Cloud-based ERP Successful Implementation: A Critical Soft Factors Analysis for Egyptian Industrial Organizations

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Abstract

The purpose of this study was to explore the intangible factors that are essential for a cloud-based Enterprise Resource Planning (ERP) system to be successful. The survey was done on a total of 150 companies in various Egyptian industrial sectors, using a questionnaire list as a data collection instrument. The study hypotheses were tested using both multiple regression analysis and One-Way ANOVA test, as both methods were most suited to the characteristics of this study due to sample size and nature of data. Contrary to expectations, the study findings revealed that Egyptian industrial organizations have a medium level of success, indicating that they have partially succeeded in implementing a cloud-based ERP system. This partially success was driven by top management. The findings also revealed that training and education, workforce commitment, and teamwork are the most critical soft factors (CSFs) required for cloud-based ERP success in the Egyptian environment. Finally public sector companies, followed by multinational corporations, were the most influential in terms of implementing cloud-based ERP.

Keywords: Cloud-based ERP, Critical Soft Factors, Egyptian Industrial Organization

Introduction:

Egyptian organizations are currently looking for innovative and creative ways to boost their competitive capacities due to the intense competition they face.

Real-world experience demonstrates that technology improves production process efficiency, which boosts a nation's competitive capacities and reduces its vulnerability to market changes (UNIDO, 2015).

Cloud computing is a revolutionary technology that will keep spurring new ideas and bringing benefits and efficiencies to business, therefore, cloud-based ERP allows the organizations to leverage computing requirements as there is neither the requirement for high capital budget nor operational expertise to acquire (Hofmann & Woods, 2010). Gupta & Misra (2016) stated that benefits offered by cloud ERP are second to none. It also could adopt countermeasures to minimize the risks (Paulsson & Johansson, 2023).

Since cloud ERP is still a relatively new concept, businesses are continuously learning about its benefits and drawbacks (Christiansen *et al.*, 2022). Academics and practitioners alike are becoming more interested in cloud applications. Vendors offering cloud ERP assure their customers of quick adoption, high benefit realization, and significant cost savings. Cloud ERP systems are currently becoming more widely used, however they have rarely been the focus of in-depth empirical research (Haddara, 2015).

Although, few studies dealt with factors that influence ERP in less developed countries especially in Egypt (*i.e.* Salaheldin & Abbas, 2015; AlBar & Hoque, 2019; Usman *et al.*, 2019; Zamzeer *et al.*, 2020; Omar *et al.,* 2022), it did not address the CSFs which can needed to guarantee the success of cloud-based ERP implementation.

The significance of soft factors in managing complicated projects was noted by Azim *et al.* (2010) and they mentioned that soft factors are all issues connected to people in an organization. Egyptian culture has an impact on business settings and effective implementation of ERP, which is why the success rate of ERP implementation in Egypt is lower than that in other western nations (El Sawah *et al*., 2008).

From this point on, Egyptian manufacturing needs unavoidably acquire advanced technology to keep up with the global standard and compete in international markets, therefore, this paper attempts to examine the CSFs needed to ensure the success of Cloud-based ERP implementation in the Egyptian industrial sector.

Literature review:

Enterprise Resource Planning (ERP)

ERP is defined as a packaged business software system that helps a corporation to manage the efficient and effective use of resources such as materials, human resources, and financing (Dey *et al.*, 2010).

The ERP system is a set of software programs that work together. It performs transactions across functional domains using shared databases, standard procedures, and data sharing between and within functional domains (Prakash *et al.*, 2022).

ERP system is a well-known and widely used corporate solution. It has validated process integration and automation, as well as performance enhancements and cost savings. This integrated system has forced organizations to stay up with production processes and shift from a product-centric to a customer-centric mindset (Bahssas, 2018).

ERP solutions generate flexible and adaptive processes that support an organization's diversification strategy and ensure quicker responses to business needs (Ruhani *et al.*, 2017).

Although ERP system evolution began in the 1960s, ERP was conceptualized and developed in the 1970s, but its significant benefits to the corporate world were not appreciated until the early 1990s, when it became the technology of choice for organizations (Salaheldin & Abbas, 2015).

Before the 1990s, the ERP system did not exist in its current form. The primary distinction between ERP and its forerunners is that ERP supports all of the key business processes across all of the different business functions, whereas earlier systems concentrated on specific operations like production planning and manufacturing-related operations (Demi & Haddara, 2018). Material requirements planning (MRP) systems, which were first developed in the 1970s, later became manufacturing resource planning (MRPII) systems. Other, more structured business processes that had not previously been covered by MRPII were also covered (Garverick, 2014).

Due to its advantages of economies of scale achieved through shared resources, cloud-ERP is becoming the new trend in the ERP industry as compared to on-premise ERP systems (Demi & Haddara, 2018); therefore, it is vital to address cloud computing and cloud-based ERP in the following part of this research.

Cloud Computing

Cloud computing is an advanced IT outsourcing model, which allows organizations to use a pool of third-party hosting IT resources and applications as services virtually through the web, without physically holding these computing resources internally (Mell, 2011; Dutta *et al.*, 2013).

Cloud computing is the use of comprehensive digital capabilities delivered via the internet for organizations to operate, innovate, and serve customers. It eliminates the need for organizations to host digital applications on their own servers (McKinsey & Company, 2022).

