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Using cloud computing services to enhance competitive advantage of commercial organizations

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A B S T R A C T

Using advanced technology in business has created hyper-competition among organizations to satisfy customers' needs. Using advanced technology aims to provide customers with quality products/services at suitable prices in the right place better than competitors. Therefore, the current study's purpose is to explore the influence of cloud computing services on Jordanian commercial organizations' competitive advantages, organizations which use cloud computing services. The study uses quantitative, cause-effect, and cross-sectional methods and uses a convenience sampling approach to collect the data by questionnaire from 111 managers and/or owners of commercial organizations. The collected questionnaires are examined and inserted into SPSS. The instrument validity, normal distribution, and reliability are verified, then descriptive analysis is performed, the relationship between independent and dependent variables is tested, and finally multiple regressions are used to test the hypotheses. The findings indicate that commercial organizations are concerned about cloud computing services as well as competitive advantage sub-variables. The results also show that there was a significantly strong correlation between cloud computing services and competitive advantage. Moreover, cloud computing services influence the dimensions of competitive advantages (quality, cost, reliability, innovation, and responsiveness) of commercial organizations, where cloud computing services have the most significant influence on quality followed by cost and responsiveness, respectively. However, cloud computing services do not significantly influence innovation and reliability. Finally, the study recommends doing comparable research on other sectors, and industries as well as in other countries to test the results' generalizability.

1. Introduction

Nowadays, customers' requirements are rising and evolving, customers need quality products at the right time, place, and at a suitable price. Therefore, the competition among organizations is evolving very fast, and every organization seeks to use the best strategy and tools to respond to complex and uncertain demands, satisfy customers' needs, and maintain market share. The advancement of information and communication technology (ICT) innovated many tools such as cloud computing, which can be used to improve quality, speed operations, and reduce costs. Cloud computing is an emerging technology, which attracts almost all organizations to use it. It has many benefits as well as many challenges and it affects the organization's competitive advantage (Truong, 2010). Cloud computing consists of multiple companies, multiple servers, and multiple networks. Anybody from anywhere can access it through the Internet. It is a collection of computers, servers, applications, and the Internet. It facilitates group collaboration (Mirashe & Kalyankar, 2010). Cloud computing uses centralized and shared infrastructure which creates economies of scale and reduces costs to customers (Durkee, 2010). Cloud computing is an information technology (IT) service that uses hardware and software to provide customers' requirements over the Internet anywhere (Liu et al., 2015). Cloud is related to hardware, software, and easy use of the Internet. It Improves scheduling algorithms,

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which reduces execution time without increasing cost (Paridar et al., 2018). Cloud computing reduces business costs by using providers' hardware and software, which will be updated automatically (Abusaimeh, 2020a). Cloud computing is efficient and effective in using the infrastructure (Basilier et al., 2014). Balancing and harmonizing the organization's IT environment with the cloud improve performance and create a competitive advantage (Chang et al., 2019). The technology acceptance model (TAM) and the technology-organization-environment (TOE) have been used to determine cloud computing adoption factors that are related to performance and cost-effectiveness (Fernando et al., 2019).

Cloud computing services have unique features, which work well when long-time economic prediction is not easy (Kilcioglu & Rao, 2016). Cloud computing environments are dynamic due to the unpredictability of the users' requests arrivals (Chiou & Lin, 2010), therefore organizations select flexible resources to respond to demand changes and it decreases the cost (Lam, 2014). Organizations have to select cloud computing services that suit their operations and business to get the maximum benefit from them and reduce different processing costs (Wišniewski, 2014). Organizations have to select new technologies, which will be used as a competitive tool to develop a competitive advantage through cost-effectiveness (Adane, 2018). Cloud-based solutions reduce IT-related costs, improve productivity, enhance innovation, and increase agility (Wielki, 2015). Cloud computing increases organizations' productivity and outcomes. It improves innovation and creates more business opportunities to compete globally and successfully (Fakieh et al., 2016). Hybrid cloud computing encourages partnership, improves risk mitigation, and provides several service qualities. It reduces cost and improves scalability and speed. (Banditwattanawong et al., 2016). Cloud computing has several advantages such as cost reduction, faster than most in-house IT functions, and reduces effort and time (Abbas, 2016). Cloud computing reduces costs and time without trade-offs with innovation. It increases flexibility and adaptability, which create long-term competitive advantages (Nowicka, 2017). Cloud computing provides scalability, adaptability, and cost-effectiveness. It reduces response time and enhances performance (Suresh, 2017). Cloud computing services affect competitiveness factors, which include quality, time, costs, and flexibility (Nowicka, 2018). Cloud computing enhances creativity and inventions to be in a better competitive position (Abusaimeh, 2020b). Cloud computing guarantees high-quality service delivery (Babcock, 2015). Mobile Cloud Computing reduces the time and cost of operation as well as the maintenance of cloud servers (Abusaimeh, 2022).

The above discussion shows that cloud computing services have many advantages over in-house infrastructure such as reducing the time of processes, improving the quality of services, reducing costs, improving reliability, and enhancing innovation, which creates and maintains competitive advantages. However, as mentioned in the following literature review also cloud computing services have several disadvantages such as security and privacy, at the same time there is a debate about the influence of cloud computing services on reliability and innovation. Anyway, there are only a few studies that explored the impact of cloud computing services on all competitive advantage factors. Therefore, this study is devoted to exploring the influence of cloud computing services on competitive advantages (quality, speed, reliability, cost, and innovation) in Jordanian Commercial companies, which use cloud computing services. This study is directed to answer the next question: Do cloud computing services influence competitive advantages (quality, speed, cost, innovation, and reliability) in Jordanian Commercial companies?

Since few research papers tackle the topic of the correlation between cloud computing services and competitive advantages, this paper provides an overview of this relationship to enrich the academic discussion about the advantages of cloud computing and provides sound recommendations to both providers and users of cloud computing services to increase awareness about this topic and satisfy customers' demands.

