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Selecting the Cloud Computing Model for E-Commerce Enterprises in Developing Countries Using an Uncertain Model

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ABSTRACT

E-commerce means the production, marketing, sales, and delivery of goods and services using electronic tools. In recent years, cloud computing has become an important technology in the IT field. E-commerce Experts believe that cloud computing will transform processes in the field of information technology. Cloud computing is a novel processing method in which scalable and often virtualized resources are delivered as a processing service through communication networks such as local area networks and the Internet. The focus of this model is on-demand service to the user, without the user having to process specific equipment or being aware of the process. Cloud computing services can be divided into three groups of IaaS, PaaS and SaaS. In this research we aim to provide an uncertain model for selecting the cloud computing model for e-commerce enterprises in developing countries based on hesitant fuzzy decision making methods.

Keywords: E-commerce, Cloud computing, developing countries hesitant fuzzy set.

Introduction

Today, the introduction of ICT into economics and commerce has led to a revolution called "e-commerce" that staying away from this revolution will cause isolation in the world economy. E-commerce has changed the competitive environment of the business by creating benefits such as improving productivity, reducing prices, saving costs and changing the size and structure of the market, as well as eliminating intermediaries and allowing manufacturer's access to end users is fundamental [3].

The Internet has made fundamental changes in many business activities. On the one hand, the Internet facilitates communication between supply chain members and provides inclusive communication infrastructure as well as enormous business opportunities. On the other hand, the Internet has affected the power of companies and their competitive advantage [1].

The Internet has a huge impact on business, from communications to after-sales service. In particular, the Internet has revolutionized marketing, retailing, shopping and advertising of products and services. Companies use Internet technology to reach their suppliers, manufacturers, suppliers or customers and access 24 hours a day, 7 days a week [2]. Examples of recent benefits that companies have gained through the use of the Internet and IT are: (1) faster response and access to information (2) better customer service (3) increased competition, (4) reduced data and Data input response. As such, the Internet has become a convenient and effective tool for real-time communication with all members of the supply chain [4]. In addition, using the Internet enables electronic customers to easily access information about products and services, vertical information (e.g., product comparison across providers) at a low cost, efficiently on-screen Display provided, and easily provided with a low price for a specified item. In other words, there are several attractive features on the internet in shopping including, save time - and money, convenience or easy access, the ability and ability to display a wide range of E-Customer options (Electronic customer) on-screen, and availability of information for purchase or order and so on. The impact of the Internet on business activities can also be analyzed separately in commerce, marketing, retail industry and SCM activities [5].

E-commerce is one of the advantages of information and communication technology in economy and commerce and has many advantages. But now an important issue for organizations and companies is the start-up cost associated with information technology and e-commerce [6]. Organizations seek to reduce costs, increase revenue, productivity, and customer satisfaction. To this end, cloud-based e-commerce is one of the most important topics on which world-wide planning is ongoing. By creating cloud computing-based e-commerce, we are able to access new technology at the lowest cost, as well as mass data storage and high-capacity computing capability. Using this technology makes it possible for small and medium-sized organizations to implement it [7].

Cloud computing is a type of internet-based computing that can share software and hardware resources for computers and other devices. Another reason for cloud computing is a pattern of It infrastructure, where users can get their own service over the Internet through a request that can be expanded [8]. This service can be IT or Internet or any other service that the user can pay for, eliminating the need for traditional hardware and software investments. Cloud computing allows users to reap the benefits of it without having to deal with complex IT concepts [9]. So cloud computing can be the Internet that offers user-friendly services and applications that can be managed by the user themselves and be self-managed [10].

Cloud computing is a combination of traditional network technology and computer technologies such as parallel processing, distributed processing, and so on. Cloud computing eliminates the need for users to continuously upgrade software and hardware, allowing the user to use powerful computing resources with a simple system. Many organizations and websites, like Forrester, all agree that cloud computing is a technology gap. In short, cloud computing is a cloud-based model of internet-based computing that emerges from the sharing of IT infrastructures in which all IT services can be accessed [11].

Developing countries such as Iran, Iraq and etc., because studying on these countries is definitely different from developed countries with more electronic facilities and has good application [12]. In this study, the developed uncertain fuzzy sets are used. The advantage of these methods over other models is that it provides a set of membership function values.

There are many qualitative concepts in everyday life, and measuring these components with definite numbers may not reflect the correct result. Uncertainty methods are used for this purpose [13].

Problem definition

These days, various types of Internet-based systems such as e-commerce are running on cloud computing. There are many successful e-commerce companies in the world, but e-commerce has not reached its full potential [5]. The main reason for this is the lack of trust in e-commerce and its security. Existing models are not secure enough to execute transactions, especially on cloud platforms. Most of the time users cannot distinguish between good and bad online business companies, which is an obstacle for users and companies to migrate to the cloud [20].

Cloud computing as a new technology using the Internet infrastructure can be the best solution in the development of e-commerce. Effective factors need to be identified and explored for its use in e-commerce. In this study, we identify and investigate the factors affecting the use of cloud computing in e-commerce and then rank the cloud computing models for the industry [17].

Deploying cloud computing creates new competitive advantages for companies by providing cloud services such as efficient use of resources and management of capital and cost support, rapid increase of storage space and facilities without deployment of new infrastructure [20]. The main purpose of this article is to identify the factors affecting the use of cloud computing in e-commerce and their ranking. To this end, the introduction of cloud computing and e-commerce is first introduced, with a review of the research that identifies key factors including: stakeholders, governance, organizations, theology, and its sub-criteria, and then establishes these factors and criteria. The questionnaire was surveyed by e-commerce companies and experts. Then the new fuzzy decision making method is used to rank.

E-commerce enterprises

E-Commerce is a powerful concept and flow that has made major changes in the lives of today's people. E-commerce is one of the concrete features of the ICT revolution in the economic arena. This style of business is rapidly expanding due to the enormous benefits and benefits to humans. It can be safely asserted that e-commerce has overcome many of the limitations of traditional commerce, and has not only altered the form and form of traditional commerce but also the content of commerce, a change that underpins any action in the business. The realm of economics is located [28].

There are markets, passageways, and virtual shops that occupy no physical location, yet they can be visited in a moment, anywhere in the world without leaving home, as well as choosing and ordering goods that they are displayed in virtual shops in unknown locations around the world and advertised on the virtual network through electronic payments. All of these options have made e-commerce a miracle of the century [15].