Software as a Service (SaaS), Infrastructure as a Service (IaaS), and Platform as a Service (PaaS) are the three categories that reflect the many types of cloud computing services. Cloud computing architecture consists of four main layers which are Hardware, Infrastructure, platform, application layer (Musse *et al.*, 2016).

The rise of cloud computing has given organizations chances to develop new lines of business through technology that improves collaboration and communication by delivering cloud-based ERP, In addition, cloud computing offers modern IT resources and a pay-per-use transaction model as an alternative to upfront investments (Demi & Haddara, 2018).

Cloud computing is quickly emerging as a market trend that all companies will eventually adopt, however, developing nations that understood the benefits of moving to the cloud for their economic development also understood how tough the journey there would be. (El-Gazzar, 2015).

Cloud-based ERP

Alsharari (2022) mentioned that, according to the literature on cloud computing, cloud ERP is a packaged business software system that uses cloud computing options to enable the organization to manage the efficient and effective use of resources by offering a complete integrated solution for the organization's information processing necessities.

Peng *et al.* (2014) defined Cloud ERP systems as "*an ERP application hosted through a third-party vendor managed and controlled infrastructure*" (p.22). It is, for the most part, a suite of business organization programming tools can be access by Administrator, User and Vendors, that a company can

use to store and manage data from every aspect of operations, including production, sales and marketing, inventory control, shipping and payment, and product development and planning (Motalab & Shohag, 2011; Singh & Nagpal, 2014; Al-Ruithe et al., 2017).

These cloud-ERP systems, which include software programs, computing resource services, and data storage, represent a paradigm shift from conventional ERP systems (AL-Shboul, 2019), Figure (1) demonstrates Cloud-based ERP system.

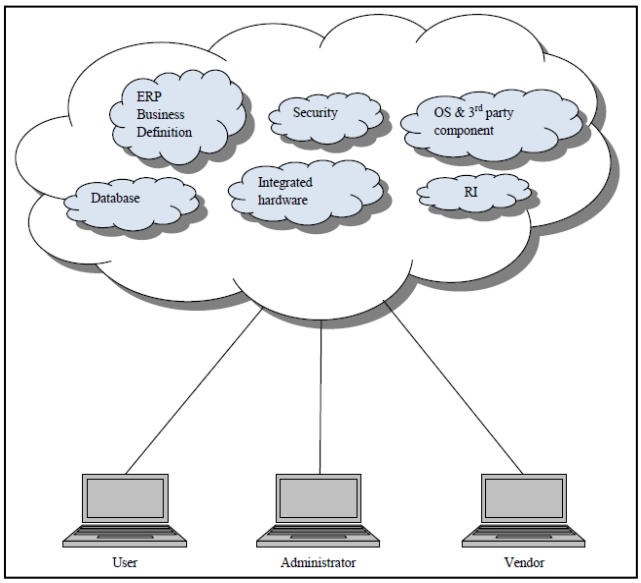

Figure (1) Cloud-based ERP system

Source: Motalab, M. B., & Shohag, S. A. M. (2011). Cloud Computing and the business Consequences of ERP Use. *International journal of computer applications*, *28*(8), p.34.

Just because of the most recent technological advancements in cloud computing, ERP has evolved into a Cloud-based ERP. In fact, on-premise ERP solutions force organizations to manage their own IT infrastructure, necessitating substantial investments in hardware and software as well as ongoing maintenance expenditures. In contrast, cloud-based ERP solutions provide the same capability as on-premise ERPs at significantly reduced prices because they are set up, maintained, and supported remotely (Prakash *et al.*, 2022).

Critical Soft factors (CSF)

The concept of a "Success Factor" was first developed in 1961 by Ronald Daniel, a consultant for McKinsey & Company. The "Success Factor" technique was first used in the field of information systems by Rockart in 1979.

Chen (2023) linked success factors to soft factors after Zairi & Youssef (1995) identified soft factors as one of the types of success factors. Abdullah & Uli (2007) defined soft factors as *"behavioral aspects of management or human factors"* (p.13). While human factors were described by Galar *et al.* (2011) as *"physical and psychological capabilities of the individual, like training, education, and experience"* (p.1569).

Although “Soft” factors are intangible and difficult to be measured Lewis *et al.* (2006), but Association for Project Management (APA) (2006) determined the following soft factors for contribute success: communication; teamwork; leadership; conflict management; job design; negotiation; human resource management; behavioral characteristics; training; top management; learning and development; and professionalism and ethics.

Six elements were recognized by Abdullah & Uli (2007) as CFSs: management commitment; customer focus; employee involvement; training and education; reward and recognition; and supplier relationship.

However, Psomas *et al.* (2014) highlighted nine factors: Continuous improvement, top management commitment, customer focus, human resource development, fact-based decision making, strategic quality planning, process focus, employee involvement, and supplier involvement.

Various studies have identified several soft factors; *Table number (1)* summarizes the set of common soft factors that have been discussed in the literature.