2. Literature Review

2.1. Cloud Computing

Cloud computing called public cloud has the potential to transform large data. Organizations with recent Internet services do not require huge investments in IT (Armbrust et al., 2009). Cloud computing includes several organizations, collections of computers, several servers, and many networks, which can be accessed at any time from anywhere (Mirashe & Kalyankar, 2010). Cloud computing is an Internet service, which uses hardware, software, and data to achieve economies of scale of operations (Dikaiakos et al., 2009). Cloud computing is used for storing, retrieving, and using that information at any place at any time (Goundar, 2012). Cloud computing services utilize hardware and software to satisfy customers' needs via the Internet at any time anywhere (Liu et al., 2015). Nowadays, all organizations realize the benefits of cloud computing, which is coming to be more popular (Voytenko et al., 2015). Cloud computing services possess unique features and are provided by a third party to serve market requirements (Kilcioglu & Rao, 2016). Cloud computing services provide recent information and improve communications (Fakieh et al., 2016). Cloud computing uses hardware, software, and the Internet to provide efficient scheduling of workflows (Paridar et al., 2018). The technology acceptance model (TAM) and the technology organization environment (TOE) theories define factors of cloud computing adoption and its effect on business competitiveness (Fernando et al., 2019). Harmonizing the organization's IT environment with cloud adoption is very important for competitive advantage (Chang et al., 2019). Cloud Computing makes information more reachable from anywhere, at any time, and reduces costs (Abusaimeh, 2020a). Any development in information and communication technology facilitates daily life and business operations (Abusaimeh, 2020b). Cloud computing integrates hardware and software to support a single management platform for multiple users (Zhang et al., 2020). Mobile cloud computing is widely available for users and developers, it provides many benefits to mobile users such as faster and more reliable offloading. But also, there are many challenges such as privacy, security, performance, and cost (Abusaimeh, 2022).

2.2. Cloud Computing and Competitive Advantage

Organizations search for new technologies to be used as a competitive tool to develop a competitive advantage (Adane, 2018). Cloud computing is based on a shared and centralized infrastructure that reduces costs to both organizations and customers (Durkee, 2010). Cloud Computing makes information more reachable from anywhere and anytime (Abusaimeh, 2020a), but it is still in the emerging phase and has many business benefits (Isse, 2010). Compared to traditional tools, cloud computing is more efficient, it supports an organization's flexibility, scalability, and agility, and it also reduces costs, and improves the competitive position (Xue & Xin, 2016), at the same time, security is very important, so all cloud computing components must be checked and analyzed at the micro and macro levels (Subashini & Kavitha, 2011). Each organization has to select suitable cloud computing services that maximize its benefits (Wišniewski, 2014), however, cloud computing has many benefits as well as many challenges (Truong, 2010), benefits such as faster and more reliable offloading, while challenges such as privacy, security, performance, and cost (Abusaimeh, 2022). Factors that affect cloud computing adoption include privacy and security, compatibility, management support, perceived usefulness, and competitive pressure. These factors are related to cost-effectiveness and performance (Fernando et al., 2019). Nowadays, cloud computing services are widely adopted by organizations to support strategic initiatives to enhance customer experience and their businesses because cloud computing services are cost-effective (Adane, 2018).

Due to the unpredictable customer requests incoming, cloud computing reduces scheduling complexity to create a suitable plan and reduces the processes costs (Chiou & Lin, 2010). Cloud computing reduces infrastructure and operations costs reduction, as well as improves the design and delivery (Son et al., 2011). Selecting flexible cloud computing services, which respond automatically to demand fluctuation reduces the cost of operations (Lam, 2014). Cloud computing reduces business costs by using providers' hardware and software, which will be updated automatically (Abusaimeh, 2020a). Cloud computing services support scalability, and adaptability and are cost-effective. Real-time applications allow on-time response and improve performance (Suresh, 2017). Cloud computing improves scheduling, minimizes processing time, and improves performance (Paridar et al., 2018). Mobile Cloud Computing reduces the time and cost of operation as well as the maintenance of cloud servers (Abusaimeh, 2022).

Cloud computing facilitates group collaboration (Mirashe & Kalyankar, 2010). Cloud computing creates a competitive advantage through innovation and collaboration (Truong, 2010). Cloud computing services maximize organizations' productivity and outcomes. It enhances business innovation and gives more chances to compete globally (Fakieh et al., 2016). Cloud computing reduces costs and time without trade-offs with innovation. It enhances communication, flexibility, and adaptability, as well as customer satisfaction, which creates long-term competitive advantages (Nowicka, 2017). Cloud computing is based on information systems, which are used to achieve competitive advantage through cost leadership and differentiation strategies (Al-Awawdeh & Al-Sharairi, 2012). Cloud computing reduces the inefficient use of resources in organizations to create a competitive advantage. It reduces costs related to hardware and software purchase and maintenance and also reduces the number of IT workers (Xue & Xin, 2016). Cloud computing affects organizations' strategy, structure, demand, operations, and competition, these affect organizations' competitive strategies (differentiation, cost leadership, and focus strategies respectively (Powell, 2013). The synergy between flexibility and control increases the cloud absorptive capacity, which leads to the accumulation of knowledge, improves performance, and creates a competitive advantage (Chang et al., 2019). Any development in information and communication technology enhances creativity and inventions to be in a better competitive position (Abusaimeh, 2020b). Cloud computing reduces costs and enhances planning accuracy, speed of order execution, delivery time, complaints handling, quality, returns, and flexibility, which improves competitive position (Nowicka, 2018). Customers are concerned about both cost and quality, therefore cloud computing providers should balance between them to enhance profit (Kilcioglu & Rao, 2016). Cloud computing services affect price-quality competition. It helps to reduce prices and increase profit (Kilcioglu & Rao, 2016). Hybrid cloud computing encourages business partnerships, reduces risk, and improves service quality. Hybrid cloud computing offers different service quality levels, which decreases cost and enhances scalability and speed (Banditwattanawong et al., 2016).

Finally, when using cloud computing services there is a trade-off between security and usability (Liu et al., 2015). Cloud computing services do not ensure reliability related to security for insurance and banking organizations (Wišniewski, 2014). Cloud computing increases productivity, improves innovation, reduces costs, and enhances agility, but does not guarantee reliability regarding data privacy and security (Wielki, 2015).

In summary, cloud computing consists of hardware, software, data, and the Internet. There is a consensus among previous research papers about its advantages including improving service quality and reducing operations time, and cost, but there is a debate about its effect on innovations and reliability including security and privacy.

2.3. Problem Statement and Hypothesis Development

The competitive advantage aims to create a sustainable and profitable enterprise, which is based on understanding and controlling competition priorities compared to competitors (Sigalas, 2015). Competitive advantage creates a favorable competitive position in an industry (Porter, 2017). Competitive advantage means superiority over competitors in productivity and sales (Cegliński, 2017). Generally, a competitive advantage is a uniqueness in something compared with rivals such as cost, quality, speed, innovation, and reliability/flexibility. Measuring and visualizing organizations' cloud computing activities is highly needed to recognize the noncompetitive segments to immediately launch necessary improvement actions (Nuseibeh,

2011). The visualization system is required for controlling and sharing information through cloud computing to speed the processes, respond to increasing customer requirements, visualize and measure cloud computing practices, and manage deviations (Zhang et al., 2020). The lack of cloud benchmarking is a very important factor, so developing a benchmarking performance tracking system is crucial to determine competitive advantages (Shukla et al., 2021). Competitive advantages include quality, cost, time/speed, reliability/flexibility/dependability, and innovation (Sharabati, 2021)

Finally, the competition among commercial organizations is to offer a quality product/service with a suitable cost at the right place and time, as well as to provide flexible and consistent products/services along with innovative solutions. Therefore, the aim of this is to explore the influence of cloud computing services on the competitive advantages (quality, cost, innovation, responsiveness, and reliability) of Jordanian commercial organizations by checking the next main hypothesis:

H_0: *Cloud computing services do not influence the competitive advantages (quality, cost, responsiveness, innovation, and reliability) of commercial organizations, at $\alpha \leq 0.05$.*

According to the discussion above, this hypothesis is sub-divided into the coming sub-hypotheses:

Cost: The main factor that encourages the organization to use cloud computing is reducing costs (Xue & Xin, 2016). Cloud computing converts investments in technology to expenses on operations to provide better services (Chen et al., 2016). Reduction in IT expenses helps organizations to concentrate their expenses on other resources and tasks (Boychev, 2014). In summary, cloud computing reduces costs without compromising quality compared to competitors.

