The Importance of Virtual Enterprise Systems in Times of Crisis

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***Abstract*— Virtual enterprise systems are noticeably expanding, which shortly will reveal a substantial impact on the traditional organizational model. The illustration of the major challenges and the Critical Success Factors (CSFs) of the virtual enterprise systems implementation will help other organizations to adopt the virtual enterprise systems efficiently and take advantage of this novel virtual cloud computing revolution especially in times of crises such as Covid-19. This research identifies the top ten CSFs that contribute in delivering a successful virtual enterprise systems implementation. A survey instrument was distributed to 50 enterprises that currently using virtual enterprise systems. The research outcomes indicate positive and significant relationship between eight CSFs and the virtual enterprise systems implementation. However, only two factors demonstrate positive and insignificant correlation. Overall, the results of this study show a notable impact of the CSFs on the virtual enterprise systems implementation.**

***Keywords*—** *Virtualization, Enterprise Systems, Mobility, Crisis, Supply Chain Management (SCM).*

1. Introduction

Many firms have moved from the traditional business model to the virtual one to cope with the current exceptional situation and keep their existing customers. This urgent sift requires a rapid adoption of a cutting-edge technology to grasp the potential opportunities of Covid-19 pandemic and to be able to integrate and keep appropriate communication with customers and suppliers, and other stakeholders. Virtual enterprise systems providing the right infrastructure for virtual communication and remote work. It will also save the cost of the in-house infrastructure implementation like hardware and software, consultancy and maintenance, and other operating costs, [1].

Virtual cloud system is similar to a power supply firm that provides power to public on-demand basis and pay per use. Usually firms do not generate power by themselves rather a supplier generate power for them such as a power supplier. The virtual systems providers provide services like Platform as a Service (PaaS), Infrastructure as a Service (IaaS), and Software as a Service (SaaS). Virtual enterprise systems are the new technology that make a huge change in the traditional business model and in the implementation approach of the virtual enterprise systems [2-5].

Public and private sectors need to move forward from the traditional enterprise systems to the virtual environment to be more efficient and effective, flexible and innovative to easily enable virtual communication and remote work from anywhere at any time. It is important to identify the CSFs and the major challenges that would provide the right infrastructure and the appropriate solutions for several firms via a promising technology such as virtual enterprise systems solution. Nowadays turning to the virtual environment is becoming essential and not a substitute anymore to ensure that work continues with the Covid-19 pandemic [6, 7].

2. Literature review

2.1 Virtual Computing

Virtual computing is similar to a public service that is managed by a supplier and used by many beneficiaries. The access to the resources and services and is acquired by demand from customers. Virtual computing is the remote computing infrastructure that hosts the required hardware, software, database, networks, and many other applications that offered as a service to the

final customers. The virtual model allows numerous firms to reduce the load that related to the implementation of IT resources. Using the virtual model, firms are not required to have the physical IT infrastructure in place, however they still can use them remotely at any suitable time without bothering themselves in managing the IT resources which includes upgrade, maintenance, admin work, etc. because everything will be managed by the virtual service provider [4, 5].

NIST defined cloud computing as a model that enables diffused, suitable, and on-demand network access that share several computing resources such as networks, servers, storage, applications, and services that can be quickly supplied and released with little management effort. The five vital features of virtual computing are rapid expansion, broad network access, on-demand self-service, measured service, and resource pooling. On the other hand, infrastructure, platform, and software are the three-service model provided by the virtual systems providers [5, 8].

The benefits from virtual computing can be summarized in the availability of mobile access anytime anywhere using any device, use of the latest IT resources, premium quality control over the IT resources, cost reduction, data recovery, better collaboration among the team members, effective virtual communication, and efficient remote works. The challenges of the virtual cloud computing are security, privacy, attacks from hackers, difficult to change from one provider to another, and network downtime [4, 5, 9].

This current unusual situation has increased the need to defeat all challenges and quickly move to the virtual environment. Many companies shifted to the virtual cloud computing to reduce the operating cost, enhance communication and scalability with vendors and customers, minimize the IT department and personnel requirements, reduce the hardware and software license cost, provide virtual communication among stakeholders, and operate the remote works [9].

2.2 Virtual Enterprise Systems

Virtual enterprise systems are essential part of the broad virtual cloud-computing model, which offers several features for almost all business aspects in the firm. Virtual enterprise systems are the upcoming approach in the Enterprise Resource Planning (ERP) systems field especially in times of crises such as Covid-19 pandemic. It might become the new model for many organizations to replace the legacy traditional ERP systems approach. Virtual enterprise systems are a central nervous software that offers remote facilities to many customers with several requirements. This software includes many features that connected to a single database to provide online support to all business needs such as distribution, accounting, manufacturing, storage, supply chain management, human resource management, business intelligence, database, customer relationship management, etc. [10].