Table (1) Common soft factors identified from the literature

Soft factor	Sources
Top management	Gadenne & Sharma (2009); Lewis *et al.* (2006); Salaheldin & Abbas (2015); Chen (2022); Ali *et al.* (2022).
Communication	Antonovsky *et al.* (2014); Salaheldin & Abbas (2015); AlShamsi *et al.* (2022).
Teamwork	Rahman & Bullock (2005); Lewis *et al.* (2006); Vanichchinchai *et al.* (2023).
Training	Abdullah & Uli (2007); Gadenne & Sharma (2009); Chan *et al.* (2017); Chen (2022); Ali *et al.* (2022).
Customer focus	Rahman & Bullock (2005); Abdullah & Uli (2007); Abdullah *et al.* (2008); AlShamsi *et al.* (2022).
Supplier relationship	Rahman & Bullock (2005); Abdullah & Uli (2007); Gadenne & Sharma (2009).
Professionalism & ethics	Yang & Yang (2013); Aju Kumar *et al*. (2015); Salaheldin & Abbas (2015).
Organizational culture	Yang & Yang (2013); Salaheldin & Abbas (2015).

Source: *This study.*

CSFs for Cloud-based ERP

Christiansen *et al.* (2022) determine 13 primary factors that are the most common influencers when adapting cloud-based ERP through technology, organization, and environment framework. Gupta *et al.* (2018) stated that organizational and technological factors of small and medium enterprises (SMEs) have a positive relationship with the extrinsic factors (compliance, network, and information security) during the cloud ERP implementation.

Currently, cloud ERP is used extensively and accepted in developed countries, and numerous research have been conducted to determine the factors that influence the adoption of cloud ERP (Al-shoboul, 2019). However, there are relatively few studies that address this issue in developing countries particularly in developing Middle Eastern countries (AlBar & Hoque, 2019).

Omar *et al.* (2022) examines the factors that affect the adoption of cloud ERP in Egyptian companies through combining the Diffusion of Innovation theory (DOI) and technology - organization - environment framework (TOE).

On the other hand, Abdelghaffar & Azim (2010) study the significant factors influencing ERP implementation in large Egyptian organizations, and mentioned that Soft factors are any issues involving people in an organization, while Salaheldin & Abbas (2015) examine CFSs of ERP in Egyptian companies. However, there were no empirical studies that dealt with the CFSs of cloud-based ERP in manufacturing firms in less developed countries, such as Egypt; accordingly, this study was motivated to examine the CSFs for Cloud-based ERP in an Egyptian context.

Organizational characteristics and Cloud-based ERP

Previously, Laukkanen *et al.* (2007) discussed organizational characteristics related to ERP system with an emphasis on business size, categorizing organizations as small, medium-sized, and large. They discover considerable disparities in the objectives and limits of ERP system adoption among small, medium-sized, and big firms.

Furthermore, Oliveira & Martins (2011) stated that the adoption of new technologies is positively impacted by the size factor of organizations.

Following that Johansson *et al.* (2015) attempt to decipher the adoption of cloud ERPs by identifying and categorizing opportunities and issues with cloud ERPs that are frequently related to organizational size. The results show that small businesses can benefit most from cloud ERPs because many of the features are more applicable to them. However, SMEs do not consider many of the issues around cloud ERPs to be very significant. On the other side, complexity and particular demands are two major size-related concerns for large organizations. Organization size is a significant influence in cloud ERP adoption, according to Zamzeer *et al.* (2020), with the demand to implement cloud ERP being higher for smaller firms.

Ahn & Ahn (2020) examined organizational characteristics that impact cloud-based ERP in order to determine the factors influencing the intention to adopt cloud-based ERP from a comprehensive approach. Christiansen *et al.* (2022) discuss research on the adoption of cloud-based ERP through organizational context, taking into account the attributes of the organization. Salaheldin (2007) lists the following as organizational traits: ownership type, production system type, and firm size.

On the other hand, Torbacki (2019) addresses a workflow in an ERP cloud system related to production system. Shi (2012) present a framework that can describe respective implications of integrating ERP with three types of cloud services with regard to ownership type. They've all come to the same conclusion: there are a number of challenges that could raise the total cost of ownership.

As a consequence, an in-depth comprehension of all significant factors, including organizational characteristics that influence cloud-based ERP adoption, is required.

Research questions and objectives

The goal of this study was to investigate the intangible aspects that are critical to a successful implementation of cloud-based ERP. This initial investigation examined the cloud-based ERP implementation of Egyptian industrial firms.

Therefore, this study will address the following questions:

i. *How successful is cloud-based ERP in Egyptian industrial organizations?*
ii. *What are the CFSs that have a significant impact on successful cloud-based ERP implementation in the Egyptian industrial sector?*
iii. *What are the differences among manufacturing firms in terms of cloud-based ERP implementation based on firm size, production system and type of ownership?*

Research Methodology

Hypotheses

The empirical nature of this study stems from its objectives. Thus, in order to shed light on the status of the Egyptian manufacturing firms, implementation of cloud-based ERP and factors which may influence the success implementation of cloud-based ERP in an Egyptian context; it is important to consider the following hypotheses:

H1*. Cloud-based ERP implementation had a poor degree of success in Egyptian industrial organizations.*

H2. *Soft factors have a significant impact on successful cloud-based ERP implementation in the Egyptian industrial sector.*

H3. *There is a significant difference among Egyptian manufacturing firms concerning implementation of cloud-based ERP based on firm size.*

H4. *There is a significant difference among Egyptian manufacturing firms concerning implementation of cloud-based ERP based on production system.*

H5. *There is a significant difference among Egyptian manufacturing firms concerning implementation of cloud-based ERP based on type of ownership.*

Scales and Measurement Tools

In order to confirm the availability of cloud-based ERP, this study relied on the scale developed by Rahman & Bullock (2005), in relation to the variable "soft factors", which was relied upon by Seng (2007), Kamhawi (2008), El Sawah *et al.* (2008), Dezdar & Ainin (2011), Salaheldin & Abbas (2015). The key soft factors, including: Commitment and support of top management, communication, teamwork, customer focus, supplier relations, training and education, and workforce commitment have been gathered to confirm the validity of cloud-based ERP, on which the first section of questionnaire list was based. The questionnaire has a five-point Likert scale and is designed as follows: (1 = Very important; 2 = Important; 3 = Neutral; 4 = Not important; and 5 = Not important at all).