H_{01}: *Cloud computing services do not influence the cost of commercial organizations, at $\alpha \leq 0.05$.*

Quality: Cloud computing improves the quality of service provided to users (Frank & Jerry, 2012). Cloud computing service providers are responsible for providing a better service quality of services (Xue & Xin, 2016). Cloud computing provides higher service quality, which increases customer satisfaction (Neicu et al., 2020). In summary, quality is the ability of the organizations to differentiate their products/services compared to other competitors, it is a key factor for competition.

H_{02}: *Cloud computing services do not influence the quality of commercial organizations, at $\alpha \leq 0.05$.*

Responsiveness: The ability of organizations to respond to complex and uncertain environments better than competitors including opportunities and threats (Mutunga, 2014). Cloud computing leads to a suitable response to rapidly changing customer needs (Xue & Xin, 2016). Responsiveness includes fast product or service development, fast market introduction, delivery speed, fast operations, and responding to satisfy customers' needs (Heizer et al., 2017). Cloud computing uses Internet services to identify customers' needs and move faster than others (Mitra et al., 2018). In short, responsiveness is the organization's ability to deal with changes in the market and respond to customers' needs faster than competitors.

H_{03}: *Cloud computing services do not influence the responsiveness of commercial organizations, at $\alpha \leq 0.05$.*

Reliability: Cloud computing improves the products and services availability and reliability, which maintains customer trust and satisfaction (Mesbahi et al., 2018). Cloud computing reliability is related to the performance and ability of the system to be used in different situations (Thanakornworakij et al., 2013). For cloud computing, reliability is concerned with security and privacy which provide customers' trust. (Naghdehforoushha et al., 2023). In summary, reliability is related to flexibility, dependability, security, and privacy. As explained in the section above there is a debate about the influence of cloud computing on reliability.

H_{04}: *Cloud computing services do not influence the reliability of commercial organizations, at $\alpha \leq 0.05$.*

Innovation: Cloud computing encourages organizations to innovate (Isse, 2010). Cloud computing supports organizations to deal with an opportunity efficiently, and faster, and provide innovative solutions to use IT investments effectively. Cloud computing may be used for the fast launch of a new innovative program, which reduces time and cost (Kent, 2019). In summary, innovation is the organization's ability to provide outstanding products/services that are different from competitors to satisfy customers' needs, but there is a debate about the influence of cloud computing on innovation because it shifts some operations to a third party.

H_{05}: *Cloud computing services do not influence the innovation of commercial organizations, at $\alpha \leq 0.05$.*

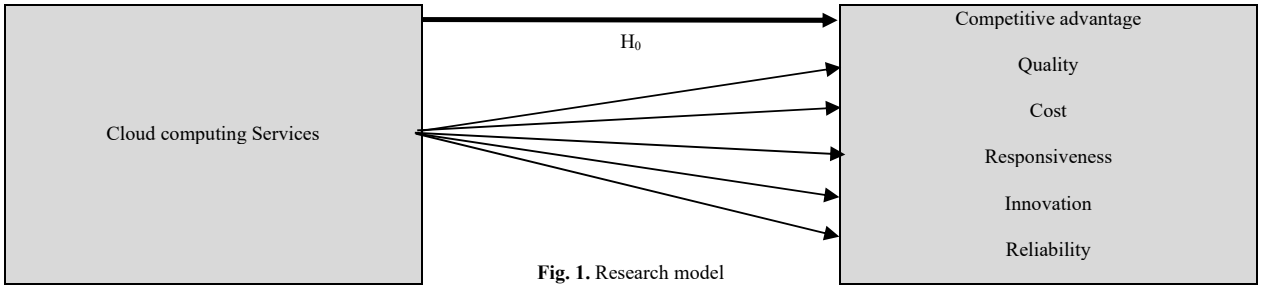

Fig. 1. Research model

Sources: (Boychev, 2014; Cegliński, 2017; Chen et al., 2016; Mitra et al., 2018; Neicu et al., 2020; Porter, 2017; Powell, 2013; Sigalas, 2015; Smith, 2020)

3. Methodology

3.1. Research Design

This study is a quantitative cause-effect, it uses convenience and cross-sectional sampling methods to collect the data from commercial organizations in Jordan, which utilize cloud computing. The questionnaire has been purposefully developed and used as a main instrument to collect the data. The collected questionnaires have been examined for their suitability to be used and then entered in SPSS 20, then reliability, normal distribution, and validity of the tool were confirmed and the relationships among variables were confirmed. Finally, the influence of cloud computing services on competitive advantages was tested through multiple regressions. The study population includes commercial organizations that utilize cloud computing services and count about 200 organizations. The questionnaire was sent to all these organizations, which negates the need for sampling. The managers/owners of these organizations were used as the unit of analysis.

3.2. Data Sources and Research Tool

To conduct this research two sources have been used secondary and primary sources. Theses, books, dissertations, journals, articles, and other sites on the internet have been used as a secondary source. While primary data has been collected through a questionnaire, which was developed for this research. The questionnaire includes three segments. The first segment was about the demographic dimensions (age, gender, education, experience, and position. The second segment was about cloud computing services and included fifteen questions. The third part was related to competitive advantage, which was divided into five dimensions (quality, cost, responsiveness, innovation, and reliability), and each dimension was measured by five questions. Both cloud computing and the competitive advantages were measured by a 5-grades Likert scale rating from 1 to 5, where 1 indicates never applied, Slightly and 5 strongly applied)

3.3. Primary Data Collection

The questionnaires were sent to all commercial organizations in Jordan, which implement cloud computing services, which are about 200 organizations, this negates the need to use sampling. Only 111 questionnaires came back, all were checked for their completeness and suitability to be coded against SPSS 20 for further analysis. The demographic analysis shows that most respondents were males 84 (75.7%), while the females are 27 (24.3%) respondents, according to age, most respondents are aged between 30-39 count of 53 (47.7%), then between 40-49 count 37 (33.3%), less than 20 years 20 (18.0%), and more than 50 only 1 (0.9%). According to experience, the majority of respondents were between 10-20 years of experience 59 (53.2%), then less than 10 years 29 (26.1%), between 21-30 years 21 (18.9%), more than 30 years only 2 (1.8%). Related to education, most of the respondents are holding a Bachelor 76 (68.5%), then a Master 19 (17.1%), Diploma 9 (8.1%), and Ph.D. 7 (6.3%). Finally, most of the respondents are managers 53 (47.7%), then Supervisors 49 (44.1%), and general managers/owners only 9 (8.1%).