E-commerce is the purchase, sale, and exchange of goods, services, and information through computer networks, including the Internet. This type of business is based on the processing and electronic transmission of data, including text, sound and image. E-commerce also includes a variety of activities including exchange, immediate delivery of digital content, electronic transfer of funds, electronic stock exchange, electronic bill of lading, engineering and business plans and after-sales services [29].

The main feature of this type of business is to facilitate business processes, eliminate unnecessary and unnecessary business processes and reduce costs by improving and enhancing coordination, reducing administrative costs, especially correspondence costs, as well as improving market access and increasing diversity for customers. In the meantime, new communication technologies such as Internet, Extranet, e-mail and mobile phones have been instrumental in expanding e-commerce [28].

History of E - commerce

In the early years of the decade , the term e - commerce referred to the exchange of electronic data for sending business documents such as purchase orders or electronic bills , and later with the development of the word e - commerce industry through the Web for the purchase of goods and services The service was called [30].

When the first web of the World Wide Web became widely known and widely recognized , many scholars predicted that this type of business , IE web - based business , would soon

become an important part of the world economy , but it took five years to complete http - based protocols are widely available to users [31].

The earliest electronic businesses can be found in and among a number of reputable businesses in the US and Western Europe. Businesses formed by launching elementary websites and then developing. In year 4, e-commerce grew rapidly in most cities in America, Europe and East Asia. Some believe that the age of e-commerce dates back to the advent of the present Internet, but because of the heavy cost of this style of business, it has only been possible for companies, businesses and institutions to use it for the past few years. It was economical, but with the advent of the Internet and the opportunity for all people to use it, it was possible to change the structure of e-commerce and to become a proprietary category and become an accessible industry [32].

E-Commerce Framework

E-commerce frameworks are made up of four levels. To have a successful e-commerce, these frameworks are necessary [15,17,32,33]:

Infrastructure: The first part of the frameworks required for e-commerce include hardware, software, databases, and communications to perform the task of providing worldwide web services over the Internet or other messaging and messaging methods. Internet or other networks are used.

Services: The second part of the frameworks cover a wide range of services that provide the ability to find and present information, including search for business partners as well as negotiating and agreeing to trade.

E-Commerce Products and Structures: This part of the E-Commerce Framework includes the direct provision and provision of business-related information products and services to customers and business partners, collaborating and sharing information within and outside the organization and the organization of the environment Electronic market and supply chain.

E-Commerce Models

The use of the Internet as the main communication platform in e-commerce has led to various models in this style of business. These models, which are the result of the interaction of the three main groups of e-commerce, namely government, customers and businesses, have developed and expanded various e-commerce models:

The B2B e-commerce platform is a recommended solution for large and medium-sized companies seeking to improve their position in the e-market. Another benefit of this solution is efficient competitive development for companies that want to expand their infrastructure and consolidate their business position in the market. With B2B e-commerce, businesses will be given the opportunity to customize, customize and connect with their digital business [19].

Our audiences in this segment, called online businesses, will experience an exciting and profitable path to online business by providing new and completely online access to their users [20].

Although the company's e-commerce solutions have provided customers with the capabilities of an e-commerce platform (B2B), the platform offers a wide range of e-commerce services including virtual stores, travel and travel services, systems Includes the production and distribution of goods and other online sales services. This unique comprehensive e-commerce

solution for growing offline businesses and businesses enables you to become a powerful online organization, enabling your company or an enterprise to attract with the least effort, least cost and no time Pay for new online customers or retain regular customers and thereby serve them [16]:

- Distinctive features included in the B2B structure
- Compatibility with B2B business rules and standards
- Easy Implementation - The First Steps to Using a B2B Platform
- Technical documentation - to create your own unique B2B solution

Business to Consumer or B2C and Consumer to Business or C2B models:

B2C and C2B models illustrate the interplay between the manufacturer and the final buyer of products and services. Dual B2C and C2B models have advantages such as cheaper shopping than the real world, the ability to ship purchased to customer's requested location, and so on. This model of e-commerce is known as the simplest type of e-commerce that will result in a close relationship between the customer and the seller.

Consumer to Consumer or C2C model:

This model of e-commerce is mainly aimed at retailers of second-hand household goods. Where both buyers and sellers are from the final group, there is no producer or intermediary footprint. A common example of this type of trading can be found in local or regional markets or local auctions on Friday, where each individual product is sold to buyers as a single sale. One of the most famous examples of this model of e-commerce is the ebay site [30].

Government to Business or G2B and Business to Government or B2G:

In these models, public and private organizations and centers are associated with state-owned businesses and businesses. In this structure, the two parties do their business by accessing the websites of the contracting parties and interacting with each other through computer networks. These include submitting bank applications to government agencies, obtaining administrative clearances, paying agencies and banks, and so on. The two main advantages of these models are saving money for public companies and private organizations as well as reducing the time it takes for them to do so, as well as making government processes more educated [31].

Government to Customer or G2C model and Customer to Government or C2G:

In these models, the relationship between the people and the government is concerned, rather than being of a commercial nature, it is of a service nature and includes services that the government can provide to the public or provide a framework for facilitating public-government financial communications. In tax matters or requests for services provided by citizens to the government include various requests in the economic or commercial field [32].

Government to Government or G2G Model:

In this model, there is an interaction between two or more government agencies or ministries, including the municipality's relationship with the police, the electricity and water departments with the municipalities, the military and law enforcement agencies with the ministries, and so on. In this model, it is possible to exchange information between state-owned enterprises or

trade between state-owned companies. In addition, government letters and guidelines can be sent to organizations through this electronic business model [33].

Cloud computing

Cloud computing is a large-scale distributed system that provides economies of scale. In these systems, resources are abstracted and virtualized, which helps to make these resources scalable. In fact, computing power management, storage, and infrastructure and service delivery can be provided based on consumer demand. In cloud computing models, fees are paid periodically and the customer does not need to pay a one-time fee. The most important features of cloud computing can be summarized as follows [3]:

- Very high scalability internationally
- Offering an integrated view of services and features to users outside the cloud computing environment
- Creating economies of scale
- Dynamically configurable services through virtualization
- Demand-based and resource-saving services
- The process of evolution of cloud computing

Cloud computing is a technology that has evolved dramatically over the past decade in the use of a variety of corporate networks and the Internet. This technology has been recognized as a new paradigm of secure and remote service delivery while reducing costs and increasing productivity [12]. Cloud computing is attractive to organizations in that it reduces the need for continuous planning of information technology infrastructure and enterprise software and drives its overhead costs to other strategic sectors of the organization [9].

