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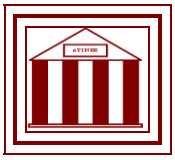

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Influence of Cloud Computing Technologies on Achieving Agility in Organizations: An Empirical Investigation

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Influence of Cloud Computing Technologies on Achieving Agility in Organizations: An Empirical Investigation

Faisal Aburub

Abstract

Winning new customers, increasing customer satisfaction, and meeting customers' expectations are considered priorities in most organizations, but organizations face very dynamic and changeable business. Therefore, organizations need to handle unexpected challenges with smart methods in order to achieve their goals. Today, many organizations invest in cloud computing technologies. Many Cloud Computing Technologies can be considered as essential pillars for most organizations to accomplish their goals. The paper aims to explore the influence of cloud computing technologies usage on achieving agility in organization. An empirical investigation was completed. A new model has been examined using the banking sector in Middle East. Outcomes show that the impact of using cloud computing technologies on a bank's agility is significant, while the variance of bank's agility that is explained by cloud computing technologies is weak. This indicates that there are other significant variables that contribute to the agility in organization within banking sector. Moreover, the results show that the current agility drivers (competency, flexibility, quickness and responsiveness) are more restricted on manufacturing than on the banking sector. Finally, further work can be performed to investigate new drivers of organizational agility given the difference in the characteristics between manufacturing and services sectors.

Keywords: Agile Attributes, Cloud Computing Technologies, Empirical Investigation, Organizational Agility.

Introduction

Responding to dynamic business environments is considered an essential key for an organization's success. Those challenges may lead the organizations to uncertainty and unpredictability in all sectors. According to Ghilic-Micu et al. (2014), under the dynamic and complex business environment, organizations need to be able to adapt by becoming agile and flexible. Organizational agility is also important for service delivery to customers. According to Khoshlahn and Ardabili (2016), an organization must be flexible, speedy and able to face changing conditions. This means that organizations should create agility and compatibility. Moreover, agility stimulates organizations to produce high quality products and services, and is thus an essential factor for organizations' productivity (Mehdibeigi et al., 2016). Agility helps organizations to compete efficiently in the dynamic global business environment.

According to Ganguly et al. (2009), an agile organization should be able to adjust efficiently and quickly to any sudden or unexpected changes in the business environment. Ashrafi et al. (2005) state that organizational agility can be defined as the ability of an organization to respond effectively and efficiently to changes in the business environment. In addition, organizational agility is considered key for organizational success and survival. According to Felipe et al. (2016), organizational agility is the capability of the organization to achieve competitive and sustainable advantage within a dynamic environment.

According to Ghilic-Micu et al. (2014), one solution for an organization to become agile is to apply information technology. Moreover, response to changes strategically and operationally in the external environment can be achieved through information technology (Lowry and Wilson, 2016). This research aims to investigate impacts of information technology, particularly cloud computing, on achieving organizational agility.

The research proceeds as follows. The next section presents the literature review, followed by research aims. In section 4, research methodology is shown, followed by data analysis. Section 6 provides results of the research. Section 7 presents discussion of the research results. The last section presents conclusions and future work.

Literature Review

Cloud computing is considered an important technology for delivering information technologies services. According to Alharbi et al. (2016), cloud computing can be defined as IT services models where services of computing either software or hardware are delivered to customers based on their demands over a network, independent of machine and location. Astri (2015) defined cloud computing as a network of configurable computing that affords computing services. These services can be accessed on-demand with minimal management effort or service provider interaction. There are three types of cloud computing, as follows.

Public cloud: A set of computing services that is available over the Internet. It contains Software as a Service (SaaS), such as Gmail and Salesforce.com, Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). The major benefits are that a public cloud is highly scalable, reduces cost, improves cash flow by changing capital investment to operational expenses, is easy to access, and automatically upgrades and backs up data.

Private cloud: this type is built only for a single business. It allows customers to host applications, as well as develop platforms and infrastructure. This model allows customers to address concerns regarding security issues that may arise in public cloud. There are two types of private clouds. The first type is called an "Internal Cloud" or on-Premises and hosts applications, infrastructure, etc. within organizations. The advantages of a scalable, virtualized and flexible private cloud are certain. A second type of private cloud is externally hosted by a third party cloud computing service provider. The third party provider is responsible for creating exclusive secured private cloud environment and managing the private cloud.