3.4. Validity Test

The validity of the instrument was assured by three approaches: content, face, and construct validities. Theses, books, dissertations, journals, articles, and internet websites have been used to confirm content validity. Face validity was confirmed via the referee committee, which included both professionals and academicians. Finally, the Principal Component Factor Analysis with Kaiser Meyer Olkin (KMO) was used to assure the construct validity. To assure the data explanation and conformity the Principal Factor Analysis was implemented. If a factor loading is higher than 0.40 it is accepted and if it is higher than 0.50 it is good (Alkunsol et al., 2019; Hair et al., 2014). The Kaiser Meyer Olkin (KMO) was used to test sampling harmony, adequacy, and inter-relationships. If KMO ranks from 0.8 to 1 signals higher adequacy, and if it is higher than 0.60 is accepted. Moreover, for data suitability and correlation, Bartlett's Sphericity has been used and if at a 95% confidence level, the significance is rated lower than 0.05, indicating that factor analysis is suitable to be used. The variance has been used to show the explanation power of construct (Cerny & Kaiser, 1977).

Cloud Computing: Table (1) shows that the cloud computing items factor loading ranks from 0.689 to 0.856, this confirms the construct validity of cloud computing. KMO shows homogeneity and good adequacy of data, where the KMO value is equal to 90.9%, and the Chi^2 is 1349.782 shows model fitness. The variance for cloud computing is 67.398%, which is used for variation explanation. Finally, at a 95% confidence level, Bartlett's Sphericity shows a significant level lower than 0.05 indicating the usefulness of the factor analysis.

Competitive Advantage: Table 2 shows that the cost items loading factor ranks from 0.687 to 0.818, quality items rated between 0.757 and 0.926, responsiveness items rated between 0.691 and 0.828, reliability items rated between 0.696 and 0.841, and innovation rated between 0.744 and 0.894. So, construct validity is ensured. KMO for cost has rated 71.5%, for quality has rated 0.856, for responsiveness has rated 0.802, for reliability has rated 0.758, and for innovation has rated 0.867, which indicates good adequacy and homogeneity, and high Chi^2 indicates model fitness. Finally, the variance for cost explains 59.042% of the variation, for quality explains 69.880% of the variation, for responsiveness explains 58.152% of the variation, for reliability explains 58.254 of the variation, and for innovation explains 69.947 of the variation. Moreover, the loading factor for all dimensions of competitive advantage rated between 0.765 and 0.875. KMO has rated 83.3%, the Chi2 is 335.034 and variance explains 70.784% of the variation. Finally, the significance of Bartlett's Sphericity is lower than 0.05, which suggests the usefulness of the factor analysis.

Table 1
Factor Analysis of Cloud Computing Items

No.	Paragraph	Factor1	KMO	Chi²	BTS	Variance	Sig.
1	Cloud computing1	0.803					
2	Cloud computing2	0.770					
3	Cloud computing3	0.768					
4	Cloud computing4	0.856					
5	Cloud computing5	0.824					
6	Cloud computing6	0.795					
7	Cloud computing7	0.769					
8	Cloud computing8	0.689	0.909	1349.782	105	67.398	0.000
9	Cloud computing9	0.763					
10	Cloud computing10	0.709					
11	Cloud computing11	0.756					
12	Cloud computing12	0.715					
13	Cloud computing13	0.780					
14	Cloud computing14	0.809					
15	Cloud computing15	0.739					

Table 2
Factor Analysis of Competitive Advantages

No.	Paragraph	Factor1	KMO	Chi²	BTS	Variance	Sig.
Cost	Cost1	0.687					
	Cost2	0.808					
	Cost3	0.818	0.715	203.402	10	59.042	0.000
	Cost4	0.784					
	Cost5	0.739					
Quality	Quality1	0.757					
	Quality2	0.863					
	Quality3	0.926	0.856	321.723	10	69.880	0.000
	Quality4	0.832					
	Quality5	0.791					
Responsiveness	Responsiveness1	0.724	0.802	181.583	10	58.152	0.000
	Responsiveness2	0.828					
	Responsiveness3	0.790					
	Responsiveness4	0.773					
	Responsiveness5	0.691					
Reliability	Reliability1	0.792					
	Reliability2	0.841					
	Reliability3	0.780	0.758	201.934	10	58.254	0.000
	Reliability4	0.797					
	Reliability5	0.696					
Innovation	Innovation1	0.830					
	Innovation2	0.876					
	Innovation3	0.744	0.867	312.548	10	69.947	0.000
	Innovation4	0.894					
	Innovation5	0.829					
Competitive Advantages	Cost	0.765					
	Quality	0.842					
	Responsiveness	0.866	0.833	335.034	10	70.784	0.000
	Reliability	0.875					
	Innovation	0.854					

3.5. Reliability Test

To confirm the reliability of the study tool Cronbach's alpha was used. If Cronbach's alpha rate is higher than 0.50 it is acceptable (Sharabati et al., 2022), if it is from.0.50 to 0.60 it is poor, if it is from 0.60 to 0.70 it is good, and if it is higher than 0.70 is acceptable (Hair et al., 2014; Sekaran & Bougie, 2016; Sharabati et al., 2022). Table (3) indicates that the reliability coefficient value for cloud computing is 0.950, and for competitive advantages (quality, cost, responsiveness, innovation, and reliability) ranks between 0.814 and 0.891, and for total competitive advantages is 0.894.

Table 3
Reliability Test for Cloud Computing and Competitive Advantages

Variable	Items	Alpha
Cost	5	0.821
Quality	5	0.891
Responsiveness	5	0.817
Reliability	5	0.814
Innovation	5	0.891
Competitive Advantages	**5**	**0.894**
Cloud Computing	**15**	**0.950**

4. Data Analysis and Results

4.1. Research Descriptive Analysis

The descriptive analysis contains the mean, standard deviation, t-value, and ranking. Table 4 indicates that commercial organizations use cloud computing services and have competitive advantages at a medium level. The table shows that Jordanian commercial organizations are more interested in innovation, quality, reliability, responsiveness, and cost respectively.