The second section of questionnaire contained items that used for measuring degree of cloud-based ERP implementation success according to Kamhawi (2008) scale, based on (Aladwani 2002; Kamhawi 2007). It was built on a set of factors that considers user satisfaction and organizational impact, respectively: Meeting the company budget; Meeting the company agenda; Contributing in improving the organization's overall performance; Gaining users' satisfaction with the system; Gaining functional managers' satisfaction. (Responses are given on a five-point Likert scale, according to the opinion of the respondent, where 5 = Very high to 1 = Very low).

Research sample

150 factories functioning in diverse Egyptian industrial sectors were the subject of the study. The questionnaires have been distributed to managers and staff members in the departments of human resources, marketing, operations, finance, maintenance, and sales, as table number (2) represents.

Table (2) Research sample

Sent questionnaires	150
Total responses	96
Final usable responses	92
Response rate as a percentage of sent questionnaires	61.33%

Source: *This study.*

Validity of the questionnaire

Since Arabic is the primary language, questionnaires were available in that language. To ensure equivalent translations, the English text was translated into Arabic and then translated back into English. A pilot study was conducted to confirm theoretical and practical issues identified by the author were appropriate to the manufacturing environment in Egyptian manufacturing firms.

Reliability of the questionnaire

Since the Chronbach's alpha coefficient describes the degree to which scores on a measure represent something other than measurement error (Glass & Hopkins, 1996, p.577), so it was used to ensure the reliability of the questionnaire.

Table (3) Distribution and reliability for soft factors and cloud-based ERP successful implementation

Soft factor	Number of items	Cronbach α
Top management	3	0.816
Communication	3	0.774
Teamwork	3	0.716
Customer focus	2	0.743
Supplier relationship	3	0.710
Training & education	3	0.803
Workforce commitment	4	0.704
All soft factors	21	0.921
Cloud-based ERP Successful implementation	5	0.852
Overall items	26	

Source: *This study.*

The coefficient alpha values were calculated for all the measures used in the study (soft factors and Cloud-based ERP Successful implementation). alpha values shown in Table number (3) indicate that each scale is a sufficiently reliable measure ($\alpha > 0.7$).

Testing hypotheses

Hypothesis one

"Cloud-based ERP implementation had a poor degree of success in Egyptian industrial organizations".

According to Table (4), "Meeting the company budget" was the most expressive element of the organization's success in applying cloud-based ERP (average 4.0870). On the other hand, the least expressive element demonstrating cloud-based ERP implementation success was "Contributing to improving the organization's overall performance" (average 3.1196), followed by "Meeting the company agenda" with an average of 3.1304.

Table (4) Extent of cloud-based ERP implementation success

Cloud-based ERP implementation success	MEAN	STDEV	STD Error
Meeting the company budget	4.0870	0.95678	0.09975
Meeting the company agenda	3.1304	0.99689	0.10393
Contributing in improving the organization's overall performance	3.1196	1.05708	0.11021
Gaining users' satisfaction with the system	3.4891	0.88323	0.09208
Gaining functional managers' satisfaction	3.3043	1.12650	0.11745

Source: *This study.*

These results partially contradict hypothesis (H1), which states, "Cloud-based ERP implementation had a poor degree of success in Egyptian industrial organizations". Egyptian industrial organizations showed a "moderate level of success," as the results confirm that the average value of the cloud-based ERP system implementation success variable is higher than 3 (all statements are around the average of 3 except for one statement (mean=4.0870)), which means that most of the respondents indicated their agreement with question items 1 to 5. Since all five statements used to measure the success of a cloud-based ERP implementation are positive, subsequently, the higher the average, the greater the success of a cloud-based ERP implementation.

Hypothesis two

"Soft factors have a significant impact on successful cloud-based ERP implementation in the Egyptian industrial sector".

It is clear from Table (5) that when company managers were asked about the soft factors of a cloud-based ERP system, "top management" ranked first (at the highest score on the scale), followed by "Customer focus", "Workforce" commitment", "Communication", while "Supplier

relationship", "Training & education" and "Teamwork" came last (lowest scores on the scale).

Table (5) the means and standard deviations of the list of soft factors

Cloud-based ERP implementation success factors	Rank	MEAN	STDEV
Top management	1	4.2138	0.72388
Customer focus	2	4.1739	0.75751
Workforce commitment	3	4.0679	0.57069
Communication	4	4.0181	0.70644
Supplier relationship	5	3.9529	0.63780
Training & education	6	3.9239	0.84458
Teamwork	7	3.7717	0.72783

Source: *This study.*

Multiple regression analysis has been used to examine soft factors that needed to ensure the success of cloud-based ERP implementation.

