

A Comprehensive Study of Critical Success Factors for the Implementation of Enterprise Resource Planning Systems

Marwa Zakarya

Faculty of Commerce and Business
Administration
Helwan University
Cairo, Egypt

Sayed Abdel Gaber

Faculty of computer and Artificial
intelligence
Helwan University
Cairo, Egypt

Engy Yehia

Faculty of Commerce and Business
Administration
Helwan University
Cairo, Egypt

ABSTRACT

Numerous companies now recognise enterprise resource planning (ERP) as an Information Technology (IT) procedure that can effectively manage, integrate, and enhance the performance of various organisational divisions. Moreover, there is a spike in digital transformation for any qualified organization to implement ERP, regardless of its size or nature. Accordingly, organizations are keeping up to date with the latest technologies, such as enterprise resource planning systems, to accommodate businesses in highly competitive mechanized environments. For this purpose, a comprehensive study of Critical Success Factors (CSFs) for implementing ERP is needed. This paper categorises CSFs ERP implementation and defines five categories with attributes that help the researcher and ERP implementer care for and organize their work suitably during the ERP implementation.

General Terms

Enterprise resource planning systems (ERP), ERP implementation, critical success factors

Keywords

Critical Success Factors of ERP implementation, CSFs, ERP, ERP CSFs categorization, Analytic Hierarchy Process (AHP), SWARA method

1. INTRODUCTION

Organizations must follow the digital transformation trend regardless of size or nature to increase profits. Accordingly, organizations are keeping up to date with the latest technologies, such as enterprise resource planning systems, to accommodate businesses in highly competitive mechanized environments. Enterprise Resource Planning (ERP) is programmed for institutionalizing, streamlining, and coordinating business forms crosswise over various account acquisitions, circulation purposes, and other divisions [1]. Also, Delivering information technology (IT) services through software and other essential infrastructures utilising internet technologies has been recognised as one of the uses of the ERP system. Since this is a system and concept driven by the industry, it is widely recognised. as a tool to solve practical problems and achieve an integrated enterprise information system.[13].

2. LITERATURE REVIEW

This study aims to review the present status of the art from March 2018 to March 2023 on Scopus databases for the critical success factors (CSFs) for implementing enterprise resource planning (ERP) in different sectors that resulted in 159

documents and then filtered into 30 documents within our scope then filtered to categorized CSFs researches. The technique depends on writing a survey to gather information on the implementation of ERP from different perspectives using the critical success factors (CSF) approach. This research is considered a comprehensive study that draws a direction for ERP implementation as an organisation's digital transformation. Critical success factors have been collected and then categorized, and definitions of categorizations have been unified to help researchers with a general approach. Our research survey scope includes case studies, reviews, comparative analysis, critical factors within various companies, ERP requirement skills, project managers, and a user perspective while excluding cloud ERP.(Wicaksono et al.,2023) Examined 14 CSFs of ERP implementation categorized into three criteria organizational, technological and process and investigated the top 3 ranked CSFs of successful ERP implementation in consumer good company, which were ERP Selection, Training and education and Technological infrastructure & implementation factor[2]. (Qureshi,2022) revealed that there were 14 CSFs of successful ERP implementation, which resulted in three top-ranked CSFS for successful ERP implementation: top management, change management, and business process reengineering [3].(Abu Madi et al.,2022) Identified new sector- and context-specific critical success factors (CSFs) with the evidence of successful implementation of public Jordanian higher education (HEIs) ERP systems and categorized CSFs from multiple aspects using semi-structured face-to-face interviews conducted with technicians and managers. The study concluded that 14 CSFs were identified and categorized into four groups [4]. (Tapia et al.,2021) formulated a model by applying the interpretive structural model (ISM) methodology and its respective validation of a three-level model consisting of 16 CSFs of successful ERP implementation categorized as strategic, support and operational within the context of SME [5].(Nkasu,2020) explored 22 CSFs of successful ERP implementation in the United Arab Emirates (UAE)organizations that resulted in only ten most dramatic effects on the successful implementation of an ERP system. The top ten factors ranked by 20 UAE managers were performance evaluation and monitoring, Champion, Support of top management, objectives/goals , user involvement, IT planning, Education and training user, composition and teamwork, support of vendor and new processes education[6]. (Epitone and Olugbara,2020) identified 20 CSFs of successful ERP implementation categorized into four groups (resource, culture, project and process) to support financial functions in higher education institutions [7]. (Taghavi,2019) emphasized a case study for successful ERP implementation in Mazandaran