Virtual enterprise systems remains as fast-growing approach and became mandatory to any organization likes to move from traditional business model to remote business model [11]. This promising technology is making all required work materials available online to provide remote works anytime at any place. Previous study on virtual enterprise systems in education sector demonstrates several reasons to adopt this virtual solution such as accountability and regulatory compliance (4%), better teaching & learning process (5%), increase efficiency and effectiveness (5%), keep institution competitive (7%), modernize campus IT environment (12%), transforming institution operations (16%), improve service to customers (21%), and finally replacing aging legacy system (30%) [12].

Cloud computing is the infrastructure for the virtual enterprise systems, which includes the entire solutions to manage all business needs in an effective way. The adoption and usage of the virtual enterprise systems services payment method can easily be through pay as you go model. In this model, the virtual systems users will pay based on their usage only to avoid waste of resources and the payment will be similar to any utility payment. Currently, most of the organizations are looking for agile solution to quickly adopt and cope with the new practice of remote work and virtual

communications to keep smooth operational and remain competitive in the existing aggressive business environment [13].

Virtual enterprise systems are the vital solution for this new approach since it has steady platform that helps in deriving notable business outcomes. This virtual solution offer extensive benefits to all organization such as cost reduction, improve productivity, efficient performance, information richness, increase profitability, and agile operations. However, prior to virtual enterprise systems implementation, organizations should identify the major challenges and the CSFs associated with the virtual adoption to be a solution to the current lockdown situation due to Covid-19 pandemic [5].

2.3 Virtual Supply Chain Management

Davenport and Brooks (2004) noted that SCM contributes to the reduction of inventory and working capital. It also makes a close relationship between suppliers and customers. SCM is coordination and cooperation between suppliers and customers to share information and exchange goods and services [14].

On the other hand, SCM contains activities that can facilitate the movement of goods and the flow of information from the raw materials to end customers. It helps companies to improve the relationship between suppliers and customers to produce a high-quality product at a lower cost. This is to gain a competitive advantage in the global market [15, 16].

According to Gormley *et al.* (1997), the basic tools of package software offered for supply chain management are supply planning tools, these tools help managers to align all the resources and activities that necessary to obtain goods. Demand planning tools, these tools assist companies to predict market demand to know what to produce exactly. Plant scheduling tools, which help companies to convert all supply requirements into daily production plans. And logistics systems, these systems assist companies to support warehouse management, inventory transportation, and finally order management[17].

In the present economy, SCM is considered as one of the most important and powerful management strategies that have a significant impact on business performance. However, when companies place SCM in their business model they can provide products with premium quality at a low price to attract customers. SCM is an important component to extend and link with suppliers, distributors, and retailers in one distribution network whereby companies can obtain the best products at the lowest cost and thus increase profitability and gain a competitive advantage in the business world [18] [19].

SCM facilitates the movement of products through the supply chain, managing the associated information flow, organizing the business relationship with customers and suppliers and other partners in the supply chain, and creating customer value to achieve customer satisfaction and loyalty [20, 21]. On the other hand, SCM can be perceived through managing upstream and downstream operations, which resulted in reducing the operational costs to improve the profit margin, and in delivering the products to the market to reach the customer on time [22]. The goals of SCM are to reduce uncertainty and risks related to the supply chain, and this is can contribute to decreasing inventory levels and cycle time, improving business processes, and enhancing customer service, and finally increase profitability and enhance the competitiveness of the company [23].

In 2000, a survey has been conducted on large manufacturing companies in the USA indicated that companies with a solid SCM can reduce their operating costs, inventories, product life cycle, and cycle time tremendously, and that will certainly increase cash flow, working capital, the efficiency of transactions in the supply chain, customer services and on-time delivery (Zheng *et al*., 2000)

However, SCM considered as one of the most important success factors in the future of the business environment, meanwhile managing the entire supply chain are very challenging and not an easy task, therefore companies began to consider and redirect their efforts toward information systems, such as enterprise systems, to improve their SCM performance and allow them to gain a competitive advantage in the global economy [24].

Zheng *et al*. (2000) pointed out that, the main five parts of any supply chain are plan, buy, make, move, and sell. SCM contains applications such as, manufacturing planning, demand planning, distribution planning, transportation management, warehousing management, performance management, production scheduling, freight payment, capacity planning, customer clearance, sourcing and procurement, and finally supply chain optimization.

Therefore, the success of the supply chain depends on how efficient and effective each part and application of the supply chain, and also on how well these parts and applications are integrated to assist the entire supply chain to move smoothly and efficiently[7]. Enterprise systems can integrate all parts and applications of the supply chain, and also able to facilitate the efficiency of each part and application in the supply chain.

To create an effective and successful SCM, it requires cross-functional integration, as well as many companies, need to integrate the whole supply chain, which includes suppliers, warehouses, factories, distributors, and retail outlets, and provide cooperation between all supply chain partners through planning, coordination, and information sharing which is critical to achieving successful and effective operation of the supply chain [25].