Table 4
Descriptive Analysis for Cloud Computing and Competitive Advantages

No.	Variable	Mean	S.D.	t-value	Sig.	Rank
1	Cost	3.281	0.939	3.152	.002	5
2	Quality	3.723	0.948	8.032	.000	2
3	Responsiveness	3.595	0.864	7.250	.000	4
4	Reliability	3.706	0.825	9.025	.000	3
5	Innovation	3.841	0.864	10.252	.000	1
	Competitive Advantage	3.629	0.745	8.893	**.000**	
	Cloud Computing	**3.480**	**0.981**	**5.154**	**.000**	

T-tabulated=1.980

4.2. Correlation between Competitive Advantages and Cloud Computing

To check the correlation between cloud computing and competitive advantages the Bivariate Pearson's correlation was performed. Table 5 indicates that the correlations among competitive advantages are high, with r rated between 0.482 and 0.743. Furthermore, the correlation between cloud computing and competitive advantages is very high, where r is 0.730.

Table 5
Bivariate Pearson Correlation for Cloud Computing and Competitive Advantages

No.		1	2	3	4	5	6	7
1	Cost							
2	Quality	.539**						
3	Responsiveness	.692**	.614**					
4	Reliability	.547**	.652**	.714**				
5	Innovation	.482**	.729**	.619**	.743**			
6	Competitive Advantage	.782**	.846**	.864**	.863**	.847**		
7	Cloud Computing	.646**	.656**	.643**	.536**	.572**	.730**	

**. Correlation is significant at the 0.01 level (2-tailed).

4.3. Testing Hypothesis

According to Uma Sekaran, before using regressions analysis to test the hypothesis, the following tests must be confirmed (Sekaran, 2003):

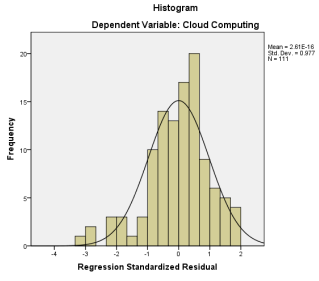

Fig. 2. Normality Test

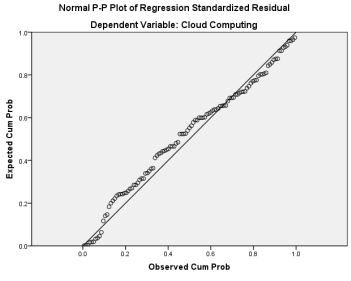

Fig. 3. Linearity Test

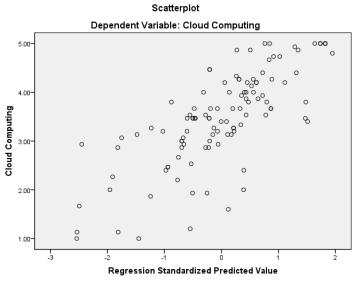

Fig. 4. Scattered Test

Normality: Fig. 2 indicates normal distribution data, so the normality proposition is assumed.

Linearity test: Fig. 3 indicates that cloud computing and competitive advantages variables have linear correlation, so the linear correlation proposition is assumed.

Equal variance (homoscedasticity): Fig. 4 indicates that responses are scattered, so there is no relationship between predicted values and errors, so the equal variance proposition is assumed.

Multi-Collinearity: Table 6 shows that the value of VIF (Variance Inflation Factor) is lower than 10, and the tolerance value is higher than 10%, so the Multi-Collinearity proposition is not breached.

Table 6
Multi-Collinearity Statistics

Model		Collinearity Test	
		Tolerance	VIF
1	Cost	0.599	2.003
	Quality	0.407	2.454
	Responsiveness	0.349	2.867
	Reliability	0.338	2.962
	Innovation	0.342	2.928

Main Hypothesis:

H_0: Cloud computing services do not influence the competitive advantages (quality, cost, responsiveness, innovation, and reliability) of commercial organizations, at $\alpha \leq 0.05$.

Table 7 indicates the relationship between cloud computing services and competitive advantages equal to 75.8%, and the table demonstrates that cloud computing explains 57.5% of the variation of competitive advantages, where (R^2=0.575, F=28.398, sig.=0.000). Based on this result, the above hypothesis is rejected, and the substitutional hypothesis is admitted, which presents that cloud computing services influence the competitive advantages (quality, responsiveness, cost, innovation, and reliability) of commercial organizations, at $\alpha \leq 0.05$.

Table 7
Multiple Regressions of Independent Variable on Dependent Variable

Model	r	R^2	Adjusted R^2	f	Sig.
1	0.758	0.575	0.555	28.398	0.000

According to competitive advantage components, Table 8 presents how cloud computing influences each competitive advantage.

Table 8
Multiple Regressions of Independent Variable on Dependent Variable dimensions

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.152	0.315		0.482	0.682
	Cost	0.325	0.094	0.312	3.461	0.001
	Quality	0.341	0.103	0.330	3.308	0.001
	Responsiveness	0.248	0.122	0.218	2.024	0.045
	Reliability	-0.106-	0.130	-0.089-	-0.817-	0.416
	Innovation	0.129	0.124	0.113	1.042	0.300

T-tabulated=1.980

H_{01}: Cloud computing services do not influence the cost of commercial organizations, at $\alpha \leq 0.05$.

Table 8 indicates that cloud computing services influence the cost, where (β=0.312, t=3.461, sig.=0.001). Therefore, the above hypothesis is denied and the substitutional hypothesis is admitted, which presents that cloud computing services influence the cost of commercial organizations, at $\alpha \leq 0.05$.

H_{02}: Cloud computing services do not influence the quality of commercial organizations, at $\alpha \leq 0.05$.

Table 8 shows that cloud computing services influence the quality, where (β=0.330, t=3.308, sig.=0.001). Therefore, the above hypothesis is rejected and the substitutional hypothesis is admitted, which presents that cloud computing services influence the quality of commercial organizations, at $\alpha \leq 0.05$.

H_{03}: Cloud computing services do not influence the responsiveness of commercial organizations, at $\alpha \leq 0.05$.

Table 8 shows that cloud computing services influence responsiveness, where (β=0.218, t=2.024, sig.=0.045). Therefore, the above hypothesis is rejected and the substitutional hypothesis is admitted, which presents that cloud computing services influence the responsiveness of commercial organizations, at $\alpha \leq 0.05$.

H_{04}: Cloud computing services do not influence the reliability of commercial organizations, at $\alpha \leq 0.05$.

Table 8 shows that cloud computing services do not influence reliability, where (β=0.089, t=-0.817, sig.=0.416). Therefore, the above hypothesis is admitted, which presents that cloud computing services do not influence the reliability of commercial organizations, at $\alpha \leq 0.05$.