Cloud computing is the rental of software and hardware services remotely based on the needs of the organization [3].

Paying for this technology model is similar to paying for the water and electricity costs of buildings that residents pay for. By comparison, organizations are accessing the services they need through the Internet rather than buying hardware, software, and at a much lower cost. In this way, each organization purchases the services based on their needs and pays the costs gradually and at a much lower cost than when purchased. If an organization needs software ownership, it can then download software from the service provider and install and run it on the company's internal hardware in the form of similar leasehold contracts [7].

The evolution of cloud computing and the various forms of computing distributed in the form of technologies are in Figure1.

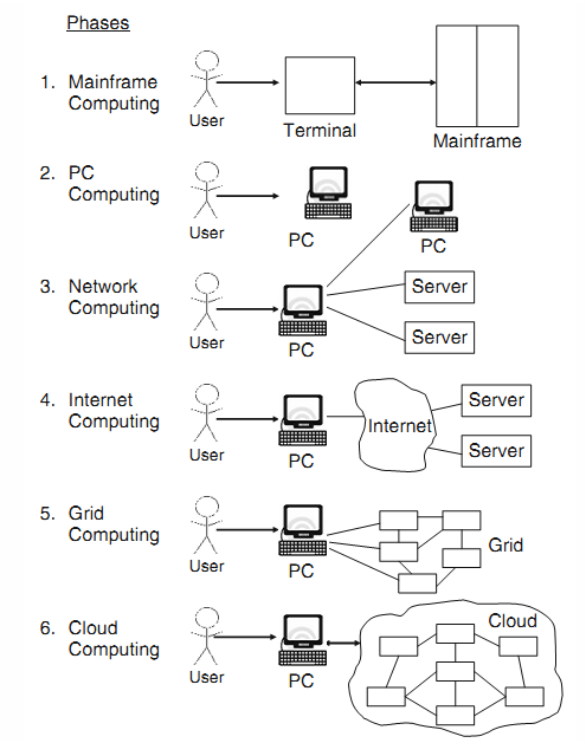

Figure1. Cloud computing development process

In the process of evolution, Grid computing is sharing computing power and resources within the context of distributed systems, while cloud computing is sharing resources in a large scale and virtual space in a simple way [1]. As you can see in the picture above, cloud computing is a return to the early stages of mainframe, with the computing power limited to mainframes but virtually unlimited in cloud computing, and computers in this technology, such as large-scale, high-cost information systems it works down [5].

Depending on the type and level of resources shared and services provided to users, there are four layers of cloud computing [6]:

SaaS: a layer that allows users to run applications remotely in the cloud.

PaaS: When the operating system, database infrastructure, and programming languages such as Java and Python are provided with a single interface, users are provided with an integrated service.

IaaS: is a layer that provides hardware resources such as processors, storage and network as a service.

These layers are visible in the figure 2:

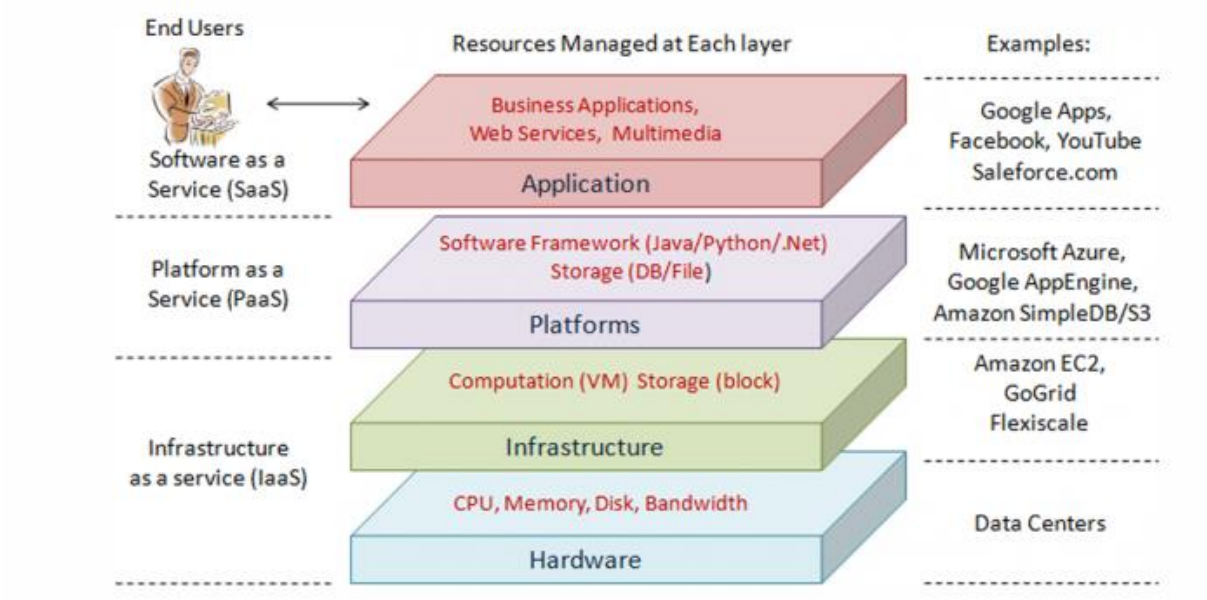

Figure2. layers for cloud computing

Cloud computing will become an appropriate and useful model of e-commerce development in organizations due to sharing and planning in the allocation of resources. This model allows organizations to start with fewer resources and only request more resources when they need more services and resources [2].

The main purpose of cloud computing is to provide access to a large volume of computing resources virtualized. This is done by pooling resources and creating an integrated system. In this model of computing services, customer payment is also based on the amount and duration of use of resources [11].

E-commerce is one of the advantages of information and communication technology in economy and commerce and has many advantages. But now an important issue for organizations and companies is the start-up cost associated with information technology and e-commerce. Organizations seek to reduce costs, increase revenue, productivity, and customer satisfaction. To this end, cloud-based e-commerce is one of the most important topics on which world-wide planning is ongoing. By creating cloud computing-based e-commerce, we are able to access new technology at the lowest cost, as well as mass data storage and high-capacity computing capability. Using this technology makes it possible for small and medium-sized organizations to implement it [6].