University based on an assessment of CSFs using The Stepwise Weight Assessment Ratio Analysis (SWARA) method. The total number of CSFs was 32, categorized into six groups (protective, cultural, software & IT infrastructure, organization capabilities, process and motivational factors) [8]. (Abo Abdo et al.,2019) investigated 14 CSFs for successful ERP implementation through a questionnaire survey within construction firms. The results showed that the Top management & support, training and support for users and team composition were the most significant factors, which agreed with the previous studies that despite being IT processes at its core, the ERP implementation process is most critically impacted by human factors [9]. (Fadelmoula,2018) examined empirically six CSFs for successful ERP implementation on the full realisation of the vital functions of computer-based information systems (CBISs) collectively rather than the achievement of each role individually within the Kingdom of Saudi Arabia's (KSA) higher education system utilising a case study of Prince Sattam Bin Abdulaziz University's ERP implementation through questionnaire survey [10]. According to the previous studies, a singularity of the consumer good company case study led to need for upstanding of the study within similar enterprises and industries, other studies were limited only to specific sectors that need to extend to different sectors and geographic countries, and also studies limitations were due to the number of respondents that determined the effects of the critical success factors of ERP applicability.

3. CRITICAL SUCCESS FACTORS OF ERP IMPLEMENTATION

One common method for defining and assessing the success of ERP deployment has been a critical success factors approach. Some researchers use the critical success factors (CSFs) approach to study ERP implementations to solve the problem of focusing Project managers on a project's technical and financial aspects and neglecting to consider the nontechnical issues [10]. Establishing organisational value through communication is a well-known goal of the ERP system. Numerous academics have thoroughly researched the identification of CSFs for ERP. The study was undertaken to investigate CSFs across eight different countries. "CSFs have almost nothing to do with technology and almost everything to do with people and process, due to the effort that has to be undertaken by the whole organization in a project of this nature" [10]. The most proper definitions for each factor within a categorization upon different aspects are shown in Table (1) as a Summary of CSFs of ERP implementation and defined as follows:

- **Project management**

Good project management, including a detailed project plan related to project goals, milestones and critical paths and establishing necessary roles, is fundamental to secure implementation success. Good project scope management is linked with concerns about project goals clarification and their unity with the organizational mission and strategic goals. This includes both scope definition and subsequent scope control. This factor comprises the scope of business processes and business units, ERP functionality implemented, technology to be replaced/upgraded/integrated, and data exchange [10].

- **Composition of the ERP Team**

From a user perspective, the study states the project team should be composed of the most qualified individuals and comprise a project champion, staff members from all departments and levels, and outside consultants in cases where internal ERP experience is limited [11]. Another study used the term balanced team specified by A mixed group of employees

forming a team with experience, skills and traits to carry out particular jobs [2]. The project champion is one of the vital roles needed for marketing the project throughout the organization [10]. Positive behaviour and good conduct must be calculated among team members to carry out the work in the best possible manner [2].

- **Consultant support**

Giving expert guidance to a person or business organisation to accomplish the stated purpose [2] and determining the number, how and when to use external consultants appropriate to the ERP implementation needs. The organization's expertise will decide whether or not to employ external consultants. [10]. Different partners, such as consultants and software and hardware vendors, are involved during the implementation phase. An adequate partnership between them will ease the achievement of the goals defined.

- **Communication**

Communication should be of two kinds: 'inwards' to the project team and 'outwards' to the whole organization[11]. The organization should regularly communicate excellent results on the project's progress to the rest of the organization during the implementation phase.

- **Top management**

Management support is vital for accomplishing project goals and objectives and aligning these with strategic business goals and management commitment at the top and middle levels during implementation[11]. Project implementation requires continuous evaluation and monitoring; therefore, it appears for each phase.

- **Change Management**

This critical success factor is vital to ensure user acceptance and reduce resistance, confusion, redundancies, and errors due to significant change, which allows the organization to benefit from its use [11].

- **Business Process Reengineering**

According to a user perspective study, business process alignment is A compilation of the best business procedures that must be chosen and adhered to to maintain direction and prevent issues with the rigorous procedural guidelines of an ERP system [12]. Within literature studies, business process reengineering is the measured success factor rather than ERP business process alignment, which helps incorporate the new system by coordinating ERP software application with the business process [3].