The key to achieve effective SCM is accomplishing customer demand on time. However, several steps must be taken to attain an effective supply chain that includes developing strategic objectives and tactics, creating strategic partnerships, coordinate activities with suppliers and customers, and finally organize planning and execution within the supply chain [24]

These require the implementation of an information system that facilitates and expedites the exchange of data and information between supply chain partners, integrate functional units, and allow everyone in a company to access a single database and use the same data and information without any data inconsistency problems. The suitable information system that can provide all the above-mentioned characteristics is the enterprise systems.

ERP could be an effective system that assists companies in creating effective and successful supply chain management. Enterprise systems are introduced to integrate all functional units of a company and its supply chain to make it in one system. Therefore, all data and information related to SCM will be accessible and retrieve from one system. The ease of access to one system from various functional units and the advancement of IT and computing research have resulted in the enhancement of SCM performance [26, 27].

Enterprise systems include SCM module which contains sub-modules for materials procurement, material transformation, and distribution of products to deliver the right product to the right place at a low price to gain customer satisfaction and loyalty as well as achieve effective and successful SCM performance [26, 27].

Moreover, enterprise systems contain SCM functionality that provides the company with a great extension through the following components (McAdam & Galloway, 2005). Supply chain replenishment is the use of real-time to integrate the processes of production and distribution to improve customer responsiveness. E-procurement, which facilitates procurement processes using Web-enabled technologies to cope with requisitions, sourcing, contracting, ordering, and payment processes. E-logistic, which supports warehouse and transportation management processes using web-based technologies. Supply web, this functionality designed to form a trading community within the supply chain by integrating supply chains of several buyers and sellers.

2.4 Major Challenges

All major challenges must be defeated prior to the adoption of the virtual enterprise systems to achieve successful virtual implementation. Vendor bargaining power is one of the major challenges where the virtual providers govern and control the entire virtual enterprise systems. The virtual systems vendors can merely lock-in all virtual resources due to the full dominance that they have over the entire virtual resources, which might cause a pressure on the companies by either reducing the services quality or increasing the price of the provided services. This research illustrates the top ten challenges related to virtual implementation of

the enterprise systems. These challenges such as organizational culture, migration, integration, customization, vendor's dominance, competencies, compliance, governance, cost, and security [28].

Security is the major concern to the entire virtual cloud computing technology and to the virtual enterprise systems in particular. It requires the host company to go through complicated processes and other protection requirements to ensure the security of virtual resources. Cost such as transition costs, monitoring costs, and coordination cost considered as hidden costs, and this is because of the contract does not describe the costs clearly. The user organizations' braining power to shift to another virtual provider is not that easy due to the limited governance and control over the virtual resources. Firms should follow the regulations and technology standards that configured by the providers and strictly follow all policies in place. The dominance and the full control of the virtual suppliers on the IT resources could create resistance to change among the end-users and the IT staff themselves, and that will cause a huge loss in the IT competencies [29].

The leaders of the virtual cloud technology providers are Google, IBM, Microsoft, and Amazon. The virtual cloud providers have ultimate power and full control over the IT resources, which will cause rigorous pressure on the end-users such as lock-in applications and data to stop them to change to other virtual vendors, reducing the quality of the service, and increase the subscription fees. The adoption of virtual enterprise systems usually suffers a common challenge from the inappropriate integration with the legacy systems application, this is due to the virtual systems offer very limited customization to avoid major configurations on the genuine virtual enterprise systems. Providers will impose on the user organizations to adjust the usual processes to match with the virtual systems features, rather than changing the genuine software package to match the company business processes. This restriction might not be appropriate option for several organizations because it does not provide them with many customization options [29].

The traditional implementation of the in-house enterprise systems is far different form the virtual one, and this is due to several dissimilarities within the virtual software packages. The new virtual approach imposes major changes in the business process, which is usually not preferable by many organizations. This major change will eliminate the boundaries between functional departments and make several changes in various business rules and policies and that usually cause huge confusion and resistance among the end-users. Change management champion, employee involvement, and top management support must all be in place to overcome the expected change resistance. During the implementation stage, change management agent should provide proper training to the end-users and keep day-to-day communication to end up with a successful virtual enterprise systems implementation [30].

2.5 Critical Success Factors

Several CSFs of enterprise systems implementation has shown in literature, but very few of them presented for the virtual enterprise systems implementation. In regards of in-house enterprise systems implantation, around 78 CSFs presented and classified in 15 major categories [15, 31].

Organizations should evaluate the enterprise systems software vendors very carefully, and consider the major CSFs such as project management, project champion, effective communication, business plan and vision, composition, teamwork, and top management support. These measures will certainly lead to a successful enterprise systems implementation (Yu 2005). A past research demonstrates the CSFs of the virtual cloud business model by analyzing 45 organizations. The study found that 39 CSFs related to virtual implementation such as consulting activities, knowhow resource, administration, knowhow transfer, print media, consolidation, monitoring, database service, one-time charge, manifold width, etc. [32, 33].