Cloud computing based e-commerce

Cloud computing based e-commerce is a new model of e-commerce activity that is changing in the model of profitability, marketing, knowledge management, investment, cost reduction and supply chain. In cloud-based e-commerce, organizations do not have to worry about building hardware and software infrastructure for e-commerce. Huge investment and specialized human resources are not needed to build an e-commerce system. All these issues are handed over to the cloud-based e-commerce service provider, and organizations can only focus on their business. In this e-commerce model, storage is heavily distributed, data management is centralized. The service is provided virtually. The data space becomes secure. High-capacity computing is done [6].

Data mining capacity increases and business intelligence for businesses increases. It is also possible to rent and allocate resources for small and medium-sized businesses at the lowest cost. If e-commerce is implemented based on cloud computing, organizations can use the vast and cost-effective resources provided by cloud providers [1].

There will also be reduced concerns about equipment downtime, inaccessibility, data loss, hardware and software purchasing management, updates, and more.

The most important applications of cloud computing in e-commerce:

Improving the Efficiency of E-Commerce Systems: Cloud computing can be effective in reducing the time needed for activities and services as well as reducing the cost of services and goods.

Improving the accuracy of e-commerce systems: Cloud computing can be used to reduce the number of errors in e-commerce systems.

Enhancing the ease of learning for users: Users of cloud computing will easily learn how to use e-commerce services and will never forget their 24-hour continuous connection with the smart system.

Creating Mental Satisfaction for Users: Cloud computing enhances users' perceived satisfaction with the system interaction experience. This is very helpful for building customer loyalty in e-commerce [6].

Providing Cognitive and Physical Requirements: Because users using the concept of cloud computing can use mobile systems via network with system and network guidance in all their locations, so ergonomic and physical and cognitive conditions are adapted to each individual's requirements which users can be localized.

Providing secure ways of storing data: Although cloud computing has its own security issues, it still provides opportunities for information security as data is centrally stored in the cloud. This way of storing data has at least two advantages for data security. First, the ability to steal information reduces information leakage and damage. Second, information security monitoring is easy. When data is stored in databases, database managers can implement centralized management such as security control, resource allocation and software deployment [3].

The advantages of cloud computing today in the field of business and e-commerce are clearly visible. The growing presence of large companies such as Microsoft 14, Google, Amazon and etc. in the competitive arena of cloud computing is indicative of the rapid development and dominance of such computing in the information technology world. For example, cloud computing, providing on-demand computing, can be used to provide services such as software as a service and platform as a service, using the first instance of *Salesforce.com* and the second instance of *Amazon's EC2* service. It is worth mentioning. Here is a brief overview of some of the cloud service providers in Iran and around the world [1].

The most important competitive advantages of cloud computing for e-commerce, in terms of virtualization, are also in storage, networking and more. The database provided by cloud computing also provides good basics for e-commerce companies to build business intelligence decision-making models and overcome existing problems [1,3,6,11].

Research Background

Martinez et al (2019) presented a cloud computing model adaptation for e-commerce with a novel 2-tuple fuzzy linguistic group decision making mode. The results show SaaS is the best choice for small and medium-sized e-commerce businesses. The result analysis indicates that SaaS is the best choice for small and medium-sized e-commerce businesses considering criteria such as complexity, reliability, security and privacy, organization readiness and firm size, while the selection of PaaS or IaaS can be reinforced considering their compatibility and scalability.

Sohaib and Naderpour (2017) in their study assess the factors associated with cloud-based e-commerce based on TOE (technological, organizational, and environmental) framework using multi-criteria decision-making technique (Fuzzy TOPSIS). The results showed that Fuzzy TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) approach proposes software-as-a-service (SaaS) as the best choice for e-commerce business.

Talib and Alomary (2016) in their research paper concluded that integrations of the internal and external services could sustain E-commerce development in cloud environment. The main goal of their proposed model is to integrate the E-commerce as a service enterprise and cloud computing. Cloud computing provide a number of internal services such as software as a service (SaaS), hardware as a service (HaaS), platform as a service (PaaS), infrastructure as a service (IaaS), data as a service (DaaS) and communication as a service (CaaS) beside an external service such as the internet service provider, IT service provider, software developer, system integration provider and hardware suppliers.

Nafi et al (2013) proposed a fuzzy logic model based certain trust for E-commerce. In this paper they have proposed a new fuzzy logic based Certain Trust model which considers these ambiguity and vagueness of different domain. Fuzzy Based Certain Trust Model depends on some certain values given by experts and developers can be applied in a system like cloud computing, Internet, Web site, e-commerce, etc. to ensure trustworthiness of these platforms. In this paper we show, although fuzzy works with uncertainties, proposed model works with some certain values.

Criteria and alternatives in research:

By reviewing the research literature, 12 sub-criteria and 3 criteria were identified.

Table 3 Criteria and sub-criteria for adoption of cloud service model for E-commerce

criteria	Sub criteria	code	references
technology	Relative advantage	T1	Sohaib et al., 2019
	compatibility	T2	
	complexity	T3	
	Security and privacy	T4	
	reliability	T5	
	scalability	T6	
organization	Organization readiness	O1	Sohaib et al., 2019
	Firm size	O2	
	Top management support	O3	
environment	Competitive pressure	E1	Sohaib et al., 2019
	Trading partner pressure	E2	
	Government regulations	E3	