- **Training and Education**

The training plan comprises both technical staff and end-users, and its scope will depend on the selected implementation approach. Some organizations use an in-house training approach, while others prefer training consultants[11]. Another definition is the process of educating and training staff members, while job redesign assists in organising and arranging jobs per the intended needs [3].

- **User satisfaction**

User participation refers to user behaviours and activities performed within the system implementation process. User involvement, defined as a system's importance and personal relevance, depends on the user's psychological state [11]. The user's involvement and participation must be involved by the top management, who should establish guidelines for deciding on and approving new organisational structures, as well as strengthen the commitment of every individual in the company. Roles and responsibilities help select a generalized definition

that appears using The user's involvement and participation terminology, while a more specified terminology used to define this factor called the top management involvement, which occurs within the literature that the top management involvement appears to be measured rather than the users' involvement and participation which conflict the impact of its importance to be not crucial according to user perspective study[12]. It can be assessed by determining the extent to which user needs fit with the system, leading to enhanced system quality, acceptance, and use.

• **Knowledge Legacy Systems**

It was defined as "Legacy systems, which are the business and IT systems prior to the ERP that encapsulate the existing business processes, organization structure, culture, and information technology" [11]. Another aspect is to decide which legacy systems will be replaced and the need to interface with those legacy systems for which the ERP does not provide an adequate replacement.

• **Selection of appropriate ERP system**

The procedure for selecting a suitable ERP system is based on choosing the most appropriate ERP system depending upon organizational requirements on the one hand and selecting the best ERP vendor on the other. Three primary attributes are taken into consideration to choose the most applicable ERP system: processes, functional factors, and business factors. The attributes associated with process and function factors encompass support by ERP operational areas within enterprises [13][3]. An ERP system can be efficient in one context but inefficient in another context. Top management stated that it is well-known that a product's cost should be compared to its usage or benefits; nonetheless, in many cases, a project's or process's advantages cannot be quantified since they are delivered over an extended time. [4].customization is recommended to adhere to the standardized specifications that the software supports [11].In this sense, A strong business vision is beneficial because it simplifies the work required to customise and capture the capabilities of the ERP business model.

• **Time**

The ERP implementation plan is influenced by the implementation strategy and time frame [3]. From a strategic technological perspective, the ERP implementation plan is called an adequate ERP implementation strategy, which includes management decisions concerning the software package and time to finalize the ERP implementation project.

• **Clear goals and objectives**

The steering critical factor of ERP successful implementation is clear goals and objectives. Since CLEAR stands for Collaborative, Limited, Emotional, Appreciable, and Refinable, it can act as an alternative or supplement to SMART goals within ERP implementation rather than a project[14]. This factor is considered a measured factor within different literature[3] but is also considered a sub-item of other factors in other studies.

• **Budget**

Financial aspects help implement ERP Systems for the improvement of performance. Commonly, the usefulness of an appropriate ERP system must exceed the cost to term as a successful system[4].

• **Qualified IT Staff**

It is the backbone of the success of an ERP system in an organization that maximizes the utilization of the ERP system[4]

• **Vendors relationship**

Users must approach vendors to provide the ERP system to impart on the organization's demand [4]. Technical assistance, maintenance, and updates have to be established by vendor support[12].

• **System Quality**

The entire organization evaluates this technical possibility based on predefined goals and objectives[12]. According to (Delone and Mclean,2003) system quality is the degree to which it is easy to use and compiles functionality, reliability, flexibility, and data quality to accomplish specific tasks[15].

• **Information Quality**

This technical possibility can be measured as clear, standardized, relevant, accurate, and trustworthy information that can influence the whole process of ERP interpretation[4].

• **Perceived usefulness**

perceived usefulness is affected by system quality, information quality, and benefits to users, organizations and society and affects user satisfaction[15].

• **Perceived ease of use**

Certain individual features of ERP systems improve the convenience of using the system[16].

• **Internal support**

Internal support is a human input to overcome organisational deficiencies in resources and abilities essential to ERP implementation [17].

• **Result demonstrability**

Result demonstrability is a potential predictor of intending to use an ERP system[18].

• **Compatibility**

ERP is an integrated multi-system that meets the requirements of the business without amendments and modifications[18].