Hybrid cloud: it combines both private and public cloud models. In this model, organizations can utilize public cloud computing services in a full or partial manner in order to take advantages of the accessibility, scalability and data backup of public clouds. The organization can simultaneously use private cloud computing services and keep its sensitive data secured on their own network.

Cloud computing services can be offered as follows:

- Software as a Service (SaaS) is a process of providing software commercially through the Internet. The provider of this service handles licenses of software. Also, the provider handles patches, software upgrades, and fixes any bugs. This includes office software, project management software and email software. All of this software can be accessed easily through the Internet. Customers do not need to pay expensive machines to host software or have software. Moreover, customers do not need to hire employees to install and maintain software. SaaS models help customers to cut unrequired resources, as the customers do not need to install different applications on their local computers. This eliminates associated troubleshooting.
- Platform as a Service (PaaS) is a process of providing a full software platform and hardware architecture to make applications run. Some customers need flexible and robust platforms to run their applications. This helps customers to write programs, regardless of specific operating systems. Instead of writing programs for Linux, Apple or Windows, they are written for environments provided by the providers of a cloud, such as Google, Amazon and Microsoft.
- Infrastructure as a Service (IaaS) is a process of providing hardware, such as servers, network and storage. Moreover, it also provides software, such as operating systems and equipment of network such as switches and routers. Infrastructure is fully outsourced and does not need maintenance from customers. This service is reliable, scalable and secured. Moreover, customers are charged based on their use, so the payments change depending on an organization's usage and capacity.

> Instead of investing in fixed infrastructure, which will exceed short organization's needs, customers can pay as use as they go. This saves money for customers because they only pay for what they use.

Many experts believe that Cloud Computing is better than investing in fixed IT infrastructure, as the value of IT infrastructure is depreciating over time, while using a cloud allows customers to pay monthly charges based on their needs.

The research aims to investigate the influence of cloud computing services on organizational agility. Although many researches have been developed to investigate organizational agility and how it can be achieved through information technology, the specific impact of cloud computing services still needs exploration. Oliveira et al. (2012) developed a model that measures the influence of combined technologies namely web services, service-oriented architecture and information architecture on how organizations speed up decision-making, compete and increase their market share. Ghalich Khani and Hakkak (2016) examined the impact of business intelligence on organizational agility through the mediating factor empowerment. The study showed that business intelligence has direct and indirect impact on organizational agility through empowerment. Moreover, Mehdibeigi et al. (2016) developed a research model to study the influence of customer knowledge management on organizational agility. They found that customer knowledge management has a positive significant impact on organizational agility. Swafford et al. (2008) stated that information systems integration could increase the flexibility of supply chain, which led to higher supply chain agility. Shin et al. (2015) developed a research model to study the influence of strategic agility on performance firm and its operations. They use Korean small and medium organizations as a case study to test the model. The results of the study indicate that the strategic agility of Korean small and medium organizations has a positive impact on firm performance, its operations and customer retention. Moreover, strategic agility of the organizations has negative influence of financial performance. Trzcielinski (2015) differentiate between lean and agile organization. Lean organization focuses on protection against changes happened in environment by reduction and elimination of wastes. An agile organization focuses on using the opportunities that are created in the changeable environment, particularly changes that take place in labor forces, finance, suppliers and customers. Balaji et al. (2014) indicated that organizations should be faster, flexible, smarter, and reactive to environment changes, this is essential to sustain in the difficult and changeable markets. Moreover, Balaji et al. (2014) stated that organizational agility could be reached by developing relationships between suppliers and buyers in the supply chain. Creating an agile supply chain is considered as one of the best methods to change the organization into agile organization. Tseng and Lin (2011) stated that agile enterprise focuses on uncertainty, change and unpredictability within environment of business, and how the enterprise can respond efficiently to these changes. They suggested that enterprises need specific attributes to deal promptly with its dynamic environment. These attributes include competency, responsiveness, speed and flexibility. According to Tseng and Lin (2011),

achieving organizational agility requires integration of personnel, technologies, innovation, business process organization and facilities into competitive properties strategies.