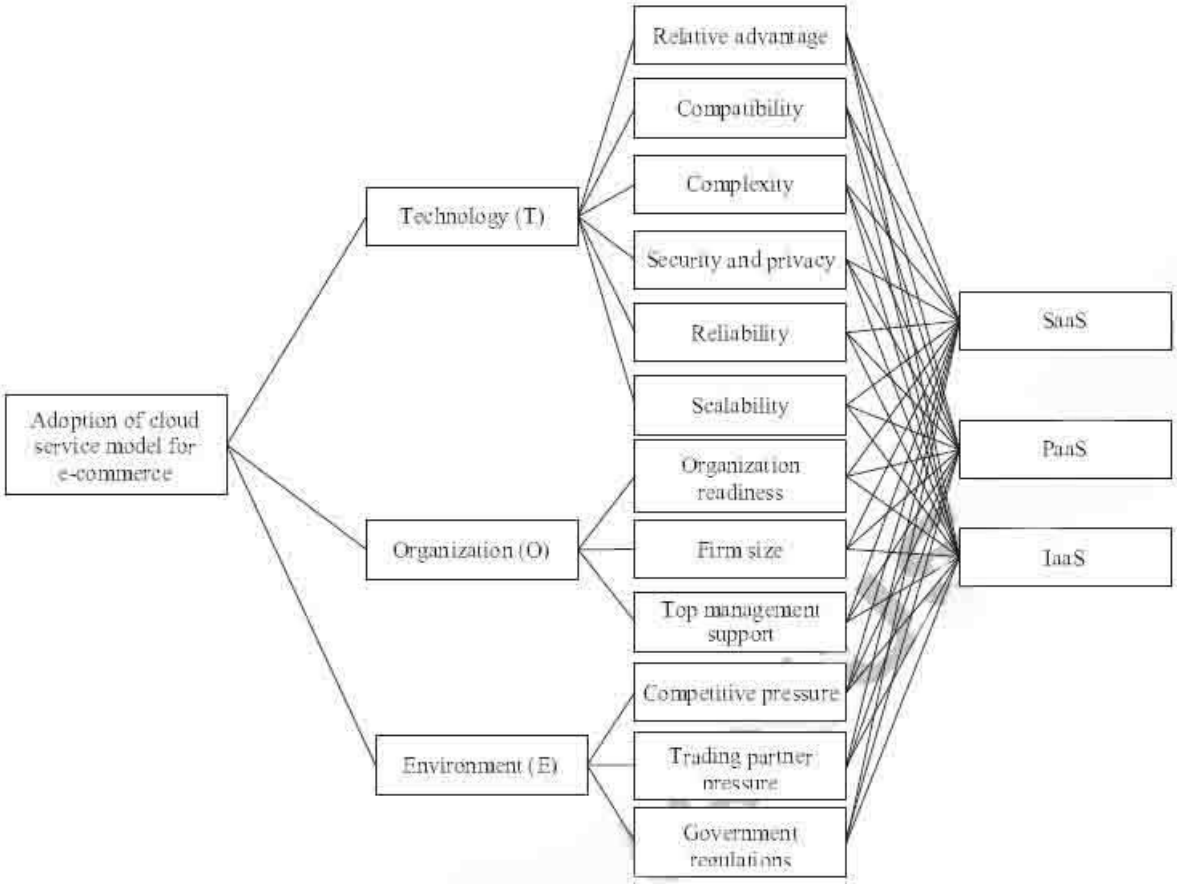

Figure2. Hierarchy of decision problem (Sohaib et al., 2019)

Research methodology:

Hesitant fuzzy set:

Multi-attribute and multi-criteria decision-making techniques play important roles in solving real-world problems. In classical multi-criteria decision-making problems, most options are evaluated in terms of precise values over criteria, while in the real world due to inherent ambiguities in human prioritization, sometimes determining the precise values of evaluating a ratio option. It is difficult or impossible to achieve the desired criteria. hesitant Fuzzy Set and type 2 hesitant Fuzzy Set - The values that allow a member in a given set to accept a set of possible values as membership degrees are effective tools for expressing ambiguous information in multi-criteria decision-making procedures they are going [22].

This is an extension of fuzzy set, which prepare the degree membership of an element by representing several possible values between 0 and 1. The hesitant sets have more advantages in comparison with traditional fuzzy, particularly in group decision-making under uncertainty. These advantages prepare the opportunity to search on decision-making in hesitant conditions. The hesitant fuzzy sets were introduced by Torra in 2009 that is widely applied in decision-making science. A hesitant fuzzy decision-making, which provides several possible values for degree membership of an element, is considered as a useful method to describe and deal with uncertain data [23].

hesitant fuzzy sets have many advantages over classical fuzzy sets. The main impetus for hesitant fuzzy introduction was that in traditional methods when defining the membership degree of an element, we might encounter a marginal error that would cause error in membership values, but in fuzzy sets we hesitate because we have a set of possible values we have this problem fixed. Experience has shown that allocating one interval to the answer set may be less accurate than one-degree membership [24,22].

The complexity of the issues and the uncertainty and ambiguity in the information makes it difficult for managers to make decisions. Hesitant fuzzy sets are a good tool to eliminate ambiguity. Hesitant fuzzy sets and uncertain fuzzy sets are the values of the developed form of fuzzy sets [25].
Suppose X is a reference set. Then, each hesitant fuzzy set (HFS) is a function of h:

$$h : X \longrightarrow \phi([\circ, 1]). \tag{1}$$

$\mu(x_i)$ and $\nu(x_i)$ are the membership function and the non-membership function in the interval [0,1] and are true in the following condition for all values:

$$0 \le \mu(x_i) + \nu(x_i) \le 1 \tag{2}$$

Now we have $\pi_A(x_i) = 1 - \mu(x_i) - \nu(x_i)$ that $\pi_A(x_i)$ is the uncertainty value of x_i in the reference set A.

The point to be made here is that the number of HFE members can be Different [22,23, 35].
Definition 3: A hesitant fuzzy element, such as H in A, is a function in HFS that is defined as a subset of h when the reference set is applied to the interval [0,1]. In fact, the hesitant fuzzy set is the generalization of intuitionistic fuzzy sets. This set is defined by Xu and Xia for convenience as follows:

$$H = \{\langle x_i, h(x_i)\rangle | x_i \in X\} \tag{3}$$

$h(x_i)$ is a set of different values in the interval [0,1]. $h(x_i)$ is called the hesitant fuzzy element (HFE) in the set H.
Definition 4: For a reference set X, if $h(x) = \{\gamma_1, \gamma_2, \ldots, \gamma_l\}$ is a hesitant fuzzy element with a set of possible values of with γ_k (k=1,2,….,l) and 1 is a value of h(x) then the mean of h (x) in the HFE is defined by the following formula:

$$\bar{h}(x) = \frac{1}{l}\sum_{k=1}^{l}\gamma_k. \tag{4}$$

To compare the rules of hesitant fuzzy elements, a definition of the value operator and also variance operator is needed:
Definition 5: For per HFE the value operator is as follows:

$$s(h) = \frac{1}{l_h}\sum_{\gamma \in h}\gamma \tag{5}$$

It is clear that for two HF elements such as h_1 and h_2, if $s(h_1) > s(h_2)$ then $h_1 > h_2$ and if these two values are equal $s(h_1) = s(h_2)$ then $h_1 = h_2$.

Note: obviously, due to the fact that the value operator of the two values is the same, there is no superiority between these two hesitant fuzzy elements [24]. Moreover, another concept called the variance operator is defined:

Definition 6: For each HFE, the variance operator formula is as follows:

$$v_1(h) = \frac{1}{l_h}\sqrt{\sum_{\gamma_i,\gamma_j \in h} (\gamma_i - \gamma_j)^2} \tag{6}$$

For both HFE elements such as h1 and h2, if $\upsilon_1(h_1) > \upsilon_1(h_2)$ then $h_1 < h_2$ [22].