Table (6) significance of relationship between soft factors and cloud-based ERP implementation success

Source	Sum of Squares	df	Mean Square	F	Sig.
Top management	1.706	1	1.706	2.723	0.102
Communication	2.711	2	1.356	2.178	0.119
Teamwork	6.287	3	2.096	3.560	0.017
Customer focus	6.297	4	1.574	2.644	0.039
Supplier relationship	6.298	5	1.260	2.092	0.074
Training & education	9.589	6	1.598	2.801	0.016
Workforce commitment	18.722	7	2.675	5.706	0.000

Source: *This study.*

As shown in table (6), there is a significant relationship between "teamwork", "customer focus", "training & education", and "workforce commitment" as explanatory variables on the success of implementing a cloud-based (ERP) system as a dependent variable, as the "F" values of these explanatory variables were, respectively, (3.560; 2.644; 2.801; 5.706), all of which had a significance of less than (0.05).

Table (7) Coefficients of soft factors and cloud-based ERP implementation success

Variable	R	R^2	β	T	Sig.
Top management	0.171	0.029	0.171	1.650	0.102
Communication	0.216	0.047	0.290	-1.271	0.207
Teamwork	0.329	0.108	0.276	2.465	0.016
Customer focus	0.329	0.108	0.015	0.131	0.896
Supplier relationship	0.329	0.108	-0.007	-0.049	0.961
Training & education	0.406	0.165	0.594	2.401	0.019
Workforce commitment	0.568	0.322	0.512	4.414	0.000

Source: *This study.*

As indicated in table (7), results indicate that the variable “teamwork” as an explanatory variable explains about 11% of the change in the success of implementing a cloud-based ERP system, as the beta (**β**) value, which explains the relationship between the two variables, is (0.267) and has a significance, as it can Inferring this from the value of "T" and the associated significance. This means that as teamwork improves by one unit, the success of implementing a cloud-based ERP system improves by (0.267) units.

Furthermore, the variables "training & education" and "workforce commitment" both explain about 17% and 32%, respectively, of the change in the success of implementing a cloud-based ERP system. Where was the value of beta (**β**), which explains the relationship between each variable and the dependent variable (0.594) and (0.512), respectively, as this can be deduced from the value of "T" and its significance. This suggests that "training & education" improves by one unit, the success of a cloud-based ERP implementation will improve by (0.594) units. Additionally, "workforce

commitment", improves by one unit, the success of a cloud-based ERP implementation will improve by (0.512) units.

Figure (2) illustrates the relationship between soft factors and successful cloud-based ERP implementation in Egyptian manufacturing companies, as well as the significance and magnitude of the improvements that occurred.

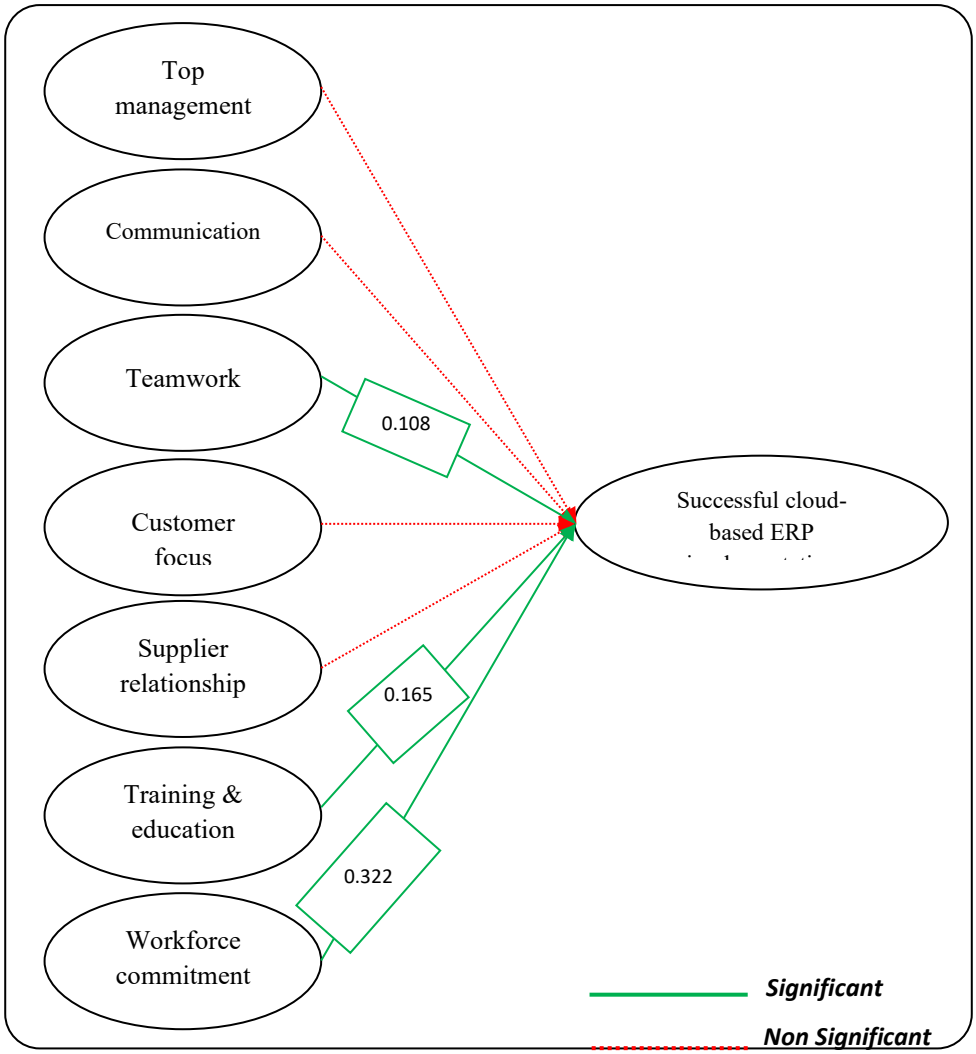

***Figure** (2) Identifying the impact of soft factors on the successful implementation of cloud-based ERP in Egyptian manufacturing companies based on multiple regression analysis results.*