Table 1: Summary of CSFs of ERP implementation

1-	Project management
2-	composition of the ERP Team
3-	Consultant support
4-	Communication
5-	Top management
6-	Change Management
7-	Business Process Reengineering
8-	Training and Education
9-	User satisfaction
10-	Knowledge Legacy Systems
11-	Selection of appropriate ERP system
12-	Time
13-	Clear goals and objectives

14- Budget
15- Qualified IT Staff
16- Vendors relationship
17- System Quality
18- Information Quality
19- Perceived usefulness
20- Perceived ease of use
21- Internal support
22- Result demonstrability
23- Compatibility

4. CATEGORIZATION OF CSFS ERP IMPLEMENTATION

This section contributed with each category definition as there are five categories, each with attributes of CSFs ERP implementation.

I. Organizational factors

(Abu Madi et al. ,2022) Organizational-related CSFs require organizations to be prepared to have the capability of recognizing the entrenched benchmarks and redesigning the core systems and processes achieved from the exemplified by the system that is implemented in an organization-wide manner where several stakeholders are involved and locations geographically dispersed in nature[3]. (Tapia et al., 2021) emphasized Operational factors (level 1) containing factors needed to finalize the supervision of the operation and implementation of ERP systems in SMEs[4]. This study definition is those set of factors considering the knowledge of legacy systems, change management, business process reengineering and training and education sequentially.

II. Management factors

(Abu Madi et al.,2022) Called project-related CSFs, any ERP project's core and successful outcomes can only be attained by the timely implementation of all essential elements. The cost of ERP software ownership and upgrading The program may only cost about 30% of what it did originally [4]. (Tapia et al., 2021) emphasized as Strategic factors (level3) are responsible for making the decisions of the entire project[5]. (Wicaksono et.al , 2022) emphasized that the attribute ERP selection was one the most important process criteria from the analytic hierarchy process (AHP) hierarchy of process attributes, which agreed with (Epizitone and Olugabra,2020), with the process category considering package selection, carefully and professionally selected[2][7]. This study sets the same set of factors considering time, budget, selection of ERP system and project management and changing the group name by management factors rather than project factors.

III. Technical factors

ERP should be considered as a business solution besides considering as an IT solution where the standardization of the IT infrastructure ensures the successful implementation and application of ERP implementation. (Wicaksono et al. , 2022) Emphasized that technological criteria attributes were data

accuracy, system reliability and flexibility. The factors considered in this study were system quality and information quality measurement[1].

IV. Social factors

It was confirmed that the social elements that had been more concern by participants were top management, qualified IT staff and vendor relations. (Tapia et al., 2021) emphasized as Support factors (internal level or level 2) which factors have functions that only involve the organization and personnel [4]. In this study, the factors considered were top management, qualified IT staff, vendor relationships, consultant support, communication, composition of ERP team, and clear goals and objectives.

V. Satisfaction factors

User satisfaction can be achieved via factors that lead to the development of a mechanism for management for ERP success considerations implementation [17]. User satisfaction factors were perceived usefulness, ease of use, internal support, result demonstrability and compatibility.

5. CONCLUSION

The categorizations of Critical Success Factors for ERP implementation concluded from different sectors and industries within different countries are shown in Figure 1. This conclusion has been based on the previous studies shown in Table (2):

Table 2: Categorizations of CSFs for ERP implementation

Author	Categorization	Remarks
Wicaksono et.al , 2022	<ul style="list-style-type: none"> organizational technological process 	There were 31 employee users of the company's ERP system, which led to a reference for similar companies. Where clear goals are the most important organizational factor, technological infrastructure & implementation on technological criteria and ERP selection on process criteria. The top 3 ranks are ERP selection, Training and education, and technological infrastructure & implementation factors[2].
Tapia et el.(2021)	<ul style="list-style-type: none"> Strategic Support Operational 	The number of samples is limited to generalize the study investigation and data was taken from manufacturing

		companies in the Austral Zone of Ecuador[5].
Epizitone and Olugabra, 2020	<ul style="list-style-type: none"> • Resource • Culture • Project • process 	nine experts were engaged concerning financial functions in a minimum of 4 and 5 participants were accepted without categorization definitions other than attributes, and in the previous studies for impact score evaluation for HEIs in South Africa developing countries[7].
Taghavi et al.,2019	<ul style="list-style-type: none"> • protective factors • cultural factors • software and IT infrastructure 	Only Five experts at the University of Mazandaran, Iran, propose a framework of key success factors for implementing these systems at

	<ul style="list-style-type: none"> • capabilities of the organization • Process • Motivational factors 	universities with no categorization definition and finally assess their preparedness before implementation[8].
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Upon the literature review, this research suggests the following categories:

- Organizational factors
- Management factors
- Social factors
- Technical factors
- Satisfaction factors

For the following reasons:

Defining each category with its attributes can lead the stakeholders to use it as a roadmap for ERP systems implementation. Accordingly, they are presented graphically, as shown in the following Figure 1.