The most notable virtual providers with high successful virtual implementation rate are VMware rating (64%), Cisco (64%), CenturyLink / Savvis (64%), IBM (65%), Amazon's AWS (65%), Microsoft (68%) [2]. A successful virtual implementation of the enterprise systems should ensure CSFs such as monitoring & evaluation of performance, project champion, project

management, business process reengineering, change management program, effective communication, business plan and vision, teamwork and composition, and finally top management support. The CSFs of the enterprise systems classified in literature in three category high, medium, and low citation [29, 32]. Table 1 presents the scope of CSFs citation in literature.

Table 1: CSFs of in-house Enterprise Systems

CSFs	Citation
Partnership with Vendor	Low
Education on new Business Processes	Low
Data Analysis & Conversion	Low
Appropriate Business & IT Legacy Systems	Low
Vendor Support	Medium
Teamwork & Composition	Medium
Strategic IT Planning	Medium
Project Champion	Medium
Monitoring & Evaluation Of Performance	Medium
Minimal Customization	Medium
Learning Competency	Medium
Clear Goals & Objectives	Medium
Change Readiness & Culture	Medium
Careful Package Selection	Medium
Business Plan & Vision	Medium
User Involvement	High
User Training & Education	High
Business Process Reengineering	High
Project Management	High
Top Management Support	High

Source: [34]

In previous studies, the virtual enterprise systems CSFs categorized into two main groups, organizational and technological factors, the organizational factors include compatibility, firm size, top management support, and relative advantage. The technological factors include security, complexity, technology readiness, and cost. Security rated as the lowest critical factors with a frequency of 23, followed by top management support with 24, relative advantage with 25, and compatibility as the top influential factor with a frequency of 27. Other factors such firm size, government regulations, competitive pressure, complexity, technological readiness, and cost are also critical to ensure the success of the virtual enterprise systems implementation [35, 36].

A related research found that factors such as reliability, redundancy, efficiency, scalability, collaboration, availability, virtually, flexibility, and cost reducing are significantly influencing the adoption of the virtual solutions. However, reliability rated as the lowest critical factor, then redundancy, on the other hand the study rated cost reduction as the most critical factors contributes in the successful adoption of the virtual enterprise systems [4].

This study illustrates the top ten CSFs of the virtual enterprise systems implementation. The citation of the CSFs of in-house enterprise systems in literature is massive comparing to the CSFs of the virtual enterprise systems. Therefore, this research categorizes the scope of citation of the CSFs in literature by two categories frequency and classification. Table 2 presents the scope of citation in literature of the CSFs that closely related to the virtual enterprise systems implementation.

Table 2: CSFs of Virtual Enterprise Systems

Influential Factors	Frequency	Classification
Compatibility	27	Technological
Security	23	Technological
Technology Readiness	17	Technological
Complexity	16	Technological
Competitive Pressure	15	Technological
Advantage	25	Organizational
Top Management Support	24	Organizational
Firm Size	9	Organizational
Government Regulation & Support	13	Environmental
Teamwork & Composition	13	Environmental

Source: [11]

Several studies in literature highlight the CSFs that lead to successful enterprise systems implementation such as employee involvement, top management support, training, and acceptance of the end- users [11].

The CSFs of enterprise systems implementation topic given high concern in enterprise systems literature. Figure one presents topics that related to the enterprise systems CSFs i.e. implementation CSFs, business processes, change management, user education, and user acceptance [37].

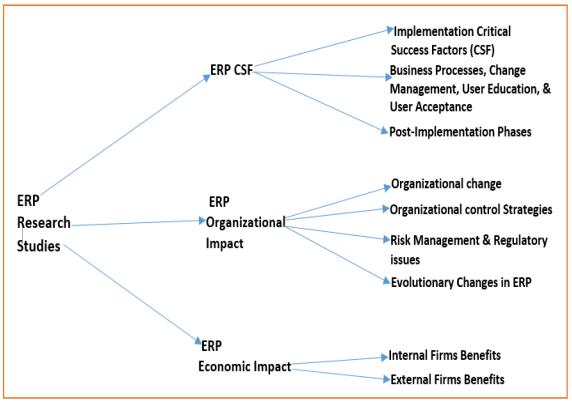

Figure 1: ERP Research Overview [37].

3. Research Methodology

3.1 Research Population and Sample

The primary goal of this research is to investigate the major challenges and the CSFs of virtual enterprise systems implementation in times of crisis such as (Covid-19). All enterprises using virtual enterprise systems in the Kingdom of Bahrain are determined as the population of this study, and the sampling technique used for this study known as convenience sampling. The major virtual enterprise solution local providers such as SAP, Oracle, Microsoft, Syskode, Inforise, Odoo, etc. were contacted to identify 50 international and local enterprises in Bahrain using virtual enterprise solution.

3.2 Research Methods and Analysis

The data collection has been carried out via a mixed-method approach that presented in two stages to measure the variable of interest of this study and achieve the research objectives. The first stage was in charge of collecting the quantitative data via a pretested questionnaire that used as a survey instrument to measure the relationship between the identified CSFs and the virtual enterprise systems implementation. The survey instrument development was carried out based on various items and measures that collected and adapted from several sources to collect some essential data about the demographic profile of the respondents, and the factors that play a critical role in the success of the virtual enterprise systems implementation. The survey instrument was distributed to the pre-identified 50 enterprises using virtual enterprise systems. Out of which only 32 usable instruments were returned back from the participating enterprises.