De Luca-Termini hesitant Entropy Method

Entropy is a term widely used in various fields, such as information and management science. Due to widespread use of entropy and uncertainty of the world, the concept of entropy for fuzzy vectors was presented. Complexity and uncertainty of decision-making process lead to the fact that the information related to the weight of the criteria is usually incomplete or completely unidentified.

In this study, a method for cases with the unidentified weight of the criteria is considered. In fact, entropy is a numerical criterion of the amount of information or the randomness of a random variable. Just to clarify, the entropy of a random variable is the expectation of the amount of information obtained from its observation. The information acquired from the observation of an event equals to the negative logarithm of its occurrence probability [22].. This method is applied in order to obtain the weights of sub-criteria that its steps are as follows [22,23,24,25].:

Step 1: computation of score matrix of the hesitant fuzzy S_{ij} on the experts' opinions matrix by applying the following formula:

$$s\left(h_E(x)\right) = \sum_{j=1}^{l(h_E(x))} h_E^{\sigma(j)}(x) \Big/ l(h_E(x)) , \tag{7}$$

Step 2 computation of the normalized matrix S' based on the previous step:

$$s'_{ij} = s_{ij} \Big/ \sum_{i=1}^{m} s_{ij} . \tag{8}$$

Step 3: By Using De Luca-Termini normalized entropy in the field of hesitant fuzzy sets

$$E_j = -\frac{1}{m \ln 2} \sum_{i=1}^{m} \left(s'_{ij} \ln s'_{ij} + (1 - s'_{ij}) \ln(1 - s'_{ij}) \right), \quad j = 1, 2, \ldots, n , \tag{9}$$

Step 4: The definition of the weight of the features is expressed by the following formula:

$$w_j = \frac{1 - E_j}{\sum_{j=1}^{n} (1 - E_j)} , \quad j = 1, 2, \ldots, n . \tag{10}$$

W_J is the weight of the sub-criteria Which is shown in Table 3 . In the second phase of this research, the weights of the criteria and sub-criteria are computed by applying Excel 2010 software.

hesitant fuzzy VIKOR method

Multi-criteria decision-making is a decision-making tool and a weighting methodology that is used to evaluate multiple options according to a set of evaluated criteria and in various fields such as selection, evaluation, planning and development, decision-making, advance Nose and etc. are used in various [26]. Human judgment to determine the criteria for assessing and selecting the most appropriate ones. One of the most widely used methods is the decision making method of the VIKOR method [27].

This method is for ranking, which is a multi-index decision-making tool and is used to solve problem-solving features to solve an acceptable decision-maker's incompatibility, which includes an algorithm that approves the closest solution to the ideal solution Gives [28] . In this way, the decision maker is responsible for approving the final solution and decision makers and decision makers should be covered. By developing fuzzy and fuzzy logic of type II and introducing fuzzy setups, the method of VIKOR was expanded as well as other methods in the field of doubt [27,29]. The steps in this algorithm are as follows:

Step1: creating a decision-making matrix named as H:

$$H = \begin{bmatrix} h_{11} & h_{12} & \dots & h_{1n} \\ h_{21} & h_{22} & \dots & h_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ h_{m1} & h_{m2} & \dots & h_{mn} \end{bmatrix} \tag{11}$$

In which h_{ij} is the degree of membership for the options A (A_1, A_2, ..., A_m) according to the criteria C (C_1, C_2, ..., C_n), and in which (j = 1,2, ..., m) and (i = 1,2, ..., n).
Step 2: Determination of the value operator and variance operator will be calculated by using the formulas number 5 and 6. After that calculate the distance between two fuzzy elements through the following formula:

$$d(h_M, h_N) = \frac{1}{l} \sum_{k=1}^{l} \left| h_M^{\sigma(k)} - h_N^{\sigma(k)} \right|. \tag{12}$$

After that, the positive and negative ideal values will be acquired:
Positive and negative ideals for positive criteria are as follows $h_j^- = \min_i h_{ij}$ and $h_j^* = \max_i h_{ij}$
This means the largest and smallest value in the positive criterion. As for negative criteria such as expense due to the inverse effect, the positive ideal has the smallest value while the negative one has the largest value [27]. The next step is to create the decision-making matrix and determine the best and worst value among the available values of each index for the decision-making matrix of the determined qualitative indices and the importance of each index has been computed by hesitant fuzzy concepts. For this purpose, firstly, the values of the hesitant fuzzy S function are calculated for managers by using Formula 1 and Formula 6. Then, the largest and smallest values are obtained with respect to the fact that all the criteria are positive [27,28]

Step 3: computation the value of S_i and R_j and the VIKOR indicator
The S_i criterion, R_j criterion in hesitant fuzzy VIKOR are calculated as follows, respectively:

$$\widetilde{S}_i = \widetilde{L}_{1,i} = \sum_{j=1}^{n} \omega_j \frac{d\left(h_j^*, h_{ij}\right)}{d\left(h_j^*, h_j^-\right)} \tag{13}$$

$$\widetilde{R}_i = \widetilde{L}_{\infty,i} = \max_j \left(\omega_j \frac{d\left(h_j^*, h_{ij}\right)}{d\left(h_j^*, h_j^-\right)} \right) \tag{14}$$

$$\widetilde{Q}_i = \upsilon \frac{\widetilde{S}_i - \widetilde{S}^*}{\widetilde{S}^- - \widetilde{S}^*} + (1-\upsilon) \frac{\widetilde{R}_i - \widetilde{R}^*}{\widetilde{R}^- - \widetilde{R}^*} \tag{15}$$

Where $\omega_j (j = 1, 2, \ldots, n)$ are the corresponding weights of criteria satisfying bellow condition:

$$0 \le \omega_j \le 1,\ j = 1, 2, \ldots, n,\ \textstyle\sum_{j=1}^{n} \omega_j = 1, \tag{16}$$

And $\tilde{S}^* = \min_i \tilde{S}_i,\ \tilde{S}^- = \max_i \tilde{S}_i,\ \tilde{R}^* = \min_i \tilde{R}_i,\ \tilde{R}^- = \max_i \tilde{R}_i,$ also υ is the weight of the strategy of the majority of criteria or the maximum overall utility. The larger the value of υ, the preferences of the decision maker over different criteria will be more average. Without loss of generality, it also takes the value 0.5 .