According to Sherehiy and Karwowski (2014), organizational agility is essential for coping with dynamic and changing business environments. They indicated that it is important to develop adaptable workforce to achieve organizational agility. They called this workforce as workforce agility. They defined agility as the capability of organization to deal quickly of changes in business external and internal business environment in order to perform proactive actions according to the business environment changes. They proposed a research model with three constructs namely: work organization, workforce agility and agility strategy. The results of this study show that building cooperative relationships within organizations, consumers and suppliers stimulates workforce agility in small enterprises. Worley and Lawler (2010) indicated that agility needs a changeable organizational design ability that can define the required changes in the organization from both external and internal sources, and perform these changes regularly with sustainable performance. One important feature of agile design is a strategy robust enough that it can generate results under a changeable environment. This strategy includes three items, namely strong future focus, economic logic and flexible intent. Another essential feature of agile design is shared leadership and identity, which is how to move an organization from individual trait of leadership to team leadership. This can be achieved through distributing knowledge and power throughout the enterprise in order to respond rapidly without need to top management directions. Moreover, in order to achieve team leadership, more employees must be involved in decision-making process. Trzcielinski (2015) developed a research model to study the impact of Knowledge Based Economy (KBE) on organizational agility. There is a positive relationship between knowledge based economy and organizational agility.

Identify a method to measure organizational agility is required. Gunasekaran (1999) stated that it is very essential to identify suitable performance measurements to specify the agility of organizations. Dowling and Pardoe (2005) defined a metric that includes three attributes: definition, name and value. Goranson (1999) classified agility measurements as upstream and downstream. Agility is called upstream if an organization is able to improve its business processes and deal with uncertainty. Also, agility is called downstream if the organization can respond to changes. Dove (2001) proposed a set of agility metrics, including time, cost, quality and scope that should be measured in order to measure the organizational agility. Goranson (1999) stated that agility measurements should be dynamic. Kumar and Motwani (1995) developed a method to measure organizational agility called Agility Index and Data (2006) proposed another method called Agility Measurement Index. Moreover, Lin et al. (2006) developed fuzzy agility evaluation method. The first appearance of the term agility in business is associated with flexibility within manufacturing systems (Shin et al., 2015). The association of agility and flexibility is similar to the relationship of capability and flexibility. Agility emphasizes capability, while flexibility emphasizes flexibility. Organizations need to

respond appropriately to uncertainties and changes that happen in their business environment. The capabilities are as follows:

- *Responsiveness*: "Which is the ability to identify changes and respond fast to them, reactively or proactively, and recover from them", (Zhang and Sharifi, 1999).
- *Competency*: "Which is the extensive set of abilities that provide productivity, efficiency, and effectiveness of activities towards the aims and goals of the company", (Zhang and Sharifi, 1999).
- *Flexibility*: "Which is the ability to process different products and achieve different objectives with the same facilities", (Zhang and Sharifi, 1999).
- *Quickness*: "Which is the ability to carry out tasks and operations in the shortest possible time", (Zhang and Sharifi, 1999).

Organizational agility has many benefits, such as efficient and quick responses to the dynamic market environment. Organizations should be able to customize services and products delivered to consumers, to produce and deliver new services and products, to decrease manufacturing cost, to increase consumers' satisfaction, increase competitiveness and remove non-added value activities. According to Tseng and Lin (2011), agility is considered as a successful strategy for becoming a leading organization within very competitive environments and continuously changing customer demands. Moreover, Ganguly et al. (2009) indicated that agility is essential in order to have a competitive advantage in the global market. Also, an agile organization is able to identify a business environment's changes and whether those changes are opportunities or threats. Then it responds quickly to its stakeholders and customers through redesigning its processes, resources and strategies.

Aims of Research

One of the research aims is to answer the following question: What is the impact of using cloud-computing technologies on a bank's agility in the Middle East? Based on this question, more questions can be derived as follows:

- What is the impact of using cloud-computing technologies on responsiveness as part of Middle East banks' agility?
- What is the impact of using cloud-computing technologies on competency as part of Middle East banks' agility?
- What is the impact of using cloud-computing technologies on quickness as part of Middle East banks' agility?
- What is the impact of using cloud-computing technologies on flexibility as part of Middle East banks' agility?

The objective of process agility and innovation has not been realized. Given the limited studies related to the use of cloud-computing technologies

and organization agility, the study aims to investigate the impact of cloud-computing technologies on organizational agility within the banking sector in the Middle East.