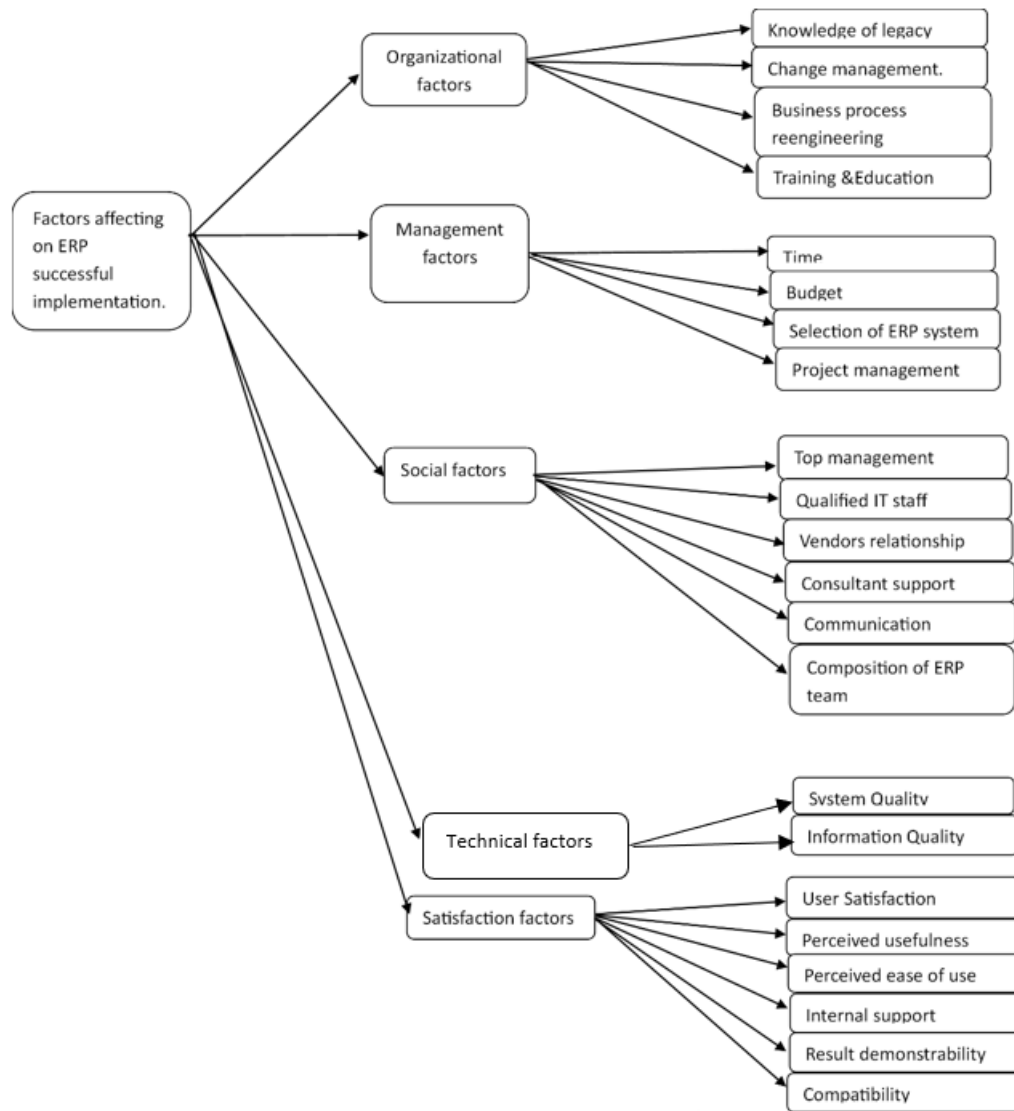


Figure 1: Categorized CSFs Model for ERP implementation

This figure may help the researcher and ERP implementer to care for and organize their work according to these CSFs in a suitable manner during the ERP implementation.