Step 4 : ranking is based on S_i criterion, R_j criterion and the hesitant VIKOR fuzzy index. This algorithm stops when:

The first condition : that $A^{(1)}$ and $A^{(2)}$ are the first and second options in arranged list. $\tilde{Q}(A^{(2)}) - \tilde{Q}(A^{(1)}) \ge \frac{1}{m-1}$

The second : $A^{(1)}$ should be the best rank for S_i,R_i

The first condition is considered as an acceptable coefficient and the second condition is an acceptable stable condition. If both conditions are true for each case, the next step will commence. If the first condition is not true, the maximum will computed by the following equation:

$$\tilde{Q}(A^{(M)}) - \tilde{Q}(A^{(1)}) < \frac{1}{m-1}$$

EXCEL 2014 software was applied to rank maintenance strategies in the final phase of the research.

Computing the values of R, S and Q
R and S and Q are computed for all of them according to the values determined in previous step and the formula of parameter.

Analysis of expert's data

In this section, data on expert from work experience and education are examined.
Descriptive statistics indices were used to examine the demographic characteristics of the respondents. Frequency of respondents was surveyed based on gender, age, level of education and charts.

Gender

32% of the respondents (64.0%) are male and 18 (36.0%) are female.

Table 4. Frequency distribution of respondents by gender

sum	%	amount	gender
64.0%	64.0%	32	male
100.0%	36.0%	18	female
	100%	50	sum

Education

4 people or 8.0% of the respondents have associate degree. 16 persons or 32.0% of respondents have a bachelor's degree. 21 persons equivalent to 42.0% of respondents have a master's degree and 9 persons equal 18.0% of respondents have a doctorate degree.

Table 5- Frequency distribution of respondents by education

sum	%	amount	education
8.0%	8.0%	4	Diploma
40.0%	32.0%	16	Masters
82.0%	42.0%	21	Masters
100.0%	18.0%	9	P.H.D
	100%	50	Total

Work Experience

1 person means 2.0% of people have less than 1 year experience. Thirteen (26.0%) have between 3 and 5 years of experience. 25 people (50.0%) have between 5 and 10 years' experience and 11 people (22.0%) have more than 10 years' experience.

Table 6. Frequency of respondents by work experience

sum	%	amount	work experience
2.0%	2.0%	1	<1
28.0%	26.0%	13	3-5
78.0%	50.0%	25	5-10
100.0%	22.0%	11	>10
	100%	50	entire

In the first step, you will gain the weight of the criteria and sub-criteria using the entropy method:

Step One: Calculate the Matrix of Sij's hesitant Fuzzy Value Matrix on the Matrix Expert Comments

We calculate the value of Sij and the results in the table 4.5

Table 7. Matrix of Sij values and their sums

t1	t2	t3	t4	t5	t6	o1	o2	o3	e1	e2	e3	
0.150	0.200	0.200	0.150	0.150	0.200	0.200	0.150	0.200	0.150	0.200	0.350	IaaS
0.400	0.4000	0.350	0.350	0.400	0.450	0.400	0.400	0.300	0.350	0.350	0.250	PaaS
0.567	0.550	0.400	0.467	0.550	0.650	0.575	0.500	0.250	0.400	0.450	0.450	SaaS
1.117	1.15	0.95	0.967	1.1	1.3	1.175	1.05	0.75	0.9	1	1.05	sum Sij

Now, according to the algorithm, we take the second step:

Step Two: Calculate the S ' normalized matrix whose values are as follows:

Table 8. the amount of S '

	t2	t3	t4	t5	t6	o1	o2	o3	e1	e2	e3
8	0.173913	0.210526	0.155119	0.136364	0.153846	0.170213	0.142857	0.266667	0.166667	0.2	0.33333
2	0.347826	0.368421	0.361944	0.363636	0.346154	0.340426	0.380952	0.4	0.388889	0.35	0.23809
1	0.478261	0.421053	0.482937	0.5	0.5	0.489362	0.47619	0.333333	0.444444	0.45	0.42857

Step 3: Calculate the Ej value and weight of the sub-criteria, the results of which are given in the table 9.

Table 9. Computation and obtaining sub-criteria weights

t1	t2	t3	t4	t5	t6	o1	o2	o3	e1	e2	e3	
-0.39446	-0.46204	-0.51465	-0.43149	-0.39831	-0.42932	-0.45622	-0.41012	-0.57992	-0.45056	-0.5004	-0.63651	IaaS
-0.65232	-0.64609	-0.65811	-0.65453	-0.65548	-0.64503	-0.64132	-0.66453	-0.67301	-0.66825	-0.64745	-0.54887	PaaS
-0.69303	-0.6922	-0.68063	-0.69256	-0.69315	-0.69315	-0.69292	-0.69201	-0.63651	-0.68696	-0.68814	-0.68291	SaaS
-1.73981	-1.80033	-1.85339	-1.77858	-1.74694	-1.7675	-1.79046	-1.76666	-1.88944	-1.80577	-1.83599	-1.8683	SUM
0.400937	0.414884	0.427113	0.409872	0.40258	0.40732	0.412611	0.407125	0.43542	0.416139	0.569453	0.430547	Ej
0.599063	0.585116	0.572887	0.590128	0.59742	0.59268	0.587389	0.592875	0.56458	0.583861	0.576898	0.569453	1-Ej
0.08543	0.083441	0.081697	0.084155	0.085195	0.084519	0.083765	0.084547	0.080512	0.083262	0.082269	0.081207	wj

Table 10. amount of S

t1	t2	t3	t4	t5	t6	o1	o2	o3	e1	e2	e3	
0.200	0.200	0.150	0.200	0.150	0.200	0.350	0.250	0.267	0.200	0.250	0.267	IaaS
0.800	0.767	0.750	0.800	0.850	0.600	0.600	0.750	0.733	0.767	0.700	0.767	PaaS
0.850	0.750	0.850	0.700	0.750	0.800	0.700	0.800	0.750	0.750	0.800	0.800	SaaS
0.850	0.767	0.850	0.800	0.850	0.800	0.700	0.800	0.750	0.767	0.800	0.800	MAX
0.200	0.200	0.150	0.200	0.150	0.200	0.250	0.250	0.267	0.200	0.250	0.267	MIN
0.650	0.567	0.700	0.600	0.700	0.600	0.450	0.550	0.483	0.567	0.550	0.533	MAX-min

To rank with the hesitant fuzzy Vikor method, uncertain depending on the sub-criteria and their interaction on the optimal strategy selection, the maximum and minimum values are selected.