Hypothesis three, four, five

"One-Way ANOVA" test was used in the current study to find significant differences between the study's groups. "Scheffe" test was also used as a post-test in this study to evaluate the direction of the differences between the groups. To make reading and linking between sections easier, this study included a section on "descriptive statistics" shortly before testing hypotheses three to five, as seen in the following part.

Descriptive statistics

Description	Less than 10	Less than 200	Bigger than 200
Employee number (size)	21.74%	17.39%	60.87%
	20	16	56
Description	**Private sector**	**Public sector**	**Multi-national**
Type of ownership	52.17%	30.43%	17.39%
	48	28	16
Description	**Batch**	**Continuous**	**Assembly**
production system	50.00%	23.91%	26.09%
	46	22	24

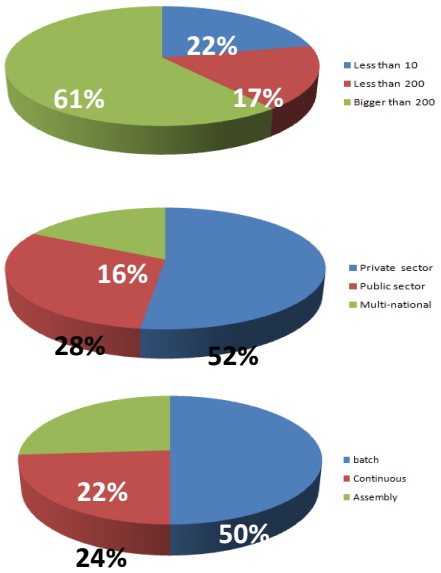

Figure (3) depicts the total and percentage of the companies' size, production system, and type of ownership.

Description	Chemical industries	electronic industries	Food industries
Industrial sector	35%	11%	3%
	32	10	3
Description	**Metal industries**	**Engineering industries**	**Textile industries**
Industrial sector	10%	28%	13%
	9	26	12

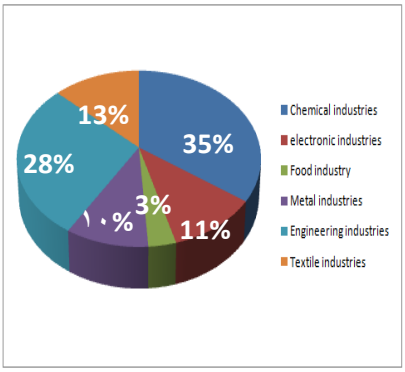

Figure (4) shows a description of the research sample in terms of total and approximate percentage for each industrial sector.

Hypothesis three testing

"There is a significant difference among Egyptian manufacturing firms concerning implementation of cloud-based ERP based on firm size".

Table (8) significance difference among study groups according to firm size

Variable	Source	Sum of Squares	df	Mean Square	F	Sig.
Cloud-based ERP implementation success	Between Groups	27.960	2	13.980	26.786	0.000
	Within Groups	46.449	89	0.522		
	Total	74.409	91			

Previous numbers indicate that the three groups: sig. = 0.000 < 0.05, indicating that there are significant variances regarding the success of the cloud-based ERP Implementation dependent on the firm size.

"Scheffe" test was used to assess the direction of the significant differences between groups.

Table (9) significant difference between groups ("Scheffe" post analysis)

Groups	Mean	Groups Mean deference		
		Group (1)	Group (2)	Group (3)
Group (1) "Less than 200"	2.62	-	-1.38	-1.32
Group (2) "Less than 10"	4.00	1.38	-	
Group (3) "Bigger than 200"	3.94	1.32		-

There is a statistically significant difference at the level of (0.05), where the average difference was (1.38) between the second group "Less than 10" and the first group "Less than 200". This difference supports the second group, as the average of the second group reached (4. 00), while the average of the first group reached (2.62), in terms of the success of the cloud-based ERP system.

Furthermore, there is a statistically significant difference at the level of (0.05), where the average difference was (1.32) between the third group "Bigger than 200" and the first group "Less than 200" and this difference supports the second group, as the average of the third group reached (3.94), while the average of the second group reached (3.94).

Hypothesis four testing

"There is a significant difference among Egyptian manufacturing firms concerning implementation of cloud-based ERP based on production system".

Table (10) significance difference among study groups according to production system

Variable	Source	Sum of Squares	df	Mean Square	F	Sig.
Cloud-based ERP implementation success	Between Groups	4.657	2	2.328	4.139	0.019
	Within Groups	50.071	89	0.563		
	Total	54.728	91			

Table (10) indicates that the three groups: sig. = 0.019 < 0.05, indicating that there are significant variances regarding the success of the cloud-based ERP Implementation dependent on the production system.

"Scheffe" test was used to assess the direction of the significant differences between groups.