Research Model

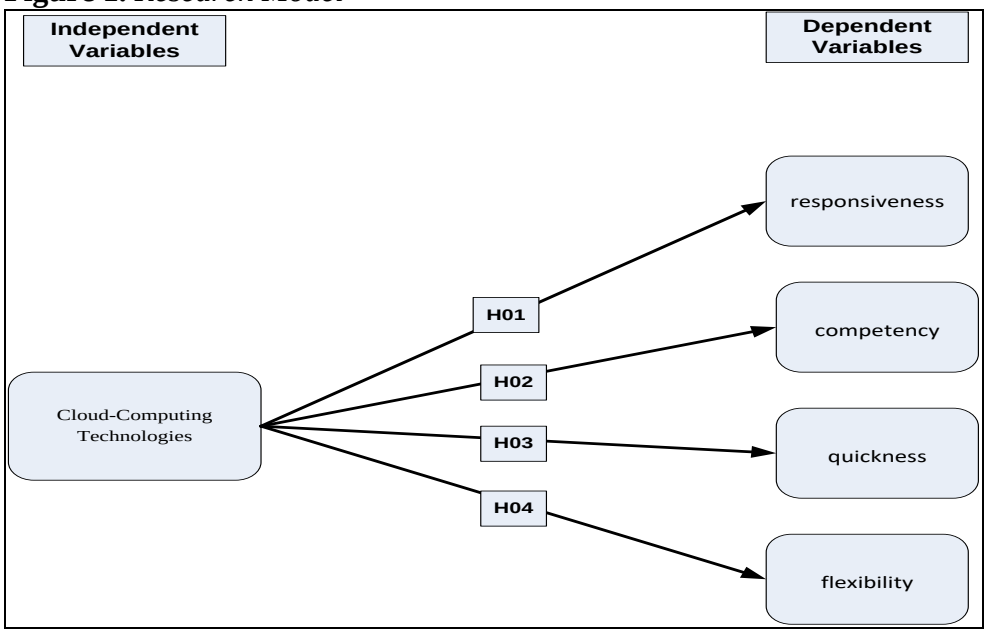
The proposed model is investigated and examined empirically using the banking sector in the Middle East. Figure 1 shows the new research model that includes five variables: the use of cloud-computing technologies, responsiveness, competency, quickness, and flexibility. The model shows that use of cloud-computing technologies may lead to bank agility. Also, this model indicates that one of the important strategic objectives of using cloud-computing technologies is to achieve bank agility. Therefore, the following hypotheses can be formed:

H0: There is no relationship between usage of cloud-computing technologies and bank agility.

More hypotheses can be derived from the above hypothesis, as follows:

H01: There is no relationship between usage of cloud-computing technologies and bank's responsiveness.
H02: There is no relationship between usage of cloud-computing technologies and bank's competency.
H03: There is no relationship between usage of cloud-computing technologies and bank's quickness.
H04: There is no relationship between usage of cloud-computing technologies and bank's flexibility.

Figure 1. *Research Model*



Research Methods

Data Sources

The data were collected using questionnaire surveys of banks in the Middle East. The questionnaire targeted heads of departments, managers and IT managers in the banks. 200 questionnaires were distributed to different banks in the Middle East. 97 questionnaires were returned.

Measurements Development and Pilot Test

An intensive literature review has been conducted to develop the research constructs and item-based measurements. Some changes have been performed to measures in order to suit the banking context. Several approaches and methods have been developed to measure cloud-computing technologies usage in banking sector.

The measures for cloud-computing technologies usage were implemented from Zain et al. (2005). They contain three items to measure how long the respondents are using cloud-computing technologies in the banks. Furthermore, the measures of agility were developed based on Zhang and Sharifi (2000). Measures of agility include four factors, namely responsiveness, competency, quickness and flexibility. Nine items were adopted to measure the responsiveness factor; six items were adopted to measure the competency factor; four items were implemented to measure quickness; and 16 items were used to measure flexibility.

Descriptive Analysis

The descriptive statistics of the sample showed that 61.4% of the respondents were male and 38.6% were female. The mean age of respondents is 30.5 years.

Data Analysis

Reliability

The internal consistency of the research constructs has been tested using Cronbach's alpha. The Cronbach’s Alpha values for all scales more than 0.88 and less than 0.95. This means good reliabilities of the scales according to Hair Jr. et al. (2006) as shown in table 1.