H_{05}: Cloud computing services do not influence the innovation of commercial organizations, at $\alpha \leq 0.05$.

Table 8 shows that cloud computing services do not influence innovation, where (β=0.113, t=1.042, sig.=0.300). Therefore, the above hypothesis is admitted, which presents that cloud computing services do not influence the innovation of commercial organizations, at $\alpha \leq 0.05$.

5. Results Discussion

This study is directed to search the impact of cloud computing services on the competitive advantages of commercial organizations in Jordan that use cloud computing. The study covers 111 organizations out of 200 organizations that use cloud computing in daily activities. The data was collected from 111 managers/owners through a questionnaire, which was developed purposely for this research paper. After confirming the reliability, normal distribution, and validity of the study tool. Then the relationship between variables was confirmed, and multiple regressions were conducted to test the hypotheses. Results show that cloud computing services influence the competitive advantages dimensions (quality, responsiveness, cost, innovation, and reliability) of commercial organizations in Jordan, where cloud computing services have the highest positive significant influence on quality at 33.0%, then cost at 31.2%, followed by responsiveness at 21.8%, however, cloud computing services do not significantly influence innovation, and it has an insignificant negative impact on reliability. These results are matching with previous studies' results except for reliability and innovation. Most previous studies indicated that cloud computing reduces cost, enhances responsiveness, and improves quality such as cloud computing reduces costs for both organizations and customers (Durkee, 2010). Cloud computing reduces costs and improves its competitive position (Xue & Xin, 2016). Cloud computing is related to cost-effectiveness and performance (Fernando et al., 2019). Cloud computing services are cost-effective (Adane, 2018). Cloud computing reduces scheduling complexity and process costs (Chiou & Lin, 2010). Cloud computing reduces infrastructure and operations costs, as well as improves design and delivery (Son et al., 2011). Flexible cloud computing services reduce the cost of operations (Lam, 2014). Cloud computing reduces business costs (Abusaimeh, 2020a). Cloud computing services support scalability, and adaptability and are cost-effective (Suresh, 2017). Cloud computing improves scheduling, minimizes processing time, and improves performance (Paridar et al., 2018). Mobile Cloud Computing reduces the time and cost of operation and maintenance (Abusaimeh, 2022). Cloud computing reduces costs and enhances planning accuracy, speed of order execution, delivery time, complaints handling, quality, returns, and flexibility, which improves competitive position (Nowicka, 2018). Cloud computing services affect price-quality competition (Kilcioglu & Rao, 2016). Hybrid cloud computing offers different service quality levels, which reduces cost and improves scalability and speed (Banditwattanawong et al., 2016). Cloud computing reduces costs related to purchasing and maintenance and the number of IT workers (Xue & Xin, 2016). Cloud computing is used to achieve competitive advantage through cost leadership and differentiation strategies (Al-Awawdeh & Al-Sharairi, 2012). Cloud computing supports differentiation, cost leadership, and focus strategies (Powell, 2013).

The study results show that cloud computing does not significantly influence innovation. This result does not match some previous studies' results such as cloud computing creates a competitive advantage through innovation (Truong, 2010). Cloud computing enhances business innovation (Fakieh et al., 2016). Cloud computing reduces costs and time without trade-offs with innovation (Nowicka, 2017). Cloud computing enhances creativity and inventions to be in a better position compared to competitors (Abusaimeh, 2020b).

The study results show that cloud computing has an insignificant negative effect on reliability. This result is matching with many previous studies' results such as when using cloud computing services there is a trade-off between security and usability (Liu et al., 2015). Cloud computing services do not ensure reliability related to security for insurance and banking organizations (Wišniewski, 2014). Cloud computing does not guarantee reliability related to privacy and security (Wielki, 2015). Cloud computing has many challenges such as privacy, security, performance, and cost (Abusaimeh, 2022).

6. Conclusions

The current research paper aims at exploring the influence of cloud computing on competitive advantage dimensions in commercial organizations in Jordan. The competitive advantage dimensions include quality, responsiveness, cost, innovation, and reliability. The data were collected from 111 commercial companies that utilize cloud computing services via questionnaire. Then after ensuring the normal distribution of data, the reliability and validity were checked, then multiple regressions were performed to check the hypothesis. Results show that cloud computing services influence the competitive advantages (quality, responsiveness, cost, innovation, and reliability) of Commercial Organizations in Jordan, where cloud computing services have the highest level of influence on quality (β=0.330, t=3.308, sig.=0.001), then on cost (β=0.312, t=3.461, sig.=0.001), followed by responsiveness (β=0.218, t=2.024, sig.=0.045). While cloud computing does not significantly affect innovation (β=0.113, t=1.042, sig.=0.300) and reliability (β=0.089, t=-0.817, sig.=0.416). The previous studies' results are supporting the current study results related to the effect of cloud computing on quality, cost, and responsiveness, but the results do not support the current study results related to innovation, and finally, there is a debate about the effect of cloud computing on reliability, where the results of the current study show there is a negative insignificant effect for cloud computing on reliability.

Limitations, Recommendations, and Future Studies: This study was carried out on Jordanian commercial organizations that use cloud computing in their daily practices. Therefore, conducting similar studies on other industries/sectors and in other countries, specially developing countries is recommended. Special studies related to the influence of cloud computing on innovation and reliability are recommended to be able to generalize the results. Furthermore, studies related to other

competitive advantages, specifically privacy and security, are recommended. Moreover, the study recommends including other employees' levels to gain more information about the effect of cloud computing on organizational performance.

Practical Implications: Managers and owners of any organization can get many benefits from using cloud computing to improve daily practices and general performance, where cloud computing enables the organization to respond faster to customers, improves the quality of products and/or services, and reduces the different costs, but they should be aware of its debatable effect on innovation and reliability, especially privacy and security.

References

Abbas, T. H. (2016). Lean Manufacturing dimensions and their impact in achieving competitive advantage of the industrial organization Exploratory study in a textile factory AL Diwaniya. *AL-Qadisiyah Journal For Administrative and Economic Sciences*, *17*(4), 96–118.