In the second stage of the survey, an in-depth interview was conducted with two IT managers and IS infrastructure administrators, one from a public sector and the other one from a private sector in order to investigate their experience in implementing and using the virtual enterprise systems. Two semi-structured interviews were conducted to explore more about the major challenges and barriers of moving to the virtual cloud solution, and how these challenges and barriers were defeated by the enterprises. Moreover, the interviewees were asked about the adopted critical success factors during the virtual enterprise systems implementation, and how those factors help in achieving a successful implementation of the virtual enterprise systems.

The collected data from the respondents were entered into the Statistical Package for Social Sciences (SPSS, version 21). The statistical tools and methods used in this study are reliability analysis, this technique was used to test the validity and the reliability of the measures that gauge the variables of interest of this study. Descriptive statistics, this technique was run to describe the characteristics of the respondents and check the research variable for any violation of the assumption underlying the statistical techniques.

Frequency analysis, this statistical technique was used to determine the frequency distribution of the research items and variables. Correlation analysis, this technique has been conducted in order to describe the strength and direction of the linear relationship between the independent and dependent variables. Multiple regression, this technique was used to test the impact of CSFs on virtual enterprise systems implementation. The technique was also used to address a variety of research questions to indicate how well a set of variables is able to predict a particular outcome and provide information about the model as a whole.

On the other hand, the qualitative data were analyzed via content analysis technique, and sometimes the Atlas.ti software was used to convert some codes and themes into numerical outcomes. The data were analyzed and described qualitatively to interpret which factors or barriers are supporting or preventing the success of the virtual enterprise systems implementation.

3.3 The Theoretical Framework

The independent variables which include the CSFs were selected based on the significant contribution of each factor in the success of the virtual enterprise systems implementation which is the dependent variable of this research. After an extensive literature review, 10 CSFs were selected as the top ten CSFs that significantly contribute to the success of the virtual enterprise systems implementation. This study develops the following framework to test the impact of the selected top ten

CSFs on the virtual enterprise systems in the Bahraini context as demonstrated in figure 2 below.

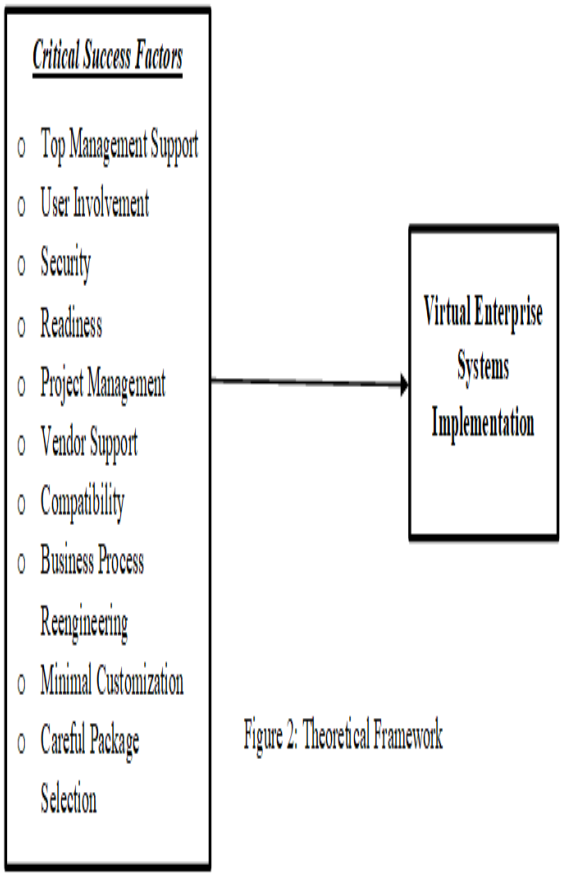

Figure 2: Theoretical Framework

4. Analysis and Findings

4.1 The Respondent's Profile

Fifty survey instruments were distributed conveniently to the participating enterprises that are using the virtual enterprise systems in the Bahraini region, out of which only 32 usable survey instruments were received. Most of the respondents are from the education sector rating 18.8%, followed by telecommunication sector 12.5%, manufacturing 12.5%, government 12.5%, and banking sector rating 12.5%. The vast majority of them are local ownership, which constitutes around 81.3% of the respondents. 68.7% of the participating enterprises are service companies, and 25% of them are in the education sector. The size of the participating companies are above 150 employees rating 68.7%, and their scope of operation is mostly local. The virtual enterprise systems are implemented and used in the participating enterprises since around 3 years rating 37.5% of the respondents. Table 3 presents the demographic profile of all respondents.