Table 11. Calculates the distance of the largest value from the other elements

t1	t2	t3	t4	t5	t6	o1	o2	o3	e1	e2	e3	
0.650	0.600	0.650	0.650	0.700	0.650	0.567	0.700	0.600	0.700	0.600	0.350	IaaS
0.150	0.100	0.100	0.150	0.050	0.050	0.000	0.100	0.000	0.000	0.200	0.100	PaaS
0.000	0.000	0.000	0.000	0.000	0.000	0.017	0.000	0.100	0.100	0.000	0.000	SaaS

After this step, we follow the algorithm's third step and calculate the S, R, and Q of the hesitant fuzzy Vikor index.

Table 12. amount of S,R

S_j	R_j	
0.9868	0.0608	IaaS
0.1175	0.0193	PaaS
0.0217	0.0098	SaaS
0.9868	0.0608	max
0.0217	0.0098	min

Now calculate the values of the Vikor index (Q) and compare it with the other two indices. A value of v = 0.5 was chosen for this study. The results of the work for ranking are reported in Table 4.11:

Table 13. Comparing alternatives based on S,R,Q

S_j	R_j	Q_j	
0.9868	0.0608	1.0000	IaaS
0.1175	0.0193	0.2373	PaaS
0.0217	0.0098	0.0000	SaaS

The results are compared on the basis of three factors: Si, Ri and Qi, and the results are as follows:

Table 14. Score each alternatives based on the three factors Si, Ri and Qi

Rank based on S_j	S_j	Rank based on R_j	R_j	Rank based on Q_j	Q_j	
3	0.9868	3	0.0608	3	1.0000	IaaS

2	0.1175	2	0.0193	2	0.2373	PaaS
1	0.0217	1	0.0098	1	0.0000	SaaS

As we can see, SaaS is the best option. SaaS, which stands for Software as a Service is one of several cloud computing services meant to be a software rental service.

One of the things that has caused software developers to look for cloud computing is to get rid of hardware dependency to install and deploy the software and to have easy and fast access to the software.

In this type of service, the software is installed in the cloud and instead of having to provide separate hardware to install the software or allocate some of its hardware resources to install a software, or to Installing a particular software will change the version of your operating system, you will only have access to the software through the Internet browser.

As such, the software developer only has to pay the monthly or yearly cost of renting the resource to the cloud provider depending on how much their users are using, thereby costing the user with hardware as well as installation and repair and maintenance does not promote it. Due to the privatization in the cloud, the software developer can rent a separate cloud server on which the relevant software is installed for users who wish to purchase the software and use it privately. With SaaS, you can access and use your software from anywhere in the world and through the web, so you'll get the most out of it by paying less.

One of the benefits of the SaaS approach to software implementation is the security of users. The proprietary nature of cloud-based services requires that all servers and their resources are individually allocated to users, and therefore in accordance with the security settings that the cloud server implements, User data will be protected from each other.

For the following reasons, SaaS is a good option in developing countries:

High versatility: SaaS is compatible with any computer, mobile, tablet and device, and has a faster learning arc in addition to high versatility.

Access anytime and anywhere: You can work with software anytime and anywhere you have access to the Internet, without having to carry your information with you.

Lower start-up cost: SaaS, without the initial cost of buying and operating complete software, costs it according to the needs of the organization at any given moment, and reduces the cost of providing hardware, software, and IT for unnecessary IT infrastructure.

Trouble-free updates: Frequent and time-consuming downloads and updates are not required to update the software, and all issues related to updating, transferring information to the updated system, increasing user volume, and providing speed and security are the responsibility of the service provider. .

Deployability: The SaaS architecture can be designed so that software can be used and integrated with other user-friendly services. This way you are no longer confined to isolated software and with the help of different APIs and combinations you can access all the different tools you need under one roof.

CONCLUSION

One of the most important roles of technology in today's business and commerce is to build strong customer relationships. Creating a secure business environment is another benefit of using technology in business. A business that can optimize the power of technology to research and develop its target market is just a few steps ahead of its competitors. It is also a prerequisite for survival for any business, growth and development. Growth leads to better opportunities for achieving business goals.

Business executives can communicate with the customer through their website or in-store software and provide a vast array of useful information to their customers. Without paying for location and other extras, they invite customers from around the world to their virtual store.

Today, business is not limited to neighborhoods, cities, and countries, you can easily connect with the rest of the world, and this capability is gained by technology

RECCOMENDATION

The results of the study showed that SaaS has a higher priority than other options, so it is suggested that service providers focus on this issue.

It is recommended to build public awareness, television and media programs to educate people about the benefits of e-commerce and cloud computing**.**

Despite the current acceptance of cloud computing in the business arena, it should be borne in mind that most of these businesses use cloud computing solely to replace their old business practices, with only 5% using cloud computing to drive business innovation. They are benefiting themselves.

The reason businesses are increasingly embracing cloud computing is the benefits that this technology has. One of the benefits is the flexibility of cloud computing, which allows users to purchase resources at any time at their own expense; this helps users get rid of the extra costs for resources they don't need much.

As with other areas of education, the benefits of cloud computing have not gone unnoticed. Cloud computing is a good choice for those educational institutions that do not have the financial capability to provide and maintain information infrastructure. In addition, cloud computing has made it easier to access remote education services than ever before.

One of the benefits of cloud computing in the field of education is the replacement of printed books with electronic versions. It is not known that the cost of textbooks is very high, and in most cases much of the educational cost is related to the cost of textbooks, to the extent that in some cases the cost of textbooks is higher than the tuition fee. Under such circumstances, providing digital educational content, cheaper than print books, has made it easier for students than ever before. Currently, US higher education institutions are testing a program for digital sharing of educational textbooks in the cloud; currently fifty publishers have participated in nearly 30,000 books.

FUTURE RESEARCH

•Identify and reduce sub-criteria evaluated using fuzzy Delphi technique

•Complicating failure factors in e-commerce cloud computing in SMEs based on EFQM organizational excellence and identifying strengths and areas of improvement

•Applying the Integrated Model of the Present Research in Gray Environment to Select Cloud Computing in E-Commerce

•Determine the relationships between criteria and sub-criteria using DEMATEL or ISM techniques

•Investigating the Role of Software Use in Selecting Cloud Computing in E-Commerce to Increase the Productivity of Large Industrial Companies

•Comparison of hesitant decision-making techniques such as hesitant Fuzzy Topsis and hesitant linmap for choosing cloud computing in e-commerce and analyzing its results

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