Abusaimeh, H. (2020a). Distributed denial of service attacks in cloud computing. *International Journal of Advanced Computer Science and Applications*, *11*(6), 163–168. https://doi.org/10.14569/IJACSA.2020.0110621

Abusaimeh, H. (2020b). Virtual machine escape in cloud computing services. *International Journal of Advanced Computer Science and Applications*, *11*(7), 327–331. https://doi.org/10.14569/IJACSA.2020.0110743

Abusaimeh, H. (2022). Computation Offloading for Mobile Cloud Computing Frameworks and Techniques. *TEM Journal*, *11*(3), 1042–1046. https://doi.org/10.18421/TEM113-08

Adane, M. (2018). Cloud computing adoption: Strategies for Sub-Saharan Africa SMEs for enhancing competitiveness. *African Journal of Science, Technology, Innovation, and Development*, *10*(2), 197–207. https://doi.org/10.1080/20421338.2018.1439288

Al-Awawdeh, W. M., & Al-Sharairi, J. A. (2012). The Relationship between Target Costing and Competitive Advantage of Jordanian Private Universities. *International Journal of Business and Management*, *7*(8), 123–142. https://doi.org/10.5539/ijbm.v7n8p123

Alkunsol, W. H., Sharabati, A. A. A., AlSalhi, N. A., & El-Tamimi, H. S. (2019). Lean Six Sigma effect on Jordanian pharmaceutical industry's performance. *International Journal of Lean Six Sigma*, *10*(1), 23–43. https://doi.org/10.1108/IJLSS-01-2017-0003

Armbrust, M., Fox, A., Griffith, R., Joseph, A. D., Katz, R., Konwinski, A., Lee, G., Patterson, D., Rabkin, A., Stoica, I., & Zaharia, M. (2009). Above the Clouds: A Berkeley View of Cloud Computing. In *Electrical Engineering and Computer Sciences University of California at Berkeley* (Technical Report No. UCB/EECS-2009-28; Issue JANUARY). https://doi.org/10.1145/1721654.1721672

Babcock, C. (2015). *Docker Tightens Security Over Container Vulnerabilities*. Information Week. https://www.informationweek.com/platform-as-a-service/docker-tightens-security-over-container-vulnerabilities

Banditwattanawong, T., Masdisornchote, M., & Uthayopas, P. (2016). Hybrid cloud computing: Economy, scalability and responsiveness optimization. *Chiang Mai Journal of Science*, *43*(4), 884–896.

Basilier, H., Darula, M., & Wilke, J. (2014). Virtualizing network services - The telecom cloud. *Ericsson Review (English Edition)*, *91*(1), 18–25.

Boychev, B. (2014). Cloud Computing - A Way To Increase the Competitiveness of Small and Medium Enterprises. *International Scientific Conference: THE FINANCIAL AND REAL ECONOMY: TOWARD SUSTAINABLE GROWTH*, *January*, 175–184.

Cegliński, P. (2017). The Concept of Competitive Advantages. Logic, Sources, and Durability. *Journal of Positive Management*, *7*(3), 57. https://doi.org/10.12775/jpm.2016.016

Cerny, B. A., & Kaiser, H. F. (1977). A study of a measure of sampling adequacy for factor-analytic correlation matrices. *Multivariate Behavioral Research*, *12*(1), 43–47. https://doi.org/doi.org/10.1207/s15327906mbr1201_3

Chang, Y., Wong, S. F., Eze, U., & Lee, H. (2019). The effect of IT ambidexterity and cloud computing absorptive capacity on competitive advantage. *Industrial Management and Data Systems*, *119*(3), 613–638. https://doi.org/10.1108/IMDS-05-2018-0196

Chen, T., Chuang, T.-T., & Nakatani, K. (2016). The Perceived Business Benefit of Cloud Computing: An Exploratory Study. *Journal of International Technology and Information Management*, *25*(4), 101–122. https://doi.org/10.58729/1941-6679.1297

Chiou, A. S., & Lin, W.-J. (2010). Using Resource Competition Strategy to Achieve Distributive Scheduling in the Grid and Cloud Computing Environments. *Annual International Conference on Advances in Distributed and Parallel Computing (ADPC 2010)*, *Adpc*, 79–84. https://doi.org/10.5176/978-981-08-7656-2_a-07

Dikaiakos, M. D., Pallis, G., Katsaros, I., Mehra, P., & Vakali, A. (2009). Cloud Computing: Distributed Internet Computing for IT and Scientific Research. *IEEE INTERNET COMPUTING*, *17*(I), 10–13. https://en.wikipedia.org/wiki/Cloud_computing#/media/File:Cloud_computing.svg%0Ahttps://www.it24hrs.com/2015/cloud-computing-and-cloud-definition/

Durkee, D. (2010). Why Cloud Computing Will Never Be Free: The competition among cloud providers may drive prices downward, but at what cost? *Queue*, *8*(4), 20–29. https://doi.org/10.1145/1755884.1772130

Fakieh, B., Blount, Y., & Busch, P. (2016). SMEs and cloud computing: The benefits to the national economy and global competitiveness. *Proceedings of the 13th European, Mediterranean and Middle Eastern Conference on Information Systems, EMCIS 2016*, *2016*, 39–52.

Fernando, Y., Achmad, S., & Gui, A. (2019). Leveraging business competitiveness by adopting cloud computing in Indonesian creative industries. *International Journal of Business Information Systems*, *32*(3), 364–392. https://doi.org/10.1504/IJBIS.2019.103082

Frank, I., & Jerry, S. (2012). Electronic-Governance for Nigeria: Opportunities and Challenges in the Digital Era. *International Journal of Electronic Governance and Research*, *1*(1), 77–84. http://eprints.lmu.edu.ng/1395/

Goundar, S. (2012). Cloud Computing: Understanding the Technology before Getting "Clouded." *Lecture Notes in Electrical Engineering*, *2*(LNEE 157), 217–222. https://doi.org/10.1007/978-3-642-28798-5_30

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). Sage Publications. *European Journal of Tourism Research*, *6*(2), 211–213.

Heizer, J., Render, B., & Munson, C. (2017). Operations Management: Sustainability & Supply Chain Management 12th edition. In *Corporate finance* (Vol. 1, Issue 2).

Isse, J. (2010). *Cloud Computing and the Innovation Process of Technology Consulting*. *June 2010*. https://www.diva-portal.org/smash/record.jsf?pid=diva2:832420

Kent, S. (2019). *Federal Cloud Computing Strategy*. https://www.whitehouse.gov/wp-content/uploads/2019/06/Cloud-Strategy.pdf

Kilcioglu, C., & Rao, J. M. (2016). Competition on Price and Quality in Cloud Computing. *25th International World Wide Web Conference Com- Mittee (IW3C2).*, 1123–1132. https://doi.org/10.1145/2872427.2883043

Lam, W. M. W. (2014). Competition in the Market for Flexible Resources : an application to cloud computing. *Working Paper, Toulouse School of Economics*, *August*.