Table 3: *Summary of Respondents*

Variables	Category	Frequency	Percentage
Line of Business	Healthcare	2	6.3
	Law	2	6.3
	Education	6	18.8
	Retail	2	6.3
	Telecommunication	4	12.5
	Finance	2	6.3
	Manufacturing	4	12.5
	Government	4	12.5
	IT Services	2	6.3
	Banking	4	12.5
Company Ownership	Local	26	81.3
	Foreign	6	18.7
Company Type	Services	22	68.7
	Construction	2	6.3
	Education	8	25
Company Size	51-150 Employees	10	31.3
	> 150 Employees	22	68.7
Operational Scope	Local	20	62.5
	Regional	4	12.5
	Worldwide	8	25
VE Systems Implementation	< 1Year	6	18.8
	1 Year - 3 Years	6	18.8
	3 Years - 5 Years	12	37.5
	> 5 Years	8	25
VE System Provider	Oracle	10	31.3
	Microsoft	4	12.4
	NetSuite	2	6.3
	Sage	2	6.3
	Syspro	2	6.3
	Odoo	2	6.3
	Epicor	4	12.4
	Other	6	18.7
Σ		**32**	**100**

4.2 Reliability Analysis

To assess the internal consistency across 28 items in the survey instrument, Cronbach's alpha coefficient (α) was used and that provides a high level of alpha i.e. (α) 0.93 compared to the acceptable level of reliability (α) which is 0.60 (Cronbach's Alpha> 0.60). Table 4 represents the reliability analysis of the used scales.

Table 4: *Reliability Analysis of Scales*

Item	**Result**
Cronbach's Alpha (α)	.93
No. of items	28
Variance	279.4
Mean for Test	110.2
Standard Deviation for Test	16.7

4.3 The Value Of The Top Ten Critical Success Factors

The descriptive statistics outcome indicates a great value of the top ten critical success factors within the implementation of the virtual enterprise systems. However, the most three critical success factors in the virtual enterprise systems as perceived by the participants are minimal customization, project management, and vendor support rating mean value 4.31, 4.03, and 4.03 respectively and standard deviation ranging from 0.859 to 1.05. The results of the descriptive statistics in Table 5 demonstrates the importance of the identified factors in the success of the virtual enterprise systems implementation and minimize the related challenges in order to avoid any unforeseen failure. Top management support $\mu = 3.85$, $\sigma = 0.756$, user involvement $\mu = 3.92$, $\sigma = 1.01$, security $\mu = 3.93$, $\sigma = 0.926$, readiness $\mu = 3.93$, $\sigma = 0.877$, and careful package selection $\mu = 3.81$, $\sigma = 0.965$, are also very important factors that significantly add value and contribute to the success of virtual enterprise systems adoption as indicated by the participating enterprises.

Table 5: *Summary of Descriptive Statistics*

Construct	***μ***	***σ***
Top Management Support	3.85	0.756
User Involvement	3.92	1.01
Security	3.93	0.926
Readiness	3.93	0.877
Project Management	4.03	1.05
Vendor Support	4.03	0.706
Compatibility	3.84	0.962
Business Process Reengineering	3.87	0.707
Minimal Customization	4.31	0.859
Careful Package Selection	3.81	0.965
Virtual Enterprise Systems Implementation	3.91	0.583

4.4 Hypotheses Testing

The correlation analysis indicates significant relationship among the top ten critical success factors and the virtual enterprise systems implementation. Table 6 presents the significant correlation of the critical success factors with the virtual enterprise systems as shown by the statistics at the bottom of the table. The independent variables such as Top Management Support (r=.491, p<0.01), User Involvement (r=.812, p<0.01), Security (r=.497, p<0.01), Project Management (r=.511, p<0.01), Vendor Support (r=.554, p<0.01), Compatibility (r=.608, p<0.01), Business Process Reengineering (r=.417, p<0.05), and Careful Package Selection (r=0.372, p<0.05) are significantly and positively correlated with the Virtual Enterprise Systems Implementation. However, Readiness and Minimal Customization (r=.157, p<0.00) and (r=.097, p<0.00) respectively are positively correlated with the virtual enterprise systems, but does not show significant relationship among them.

Table 6: *Summary of Correlation Analysis*

Measures	TMS	UI	S	R	PM	VS	C	BPR	MC	CPS	**VES**
Top Management Support (TMS)	1.00										
User Involvement (UI)	.765**	1.00									
Security (S)	.477**	.571**	1.00								
Readiness (R)	.261	.301	.0530**	1.00							
Project Management (PM)	.046	.460**	.629**	.577**	1.00						
Vendor Support (VS)	.411*	.709**	.422*	.472**	.692**	1.00					
Compatibility (C)	.396*	.407*	.432*	-.069	.307	.434**	1.00				
Business Process Reengineering (BPR)	.728**	.523**	.431*	.247	.005	.266	.539**	1.00			
Minimal Customization (MC)	.138	.250	.451**	.283	.345	.568**	.373*	.279	1.00		
Careful Package Selection (CPS)	.197	.231	.257	-.395*	.196	.009	.558**	.059	-.005	1.00	
Virtual Enterprise Systems Implementation (VES)	**.491****	**.812****	**.497****	**.157**	**.511****	**.554****	**.608****	**.417***	**.097**	**.372***	1.00

Note: *Correlation is significant at the .05 level (2 tailed). **Correlation is significant at the .01 level (2-tailed).