5. FUTURE WORK

To verify our work, we will study the relationships among the factors under each category to find the distinction between the factors under the same categorizations cross-sectional.

6. REFERENCES

- [1] A. C. M. D. A. P. S. H. A. J. M. M. Theresa, "Enhanced Recursive Feature Selection Method for Analyzing Critical Factors in Enterprise Resource Planning Implementation," *IEEE Xplore*.
- [2] M. G. P. Wicaksono, I. E. Aditya, P. E. Putra, I. Bagus, P. Angga, and P. O. H. Putra, "Critical Success Factor Analysis ERP Project Implementation Using Analytical Hierarchy Process in Consumer Goods Company," pp. 41–46, 2022.
- [3] M. Rafik and N. Mohamed, "Evaluating Enterprise Resource Planning (ERP) Implementation for Sustainable Supply Chain Management the Interne," 2022.
- [4] A. Abu Madi, R. M. Ayoubi, and M. Alzbaidi, "Spotting the Critical Success Factors of Enterprise Resource Planning Implementation in the Context of Public Higher Education Sector," *Int. J. Public Adm.*, vol. 00, no. 00, pp. 1–17, 2022.
- [5] D. Tapia, P. Vintimilla, and X. Alvarez, "A Model for Implementing Enterprise Resource Planning Systems in Small and Medium-sized Enterprises," vol. 1, no. Iccis, pp. 95–104, 2021.
- [6] M. M. Nkasu, *Investigation of the Effects of Critical Success Factors on Enterprise Resource Planning (ERP) Systems Implementation in the United Arab Emirates*. Springer Singapore.
- [7] A. Epizitone and O. O. Olugbara, "Identifying critical success factors of financial ERP system in higher education institution using ADVIAN® method," *Int. J. Adv. Comput. Sci. Appl.*, vol. 11, no. 9, pp. 389–403, 2020.
- [8] F. Taghavi, J. Antucheviciene, S. A. Yaghobian, and K. Blvd, "Assessment of Universities ' and Higher Education Centre s ' Preparedness for Successful Establishment of

- Enterprise Resource Planning Based on SWARA Method,” vol. 30, no. 4, pp. 496–506, 2019.
- [9] H. Al-amrib, “ScienceDirect ScienceDirect Implementing Enterprise Resource Planning ERP System in a Large Implementing Enterprise Resource Planning ERP System in a Large Construction Company in KSA Construction CENTERIS - International Conference on ENTERprise Information Systems / ProjMAN -,” *Procedia Comput. Sci.*, vol. 164, pp. 463–470, 2019.
- [10] A. A. Fadelelmoula, “T He E Ffects of the C Ritical S Uccess F Actors for Erp I Mplementation on the C Omprehensive a Chievement of the C Rucial R Oles of I Nformation S Ystems in the,” vol. 13, pp. 21–44, 2018.
- [11] J. E. J. Pastor-collado, “TOWARDS THE UNIFICATION OF CRITICAL,” 2014. .
- [12] E. Reitsma, “Enterprise Resource Planning System Implementation : a User Perspective,” vol. 11, no. 3, pp. 110–117, 2018.
- [13] P. Trebuna, “USING THE AHP METHOD TO SELECT AN ERP SYSTEM FOR AN SME MANUFACTURING COMPANY,” vol. 5, no. 3, pp. 14–22, 2014.
- [14] “SMART vs CLEAR Goals: Which is Better to Find a Job?” .
- [15] W. Delone and E. Mclean, “The DeLone and McLean Model of Information Systems Success : A Ten-Year Update,” no. October, 2014.
- [16] D. Kulathunga, “User Satisfaction Factors of ERP Systems : The Case of a Manufacturing Company in Sri Lanka User Satisfaction Factors of ERP Systems : The Case of a Manufacturing Company in Sri Lanka,” no. December, 2019.
- [17] J. H. F. C. Eric T. G. Wang, “Effects of the internal support and consultant quality on the consulting process and ERP system quality,” *Decis. Support Syst.*, vol. 42, no. 2, pp. 1029–1041, 2006.
- [18] N. Issn and M. J. Anjum, “Information Management and Business Review,” vol. 3, no. 5, pp. 265–272, 2011.