Liu, Y., Sheng, X., & Marston, S. R. (2015). The impact of client-side security restrictions on the competition of cloud computing services. *International Journal of Electronic Commerce*, *19*(3), 90–117. https://doi.org/10.1080/10864415.2015.1000224

Mesbahi, M. R., Rahmani, A. M., & Hosseinzadeh, M. (2018). Reliability and high availability in cloud computing environments: a reference roadmap. *Human-Centric Computing and Information Sciences*, *8*(1), 1–31. https://doi.org/10.1186/s13673-018-0143-8

Mirashe, S. P., & Kalyankar, N. V. (2010). Cloud Computing. *JOURNAL OF COMPUTING*, *2*(3), 78–82. http://www.ncbi.nlm.nih.gov/pubmed/22068528

Mitra, A., O'Regan, N., & Sarpong, D. (2018). Cloud resource adaptation: A resource-based perspective on value creation for corporate growth. *Technological Forecasting and Social Change*, *130*, 28–38. https://doi.org/10.1016/j.techfore.2017.08.012

Mutunga, E. N. (2014). *Strategic Implications of Cloud Computing As a Competitive Advantage in the Banking Industry in Kenya*. THE UNIVERSITY OF NAIROBI.

Naghdehforoushha, M., Fooladi, M., Rezvani, M. H., & Sadeghi, M. M. G. (2023). A Robust Model for Spot Virtual Machine Bidding in the Cloud Market Using Information Gap Decision Theory (IGDT). *Turkish Journal of Electrical Engineering and Computer Sciences*, *31*(1), 193–215. https://doi.org/10.55730/1300-0632.3979

Neicu, A. I., Radu, A. C., Zaman, G., Stoica, I., & Rapan, F. (2020). Cloud Computing Usage in SMEs. An Empirical Study Based on SMEs Employees Perceptions. *Sustainability (Switzerland)*, *12*(12), 1–14. https://doi.org/10.3390/su12124960

Nowicka, K. (2017). Competitiveness of Polish enterprises in relation to the potential of cloud computing. *Kwartalnik Nauk o Przedsiębiorstwie*, *42*(1), 85–99. https://doi.org/10.5604/01.3001.0010.0158

Nowicka, K. (2018). Cloud computing as a factor of the supply chain competitiveness. *Kwartalnik Nauk o Przedsiębiorstwie*, *47*(2), 51–63. https://doi.org/10.5604/01.3001.0012.4729

Nuseibeh, H. (2011). Adoption of Cloud Computing in Organizations. *17th Americas Conference on Information Systems 2011, AMCIS 2011*, *4*.

Paridar, F., Majma, M., & Maeen, M. (2018). Scheduling the parallel execution of workflows in cloud computing based on the imperialist competitive and genetic algorithms. *ACM International Conference Proceeding Series*, 16–21. https://doi.org/10.1145/3264560.3266427

Porter, M. E. (2017). COMPETITIVE ADVANTAGE Creating and Sustaining Superior Performance. In *Creating and Sustaining Competitive Advantage: Management Logics, Business Models, and Entrepreneurial Rent*. https://doi.org/10.1007/978-3-319-54540-0

Powell, T. C. (2013). Organizational Alignment as Competitive Advantage. *Proceedings - Pacific Asia Conference on Information Systems, PACIS 2013*, *13*(2), 119–134.

Sekaran, U., & Bougie, R. (2016). *Research Methods For Business: A Skill-Building Approach*. John Willey: UK.

Sharabati, A.-A. A. (2021). Lean Operations and Competitive Advantage in the Pharmaceutical Industry. *International Journal of Services and Operations Management*, *1*(1), 1–23. https://doi.org/10.1504/ijsom.2021.10038296

Sharabati, A.-A. A., Al-Atrash, S. A., & Dalbah, I. Y. (2022). The use of supply chain control-tower in Pharmaceutical industry to create a competitive advantage. *International Journal of Pharmaceutical and Healthcare Marketing*, *16*(3), 354–375. https://doi.org/10.1108/IJPHM-08-2020-0064

Shukla, S., Hassan, M. F., Tran, D. C., Akbar, R., Paputungan, I. V., & Khan, M. K. (2021). Improving latency in Internet-of-Things and cloud computing for real-time data transmission: a systematic literature review (SLR). *Cluster Computing*, *3*, 1–24. https://doi.org/10.1007/s10586-021-03279-3

Sigalas, C. (2015). Competitive advantage: the known unknown concept. *Management Decision*, *53*(9), 2004–2016. https://doi.org/10.1108/MD-05-2015-0185

Smith, T. A. (2020). The role of customer personality in satisfaction, attitude-to-brand, and loyalty in mobile services. *Spanish Journal of Marketing - ESIC*, *24*(2), 155–175. https://doi.org/10.1108/SJME-06-2019-0036

Son, I., Lee, D., Lee, J. N., & Chang, Y. B. (2011). Understanding the impact of IT service innovation on firm performance: The case of cloud computing. *PACIS 2011 - 15th Pacific Asia Conference on Information Systems: Quality Research in Pacific*.

Subashini, S., & Kavitha, V. (2011). A survey on security issues in service delivery models of cloud computing. *Journal of Network and Computer Applications*, *34*(1), 1–11. https://doi.org/10.1016/j.jnca.2010.07.006

Suresh, V. (2017). *Scalable and Responsive Real-Time Event Processing Using Cloud Computing* (Issue May). Newcastle University.

Thanakornworakij, T., Nassar, R. F., Leangsuksun, C., & Păun, M. (2013). A Reliability Model for Cloud Computing for High-Performance Computing Applications. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *7640 LNCS*, 474–483. https://doi.org/10.1007/978-3-642-36949-0_53

Truong, D. (2010). How Cloud Computing Enhances Competitive Advantages: A Research Model. *The Business Review, Cambridge*, *15*(1), 59–66. http://works.bepress.com/dtruong/12/

Voytenko, V., Stepenko, S., Velihorskyi, O., Chakirov, R., Roberts, D., & Vagapov, Y. (2015). Digital control of a zero-current switching quasi-resonant boost converter. *2015 Internet Technologies and Applications, ITA 2015 - Proceedings of the 6th International Conference*, *1*, 365–369. https://doi.org/10.1109/ITechA.2015.7317428

Wielki, J. (2015). The Impact of the Cloud Computing Model on Functioning and Competitive Abilities of SMEs. *Applied Mechanics and Materials*, *795*, 243–252. https://doi.org/10.4028/www.scientific.net/amm.795.243

Wišniewski, M. (2014). Cloud Computing as a Tool for Improving Business Competitiveness. *Foundations of Management*, *5*(3), 75–88. https://doi.org/10.2478/fman-2014-0021

Xue, C. T. S., & Xin, F. T. W. (2016). Benefits and Challenges of the Adoption of Cloud Computing in Business. *International Journal on Cloud Computing: Services and Architecture*, *6*(6), 01–15. https://doi.org/10.5121/ijccsa.2016.6601

Zhang, W., Zhang, R., Wu, C., Goh, A. T. C., Lacasse, S., Liu, Z., & Liu, H. (2020). State-of-the-art review of soft computing applications in underground excavations. *Geoscience Frontiers*, *11*(4), 1095–1106. https://doi.org/10.1016/j.gsf.2019.12.003