A preliminary analysis was conducted to ensure the non-appearance of any violation of the underlying assumptions of normality, linearity, and homoscedasticity, and to interpret the correlation among the given variables. The bivariate correlation was subject to the two-tailed test of significance from two levels i.e. highly significant ($p < .01$) and significant ($p < .05$). However, to test the Pearson correlation between every two variables, the correlation analysis was executed among the independent and dependent variables. Figure 3 below indicates the results of path coefficients of the relation between the constructs. The results reveal a positive and significant relationship between all proposed variables, this outcome support the proposed research hypotheses.

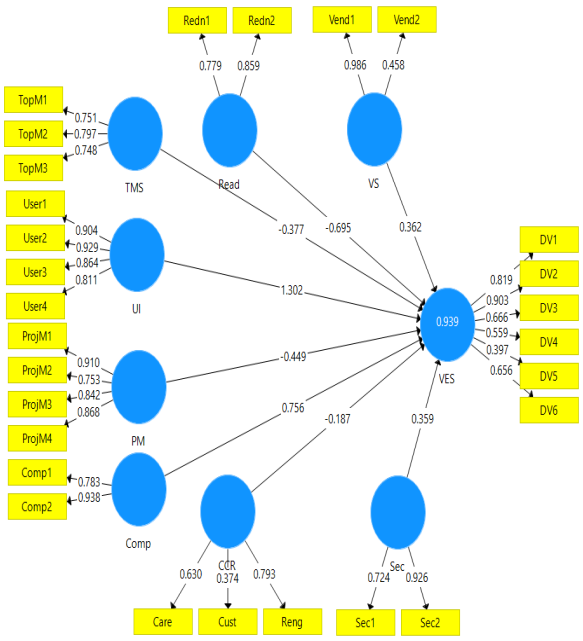

Figure 3: Path Coefficients Results

The R-value of User Involvement is r = .812 which explains around 66% of the variance in the virtual enterprise systems implementation and that indicates large and positive relationship and high overlap between the two variables. This followed by Compatibility r = .608 (37%), Vendor Support r = .554 (31%), and Project Management r = .511 (26%) respectively. These factors are rating the highest percentage, which demonstrates the largest significant contribution to the success of the virtual enterprise systems implementation. However, the other factors are still important to the virtual enterprise success, but somehow at a lower and different significant level of contribution.

As per the results in table 7 below, the top ten critical success factors contribute up to 91% of the variance in the virtual enterprise systems implementation (R^2= .910). The F value is around 21 and the significant linear model is at alpha = .01, which indicates that all the factors collectively make a notable and significant contribution to the success of the virtual enterprise systems implementation. The largest beta coefficient values among the ten factors are Users Involvement (β = 1.382, p < .01), Compatibility (β = .745, p < .01), Vendor Support (β = .594, p < .1), and eventually Top Management Support (β = -.403, p < .1). These statistics indicate the unique significant contribution of each factors in the success of the virtual enterprise systems. The notable contribution was for the Users Involvement factor as it makes the largest and strongest beta value among other factors, followed by Compatibility factors. The participants perceived that the 10 factors are critical factors that help to deliver successful virtual enterprise systems. However, they gave a different and unique attention to some factors such as users' involvement, compatibility, vendor support, and top management support.

Table 7: *Multiple Regressions: (β).*

CSFs	Virtual
Top Management Support	-.403*
User Involvement	1.382***
Security	-.221
Readiness	.223
Project Management	.151
Vendor Support	.594*
Compatibility	.745***
Business Process Reengineering	-.180
Minimal Customization	-.099
Careful Package Selection	-.148
R	.958
R^2	.910
Adjust R^2	.867
F	21.147***

Notes: Significant levels: ***p<.01; ** p<.05; * p<.1

Figure 4 below indicates the results of path coefficients T values of the relation between the constructs. The results reveal a positive and significant correlation between all proposed variables, this outcome support the proposed research hypotheses, which is also supported by pervious related literature.