Table (11) significant difference between groups ("Scheffe" post analysis)

Groups	Mean	Groups Mean deference		
		Group (1)	Group (2)	Group (3)
Group (1) " Batch "	3.78	-	0.49	0.07
Group (2) " Continuous "	3.29	-0.49	-	
Group (3) " Assembly "	3.86	-0.07		-

There is a statistically significant difference at the level of (0.05), where the average difference was (0.49) between the second group "Batch" and the first group "Continuous". This difference supports the first group, as the average of the first group reached (3.78), while the average of the second group reached (3.29), in terms of the success of the cloud-based ERP system.

Furthermore, there is a statistically significant difference at the level of (0.05), where the average difference was (0.07) between the third group "Assembly" and the first group "Batch" and this difference supports the third group, as the average of the third group reached (3.86), while the average of the first group reached (3.78).

Hypothesis five testing

"There is a significant difference among Egyptian manufacturing firms concerning implementation of cloud-based ERP based on type of ownership".

Table (12) significance difference among study groups according to type of ownership

Variable	Source	Sum of Squares	df	Mean Square	F	Sig.
Cloud-based ERP implementation success	Between Groups	20.755	2	10.377	24.437	0.000
	Within Groups	37.794	89	0.425		
	Total	58.549	91			

As shown in table (12) there are three groups: sig. = 0.000< 0.05, indicating that there are significant variances regarding the success of the cloud-based ERP Implementation dependent on the type of ownership.

"Scheffe" test was used to assess the direction of the significant differences between groups.

Table (13) significant difference between groups ("Scheffe" post analysis)

Groups	Mean	Groups Mean deference		
		Group (1)	Group (2)	Group (3)
Group (1) "**Private sector**"	3.52	-	-1.08	
Group (2) "**Public sector**"	4.61	1.08	-	-0.68
Group (3) "**Multi-national**"	3.93		0.68	-

There is a statistically significant difference at the level of (0.05), where the average difference was (1.08) between the second group "**Private sector**" and the first group "**Public sector**". This difference supports the second group, as the average of the second group reached (4.61), while the average of the first group reached (3.52), in terms of the success of the cloud-based ERP system.

Furthermore, there is a statistically significant difference at the level of (0.05), where the average difference was (0.68) between the third group "**Multi-national**" and the second group "**Public sector**" and this difference supports the second group, as the average of the second group reached (4.61), while the average of the third group reached (3.93).

Discussion and Conclusion

Contrary to predictions, the research findings show that Egyptian industrial organizations have a "medium success level," indicating that they have partially succeeded in implementing a cloud-based ERP system. This partially success was driven by "top management" which could be due to the new reality that most organizations are experiencing, not only in Egypt, but globally, as a result of the integration of remote work technologies in all aspects of business, particularly manufacturing operations, as a reflection of the new reality imposed by the Corona virus pandemic crisis, which would push the industrial community to work according to features of this environment. This new environment is supported by "Workforce" commitment" and "Customer attention" as these features were directly derived from the research findings.

On the other hand, the results revealed that "Training & education," followed by "Teamwork," were the elements that least expressed the success of cloud-based ERP implementation, which could be due to a lack of sufficient training programs at the organizational or industrial sector levels or lack of readiness to completely integrate with cloud computing technologies, which may reflect part of workers' resistance to adopting new technologies due to their fear of losing their jobs in the long run, which requires more studies to identify and address these issues.

In the same context, but within the framework of the relationship of soft factors to the implementation of cloud-based ERP, the results indicated a positive relationship between "teamwork" and the extent of its application of those technologies in the Egyptian environment, as the results showed that an increase in this factor led to an increase in the success of implementing cloud-based ERP in the Egyptian environment, this result supported by Seng (2007) and Dezdar & Ainin (2011), but contradicted by Salaheldin & Abbas (2015).

Furthermore, results revealed that "training & education" is the most critical and important factor needed to success of cloud-based ERP in Egyptian context, this is why Egyptian organizations must prioritize training and education because it has a direct impact on the success of cloud-based ERP deployment.

Additionally, "workforce commitment" has a positive impact on successful implementation of cloud-based ERP in Egyptian environment; this could be due to Egyptian manufacturers' commitment to a set of binding regulations imposed by the government or the industrial sector.

The study results, on the other hand, demonstrate that the private sector has the largest proportion of representation in the study's sample, exceeding public sector companies and multinational corporations. This could be owing to the state's privatization plans and the public sector's minimal engagement in industrial processes. However, we find that public sector companies, followed by multinational corporations, were the most influential in terms of implementing cloud-based ERP, with this impact supporting public sector companies. Nonetheless, this suggests that public sector enterprises continue to play a role in manufacturing processes.

The batch production system also had the highest representation of the study's sample, outperforming both the continuous and batch production systems. However, the batch production system outperformed the other two production methods in terms of implementing cloud-based ERP, while medium-sized companies had the lowest proportion of representation in the research sample. Large companies topped the sample's representation in terms of employee's number followed by small companies. According to the research sample, small companies had an upper hand in terms of magnitude of the impact because they were the most successful in implementing cloud-based ERP.

Managerial Implications

According to prior findings, the following managerial changes for Egyptian manufacturers, managers, decision-makers, and governmental officials should be implemented:

Because Egyptian organizations have a medium success level, the Egyptian government should provide more support to industrial organizations to increase the success of cloud-based ERP implementation by providing financial incentives and paying attention to training programs, especially since the results revealed that "training & education" is the most critical soft factor required for the success of cloud-based ERP.