Descriptive Statistics

This has been used to examine the extent to which the banking sector is using cloud-computing technologies to achieve bank agility. Table 2 shows that the use of cloud-computing technologies is above the average. Also, all the agility items are over three, which indicates that the respondents perceived

that their organizations widely used cloud-computing technologies as well in order to build bank agility.

Table 1. *Cronbach's Alpha Values*

Construct	α- value
Quickness	%88
Competency	%92
Responsiveness	%92
Flexibility	%95
Cloud-computing technologies usage	%92

Table 2. *Respondents Perception of Cloud-computing Technologies Usage and Agility Items*

Variable	Scale Average
Quickness	3.83
Competency	3.88
Responsiveness	3.72
Flexibility	3.80
Cloud-computing technologies usage	3.28

Normality Test

Data should be distributed normally in order to run regression analysis successfully. Table 3 shows the results of Kolmogorov-Smirnov and Skewness-Kurtosis tests. The results show that all factors are significant with ($p \leq 0.05$), and the values of Skewness-Kurtosis are between 2.54 and -2.54. This indicates that data is normally distributed.

Table 3. *Normality Test*

Variable	Kolmogorov-Smirnov	Skewness	Kurtosis
Responsiveness	0.00	-0.91	0.55
Competency	0.00	-1.09	1.05
Quickness	0.00	-1.00	1.02
Flexibility	0.00	-1.02	1.05
cloud-computing technologies usage	0.00	-0.38	-0.66

Correlation Analysis

The correlation analysis tests the strength of relationships between one independent variable and several dependent variables. Values of Average Variance Extracted (AVE) between responsiveness, competency, quickness, flexibility, and cloud-computing technologies usage are shown in Table 4. The values are all between 0.0 and 0.50. Therefore, the results of correlation analysis show that the strength of relationships between responsiveness, competency, quickness, flexibility, and cloud-computing technologies usage

are moderated on a 0.01 level of significance (P-Value=.000 < .01). Further analysis makes it possible to examine the amount of variance in the dependent variables that can be explained by independent variable.

Table 4. *Correlations*

Constructs		**Cloud**	**Responsiveness**	**Competency**	**Quickness**	**Flexibility**
cloud-computing technologies	Pearson Correlation	1	.376	.444	.463	.430
	Sig. (2-tailed)		.000	.000	.000	.000
	N	94	90	92	90	88
Responsiveness	Pearson Correlation	.376	1	.823	.776	.720
	Sig. (2-tailed)	.000		.000	.000	.000
	N	90	94	93	90	88
Competency	Pearson Correlation	.444	.823	1	.808	.773
	Sig. (2-tailed)	.000	.000		.000	.000
	N	92	93	96	92	90
Quickness	Pearson Correlation	.463	.776	.808	1	.844
	Sig. (2-tailed)	.000	.000	.000		.000
	N	90	90	92	94	87
Felxibility	Pearson Correlation	.430	.720	.773	.844	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	88	88	90	87	91

Results - Hypotheses Testing

In order to test the relationships between the research constructs, simple regression analysis was carried out.

Table 5 shows that cloud-computing technologies usage explains about 14.1% of the variance in the responsiveness item in bank agility. The value of F is (14.469) and hence is significant at ($p \leq 0.05$). This indicates that there is a relationship between the independent variable and the dependent one. Table 6 shows that cloud-computing technologies ($\beta = 0.376$, $p \leq 0.001$) are significantly and positively related to the responsiveness item in bank agility. Therefore, hypothesis H01 was rejected, and we accepted the alternative hypothesis.

Table 5. *Model Summary (Cloud-computing Technologies & Responsiveness)*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.376[a]	.141	.131	7.08769

Table 6. *Coefficients (Cloud-computing Technologies & Responsiveness)*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	25.442	2.315		10.989	.000
	Cloud	.849	.223	.376	3.804	.000

Table 7 shows that cloud-computing technologies usage explains about 19.7% of the variance in the competency item in bank agility. The value of F is (22.086) and hence is significant at ($p \leq 0.05$). This indicates that there is a relationship between the independent and the dependent variables. Table 8 shows that cloud-computing technologies ($\beta = 0.444$, $p \leq 0.001$) are significantly and positively related to the competency item in bank agility. Therefore, hypothesis H02 was rejected, and we accepted the alternative hypothesis.