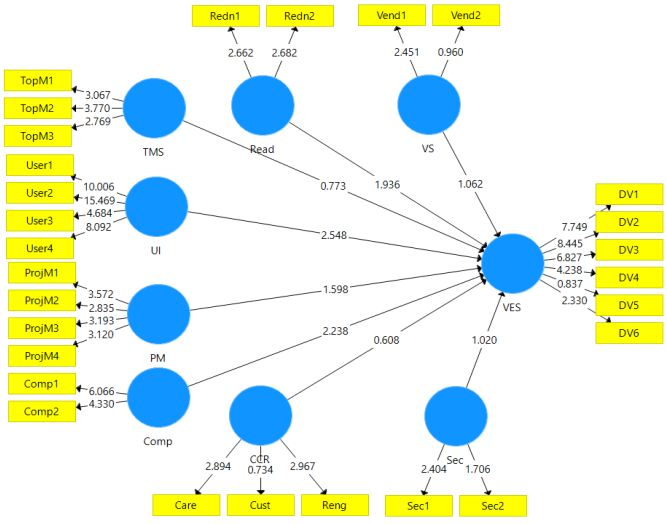

Figure 4: Path Coefficients T Values

Table 8 presents the summary of hypotheses testing of the relationship between the top ten critical success factors and the virtual enterprise systems implementation. The research outcome determined to accept all the proposed hypotheses besides hypothesis number 4 and 9 as they are partially accepted, and this is due to the Readiness and Minimal Customization factors indicate positive relationship with the virtual enterprise systems but not significant. The other eight factors demonstrate notable and significant relationship with the virtual enterprise systems successful implementation. The unique and remarkable contribution presented by Users Involvement, Compatibility, Vendor Support, Project Management, and Top Management Support respectively as perceived by the participating enterprises.

Besides, the two interviewees also agreed on the importance of the presented top ten critical success factors and they articulated how these factors support them effectively during the implementation of the virtual enterprise systems. The two IT managers argued on the importance level of factors and the challenges that have been emerged during the three main implementation stages i.e. pre-implementation stage, implementation stage, and post-implementation stage. Some of the challenges that identified by the interviewees are lack of full governance and control over the virtual cloud IT infrastructure, security concerns, some hidden cost, integration with other legacy applications, customization, migration of data, and finally organizational culture.

Table 8: Summary of hypotheses testing

No.	Statement of Hypotheses	Remarks
H_1	There is a significant relationship between Top Management Support and Virtual Enterprise Systems Implementation.	Accepted
H_2	There is a significant relationship between User Involvement and Virtual Enterprise Systems Implementation.	Accepted
H_3	There is a significant relationship between Security and Virtual Enterprise Systems Implementation.	Accepted
H_4	There is a significant relationship between Readiness and Virtual Enterprise Systems Implementation.	Partially Accepted
H_5	There is a significant relationship between Project Management and Virtual Enterprise Systems Implementation.	Accepted
H_6	There is a significant relationship between Vendor Support and Virtual Enterprise Systems Implementation.	Accepted
H_7	There is a significant relationship between Compatibility and Virtual Enterprise Systems Implementation.	Accepted
H_8	There is a significant relationship between Business Process Reengineering and Virtual Enterprise Systems Implementation.	Accepted
H_9	There is a significant relationship between Minimal Customization and Virtual Enterprise Systems Implementation.	Partially Accepted
H_{10}	There is a significant relationship between Careful Package Selection and Virtual Enterprise Systems Implementation.	Partially Accepted

5. Conclusion

The overall findings of this study indicate that the top ten critical success factors are positively and significantly influencing the virtual enterprise systems implementation. However, Readiness and Minimal Customization factors demonstrate only a positive impact on the virtual enterprise systems but not significant. The existence of the top ten critical success factors is highly contributing towards delivering a successful implementation of the virtual enterprise systems. This practice, in turn, will streamline the virtual enterprise systems adoption process throughout the implementation stages and will help many enterprises to overcome several related challenges to achieve a successful virtual enterprise systems implementation. Some of the identified challenges in this research are lack of full governance and control over the cloud IT infrastructure, security concerns, some hidden cost, integration with other applications, customization, migration of data, and eventually organizational culture.

The results of this study provide the IS project managers a deep and better understanding of the users' perceptions towards the top ten critical success factors and the related challenges which effectively direct the implementation of the virtual enterprise systems towards the success. Since many small, medium, and large enterprises are rapidly adopting virtual enterprise system and trying hard to reach to a successful virtual enterprise implementation with minor barriers, it became very crucial to identify the critical success factors that assist organizations in this matter. Moreover, it is vital that the policymakers realize the importance of identifying the major challenges and the critical success factors before the beginning of the implementation, which will certainly lead them to the right decisions in adopting such a novel solution for such difficult situation.

Therefore, the factors that investigated in this research are giving enterprises a very clear awareness about the critical success factors that highly contribute to deliver a successful implementation of virtual enterprise systems. However, to have a better understanding of the impact of the critical success factors on virtual enterprise systems, future studies must include other factors and different industries in the region to grab more responses from other enterprises in

need of virtual solution. Currently, there are many companies are not fully aware of the importance of the virtual enterprise systems solution in times of crises such as (Covid-19), yet some of them are not taking advantage of the existing success factors to end up with effective virtual enterprise systems implementation.

This is mainly due to the lack of awareness of the most important factors that entirely help in avoiding the likelihood of virtual cloud systems failure. The continuous and deep understanding of the success factors and the related challenges will certainly support enterprises to provide streamlined processes during the virtual enterprise systems implementation. The virtual solution will help many organizations to cope with the current pandemic or any future crisis, works will continue remotely from anywhere at any time to keep the virtual communications with the stakeholders without any interruption and maintain business operational.

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