The Egyptian manufacturer's search for globally organizations providing cloud computing services will help them understand how these companies can apply current technologies to save money.

The top management must provide support for the implementation of cloud-based ERP, especially given that research findings show that employees are committed to completing tasks in the presence of teamwork, and that this commitment has a positive impact on the success of implementing cloud-based ERP.

Directions for Future Research

Further research in this vital topic can broaden the scope of the investigation. Although the current study addressed various organizational characteristics (organizational type and size, as well as the production system), there is still a need for more research on which industrial sectors are more successful in implementing a cloud-based ERP in Egypt, allowing us to

better allocate and direct resources by supporting industrial sectors that are less successful in implementation.

Furthermore, to gain a better understanding of the factors influencing the success of Egyptian industrial organizations implementing cloud-based ERP, the scope of study should be broadened to include organizational and environmental factors, rather than just soft factors.

Finally, more similar research could be conducted in other developing countries, allowing us to conduct comparative studies with those countries to determine the similarities and differences regarding cloud-based ERP implementation in order to apply these technologies in different contexts, especially since some of the CFSs may not be of equal importance in different countries.

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Appendix

1-Data on the type and size of the company, as well as the production system used by the organization to which you belong

	Less than 10	Less than 200	Bigger than 200
Firm size			

	Private sector	Public sector	Multi-national
Firm type			

	Batch	Continuous	Assembly
Production system			

2- To what extent do the following elements contribute to the success of your company's cloud-based ERP system implementation?

العبارات	Very important	important	Neutral	Not important	Not important at all
Commitment and support of top management					
2/1 Existence of financial support from top management to ERP project.					
2/2 Top management support initiative of ERP project.					
2/3 Existence of communicating IT strategy for all employees in the organization from top Management to ERP project.					
Communication					
2/4 Existence flow of information between					

	the team and end user.					
2/5	Existence plan of Communications for ERP project implementation.					
2/6	Existence of Communications between top management and the project team.					
Team work						
2/7	Proportion of production operators in quality circles.					
2/8	Production of production operators in problem solving teams.					
2/9	Production of production operators in cellular work teams.					
Customer focus						
2/10	Customer requirements are disseminated and understood					
2/11	Know our customers' current and future needs					
Supplier relations						
2/12	Work closely with suppliers to improve each others' processes.					

2/13	Suppliers work closely with us in product development.					
2/14	Suppliers have an e2ective system for measuring their quality.					
Training and education						
2/15	Existence of training program for ERP implementation project team.					
2/16	Existence of training program for ERP end users.					
2/17	Existence of clear strategy for education and training.					
Workforce commitment						
2/18	Proactively pursue continuous improvement.					
2/19	Ideas from production operators are actively used.					
2/20	Has effective “top-down” and “bottom-up” communication.					
2/21	Encourage change and a culture of trust and innovation					

3- To what extent do the following elements represent the success of using a cloud-based ERP system?

Phrase		Very high	high	Moderate	low	Very low
3/1	Meeting the company budget.					
3/2	Meeting the company agenda.					
3/3	Contributing in improving the organization's overall performance.					
3/4	Gaining users' satisfaction with the system.					
3/5	Gaining functional managers' satisfaction					

التطبيق الناجح لتخطيط موارد المشروع القائم على الحوسبة السحابية:

تحليل العوامل الناعمة الحرجة للمنظمات الصناعية المصرية

د. أيمن محمد محسب

المستخلص

الغرض من هذه الدراسة هو استكشاف العوامل غير الملموسة التي تعتبر ضرورية لنجاح نظام تخطيط موارد المشروع القائم على الحوسبة السحابية (Cloud-based ERP). تم إجراء البحث على إجمالي ١٥٠ شركة في مختلف القطاعات الصناعية المصرية باستخدام قائمة الاستبيان كأداة لجمع البيانات. تم اختبار فروض الدراسة باستخدام كل من تحليل الانحدار المتعدد واختبار التباين الأحادي (One-Way ANOVA)، حيث كانت كلتا الطريقتين الأكثر ملاءمة لخصائص هذه الدراسة بسبب حجم العينة وطبيعة البيانات. أظهرت نتائج الدراسة -على عكس التوقعات-، أن المنظمات الصناعية المصرية حققت مستوى متوسط من النجاح، مما يشير إلى نجاحها جزئيًا في تطبيق نظام تخطيط موارد المشروع القائم على الحوسبة السحابية. كان هذا النجاح الجزئي مدفوعًا بدعم الإدارة العليا. كشفت النتائج أيضًا أن التدريب والتعليم، والتزام القوى العاملة، والعمل الجماعي هي أهم العوامل الناعمة (CSFs) المطلوبة لنجاح تخطيط موارد المشروع القائم على الحوسبة السحابية في البيئة المصرية. وأخيرًا، كانت شركات القطاع العام، تليها الشركات متعددة الجنسيات، هي الأكثر تأثيرًا من حيث تطبيق نظام تخطيط موارد المشروع القائم على الحوسبة السحابية.

الكلمات المفتاحية: تخطيط موارد المشروع القائم على الحوسبة السحابية، العوامل الناعمة الحرجة، المنظمات الصناعية المصرية.