Table 7. *Model Summary (Cloud-computing Technologies and Competency)*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.444[a]	.197	.188	4.86103

Table 8. *Coefficients (Cloud-computing Technologies and Competency)*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	16.319	1.577		10.348	.000
	Cloud	.716	.152	.444	4.700	.000

Table 9 shows that cloud-computing technologies usage explains about 21.4% of the variance in the quickness item in bank agility. The value of F is (23.953) and hence is significant at ($p \leq 0.05$). This indicates that there is a relationship between the independent and the dependent variables. Table 10 shows that cloud-computing technologies ($\beta = 0.463$, $p \leq 0.001$) are significantly and positively related to the quickness item in bank agility. Therefore, hypothesis H03 was rejected, and we accepted the alternative hypothesis.

Table 9. *Model Summary (Cloud-computing Technologies & Quickness)*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.463[a]	.214	.205	3.03196

Table 10. *Coefficients (Cloud-computing Technologies & Quickness)*

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	10.599	1.027		10.317	.000
	Cloud	.479	.098	.463	4.894	.000

Table 11 shows that cloud-computing technologies usage explains about 18.5% of the variance in the flexibility item in bank agility. The value of F is (19.489) and hence is significant at ($p \leq 0.05$). This indicates that there is a relationship between the independent variable and the dependent one. Table 12 shows that cloud-computing technologies ($\beta = 0.430$, $p \leq 0.001$) are significantly and positively related to the flexibility item in bank agility. Therefore, hypothesis H04 was rejected, and we accepted the alternative hypothesis.

Table 11. *Model Summary (Cloud-computing Technologies & Flexibility)*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.430[a]	.185	.175	11.09890

Table 12. *Coefficients (Cloud-computing Technologies & Flexibility)*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	45.007	3.799		11.847	.000
	Cloud	1.629	.369	.430	4.415	.000

Discussion

The research investigated the impact of cloud-computing technologies usage on organization agility. A new research model has been developed based on the work of Zhang and Sharifi (2000) and Zain et al. (2005). The research model has been tested in the context of the banking sector in the Middle East. The main outcome of this study is exploring the relationship between cloud-computing technologies usage and agility in banking sector. This study adds to the previous literature by confirming that if the organizations need to decrease uncertainty, unpredictability and volatility and resulted from dynamic business environment have to give more attention and focus on cloud computing services. The study focuses on the importance of cloud-computing technologies when coping with uncertainty in a business environment.

The results show that the impact of cloud-computing technologies usage on bank agility is moderated as cloud-computing technologies explain about 14.1% of the variance in the responsiveness item, 19.7% of the variance in the competency item, 21.4% of the variance in the quickness

item, and 18.5% of the variance in the flexibility item. Cloud-computing technologies could increase simplification, standardization, and integration, and automation of organizations. However, the results also show that cloud-computing technologies' influence on the agility of organizations is moderated.

The results show that building organizational agility may not depend only on technology, but it may also depend on other factors such as culture, organizational politics, structures, environments, routines and business processes.

Conclusion and Future Work

The problem of how organizations can cope with uncertainty, unpredictability, and a changing environment is an important topic for both academics and professionals. In order to solve this problem, organizations should be agile. Technology could contribute to building agile organizations. Cloud-computing technologies can be considered as key pillars supporting organizations to achieve their business. Therefore, this research aims to investigate the impact of cloud-computing technologies usage on organization agility.

A new research model has been developed. The research model contains two parts. The first includes the independent variable,cloud-computing technologies usage. The second part includes the dependent variables, namely responsiveness, competency, quickness, and flexibility. The research model has been tested within the context of the banking sector in the Middle East. The results show that the influence of cloud-computing technologies usage on banks' agility is moderated. The dependent variable most influenced by cloud-computing technologies usage is quickness with R square 21.4%.

This study concluded that building agility is not dependent only on technology particularly cloud-computing technologies, but also could be on other factors such as organizational politics, culture, environments, structures, routines and business processes.

In future research, the same study can be applied within other contexts to prove the validity of the research model. Furthermore, new research can be conducted to study the influence of adopting other technologies and information systems, such as web services and electronic commerce, on building organizational agility.

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