical and virtual resources	3.72	1.18
It enjoys the ability to resent highly precise information	3.89	1.11
There is a good level of storage, processing, memory and bandwidth	3.78	1.08
Reclaiming information is easy and accessible all the time	3.42	1.06
Resource pooling	**3.81**	**.69**
It enjoys a variation of workload, and different performance levels	3.76	.93
All information presented are managed and classified all the time	3.74	.95
It is easy to avoid excessive cost	4.11	.80
Resources are maintained and preserved in a safe environment	4.15	.81
Rapid elasticity	**3.94**	**.62**
Resources are automatically optimized and controlled	3.88	.96
All information retrieved are transparent and adequate	4.07	.90
The cloud system automatically controls and optimizes resource usage for a given service	4.14	.85
Possesses bare scaling capabilities (such as storage, processing, bandwidth, or active user accounts	3.93	1.01
Users can monitor and control resource usage and generate reports that can provide transparency to both service providers and users.	4.02	.78
Measured service	**4.01**	**.66**
Cloud computing, especially the public cloud, plays an essential role in the integration of the decision-making process	3.67	1.01
Decisions are made based on precise and adequate information provided by the cloud	4.04	.90
Resources are protected for future usage and monitored by users	4.07	.90
Through cloud computing, decision are made easily and on solid bases	4.05	.79
Not only higher management, but also leaders and workers have the ability to depend on the cloud to make informed decisions	3.73	1.03
The organization depends highly on resources pulled from cloud to make decision in their place	4.07	.92
Decision making process	**3.94**	**.70**

5.3 Hypothesis testing

The main hypothesis: The effect of cloud computing on decision making

Table 4 presents the results of testing the main hypothesis of the survey.

Table 4
The summary of the main hypothesis

Model	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	R	R Square	F value	Sig.
1 (Constant)	.273	.295		.925	.357	.801	.642	35.187	.000
demand	.012	.086	.014	.140	.889				
broad	.215	.103	.263	2.079	.040				
pooling	-.279	.139	-.276	-2.013	.047				
elasticity	.649	.094	.578	6.882	.000				
service	.322	.104	.303	3.108	.002				

The hypothesis stated above was put to the test with the use of multiple regression; the result, r = 0.801, suggested that there was a strong relationship between "cloud computing" and "decision making process". In addition to this, it was found that the independent variables account for **64.2%** of the variation in the variable that was being studied (the dependent variable). It was also shown that the F value was significant at the level of 0.05, which suggested that the Cloud computing attributes support organizational efforts for better decision making process.

Depending on the above table, sub-hypotheses were tested, results indicated the following:

First sub-hypothesis resulted with Beta = 0.014. It was also shown that the t value was not significant at the level of 0.05, which suggested that **on-demand self-service does not support organizational efforts for better decision-making process**.

Second sub-hypothesis scored Beta = 0.263; It was also shown that the t value was significant at the level of 0.05, which suggested that **Broad network access supports organizational efforts for better decision-making process**.

Third sub-hypothesis stated above was put to the test with the use of linear regression; Beta = -0.276; It was also shown that the t value was significant at the level of 0.05, which suggested that **Resource pooling supports organizational efforts for better decision-making process**.

Fourth sub-hypothesis scored Beta = 0.578; It was also shown that the t value was significant at the level of 0.05, which suggested that **Rapid elasticity supports organizational efforts for better decision-making process**.

Fifth sub-hypothesis resulted with Beta = 0.303; It was also shown that the t value was significant at the level of 0.05, which suggests that **measured service supports organizational efforts for better decision-making process**.

6. Discussion

Current study aimed at examining the role of cloud computing in supporting decision making among decision makers of commercial banks in Jordan. The study took into perspective characteristics of cloud computing that included "on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service". Quantitative approach was adopted through utilizing a questionnaire, the questionnaire was distributed on a sample of (104) managers within commercial banks in Jordan. SPSS was used in order to process primary data, through multiple and linear regressions results of study reached following findings:

The main hypothesis was accepted, and it appeared that Cloud computing attributes supports organizational efforts for better decision making process

Attributes of cloud computing utilized through the study were (on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service). It appeared through linear regression that the most influential attribute of cloud computing on decision making was rapid elasticity ..

Broad network access supports organizational efforts for better decision-making processes.

Resource pooling supports organizational efforts for better decision-making processes.

Rapid elasticity supports organizational efforts for better decision-making.

Service supports organizational efforts for a better decision-making process.

The study proved through the analysis that the most influential feature of cloud computing that affects decision-making processes was rapid elasticity, which indicates the flexibility of broad cloud computing provided for all the operations and activities of the organization in order to facilitate the decision-making process. Rapid elasticity appeared through the possibility of improving employee roles according to work requirements, and it contributed greatly to providing different storage options for data and information, facilitating the process of classifying and analyzing them, and providing them to professional bodies upon request in a reliable and accurate manner. In addition, rapid elasticity as one of the characteristics of cloud computing most impacting on the organization helped the organization to determine the level of control over the information on the cloud, framing authorized and unauthorized access, as well as the possibility of finding different solutions to business requirements and encryption techniques that It provided security in information and thus ensured the adoption of sound decisions based on the resources available to decision makers.

On another level, measured service appeared to be also influential, it emerged through the possibility of benefiting from cloud computing services according to need and consumption, meaning that the organization pays for the service it takes and nothing more. This gives decision makers a lot of different information about the organization's resources, its technical expenses, and provides them with greater possibilities to control and monitor expenses and find out what benefits the organization and goes on its resources. Measured services include billing, efficient use of resources, and comprehensive predictive planning.

7. Conclusion and Recommendations

In general, it was found through the results of the study that the axes of decision-making and cloud computing contribute to supporting organizations, specifically financial ones, in decision-making processes, especially in a changing environment in terms of high expectations of customers and the continuous and rapid surrounding changes, and thus, the need to make decisions based on reliable, deep and specialized information related to vital decision-making axes such as human resources, financial resources, and customer base increases. The results of the study also confirmed that the world today has become dependent on software, so the real investment is in cloud computing, which will lead to the speed of making good decisions, and thus innovation does not cost much, but must work according to the culture of the organization from the perspective of "deep thinking, beginnings Small, fast action.

Based on results, discussion and conclusion, the current study recommended examining the role of cloud computing in the field of accounting, in other meanings, investigating the role of cloud accounting in supporting the financial decision making process.

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