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Enterprise Resource Planning in The Health Industry: Problems of Its Usage Based on the Extent of the Countries' Development

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Abstract
By growing the interest of health organizations in providing quality services and the need for quick access of physicians to quality health information, the implementation of ERP in the health industry has been considered. The purpose of this study is to investigate the effect of application and exploitation problems of the enterprise resource planning system in the health industry based on the extent of the countries' development. systematic review was reported according to PRISMA Guidelines. Four scientific databases of Scopus, PubMed, Web of Science and IEEE were searched with no time limitation using keywords related to ERP, health care and challenges and benefits. The selection of articles and data extraction were carried out by three researchers and disagreements were discussed with fourth researcher. A total of 1206 articles were retrieved, after removing duplicate articles and applying inclusion criteria, 24 articles remained for further review. The findings of this study show that the severity of ERP implementation problems was different in the three categories of the studied countries. The main problems of developing countries was found in the group of the cultural and technological problems, the semi-developed countries was in the group of the economic and technological problems, and the main problems of the developed countries was referred to the problems of the service quality received from the software. Although in many cases implementing and applying ERP fails, awareness about different challenges that countries are faced based on their development level and paying attention to the appropriate strategies to each challenge and its risk management leads to successful ERP implementation.

Keywords: Enterprise Resource Planning (ERP); Health industry; Challenges and benefits

Introduction

Today, organizations are required to apply the new technologies to adjust the organizational changes immediately to survive and compete in the global marketplace. Enterprise Resource Planning (ERP) is an advanced technology that guarantees increased organization flexibility. ERP is a software which automates the key processes, eliminates job complexities, and integrates information; furthermore, it leads to business objectives, improves the quality of services and products, and

improves the organization efficiency through obtaining the optimal decision-making space. ERP is used in manufacturing industries, small sized enterprises, e-commerce, telecommunications companies, the construction industry, service organizations, and especially in the health industry [1-3]. Hospital officials and medical and health centers need accurate information to form a precise central planning and control system which can be achieved through using ERP [4].

Some of the important subsystems working integrated in health ERPs include the patient's electronic files, E-health desk, reception, hospitalization, discharge, telemedicine, insurance and finance, warehouse, pharmacy, laboratory, etc. The interactions of these interacted subsystems lead to the power of ERP software [2, 4-8]. The version 2 of the ERP supporting the two modules: "Supply Chain Management" and "Customer Relationship Management" has significant benefits, including: receiving information from outside of the organization and providing information outside of the organization in real time, using information received from outside of the organization to determine and change the decision making, increasing the information flow between different departments within the organization, focusing on the Electronic Medical Record (EMR) in the patient care process, personalizing the services based on patient status, and facilitating the usage of the Decision Support Systems (DSS) [4, 9, 10].

It is worth noting that the ERP infrastructure should be based on the best predefined processes leading to the added value of the organization. Therefore, the localization of these processes is subjected to considerable limitation in the present circumstances of the applicant organization by the organizations developing ERP. For this reason, the organization's need to implement reengineering, which requires the change of processes and establishment of ERP, that involves the organization in fundamental changes. Under such circumstances, many problems leading to the failure of ERP implementation seem inevitable [11, 12]. Managers and practitioners' resistance for changing from traditional to ERP systems, cultural and social barriers, high cost for starting up and implementing ERP, non-using the continuous training systems for users and administrators, major limitation in localizing the system processes, transferring the data from old systems to ERP are some of the challenges of implementing such software [6, 10, 12-14].

Today, various ERP models with different brand names are used in some healthcare organizations in countries such as America, Germany, Greece, Netherlands, India, Saudi Arabia, and Egypt. Studies showed the fact that these countries have faced various difficulties during using ERP, but the severity of these problems leading to ERP failure is similar to the countries with same development rates [6, 9, 13, 15-18]. This study focuses on the problems of ERP implementation in the health industry according to the extent of countries' development.

Material and Method

The present research is a systemic review study that was reported according to PRISMA Guidelines [19].

Data Resources

Three scientific databases of Scopus, PubMed, and Web of Science and IEEE were searched using a predefined search strategy. These databases were searched without time limitation. The time frame for formulate and write a search strategy and starting the search process in databases was from 1 to August 25. Also, on August 30, the database search process was completed.

Search

In order to search the databases, a list of keywords related to Enterprise Resource Planning (ERP), health care and challenges and benefits was determined. The search strategy was developed by three researchers (Moulaei, Abbasi and Mirzei) and finally, approved by the third researcher (Ayani). The keywords and search strategy are listed in Table 1. It should be noted that the same search strategy was used in the Scopus database, and the only difference was the placement of keywords in double quotation marks.

Table 1. Keywords and search strategy

Keyword categories	Keywords
Enterprise Resource Planning related keywords	(Enterprise Resource Planning OR ERP OR business management software OR Customer Relationship Management OR CRM OR Supply Chain Management (SCM) OR Systems Applications and Products OR SAP OR Business Intelligence OR BI OR E-business technologies)
Health care related keywords	(health organizations OR health care)
Challenges and benefits related keywords	(Challenges OR Benefits OR Advantages OR Disadvantages OR Problems OR Solution)
Search strategy	[(Enterprise Resource Planning related keywords) AND Health care related keywords) AND (Challenges and benefits related keywords)]

Study Selection

First, using the search strategy presented in Table 1, NA and MM retrieved the abstracts of all related articles in the three scientific databases and entered them in Endnote software. Duplicate sources were removed from the study. Then, according to the inclusion and exclusion criteria, related articles were selected based on title, abstract and keyword. All validated studies were reviewed and finalized by SHA and KHM. After final approval of the articles, the full text of the articles were downloaded and reviewed by NA, MM and KHM to extract information. Data extraction from the articles was done using a data extraction form by these two researchers. The data extraction form includes fields such as reference, the field of study, research purpose, challenges, benefits, implementation strategy, Hospital or city name, county name and development status of each countr. Finally, SHA and KHM re-examined and verified all the findings obtained and mentioned in the data extraction form.

It should be noted that the validity of the data extraction form was verified by four experts in the field of medical informatics and software engineer.

Inclusion Criteria

In this study, the inclusion criteria were articles focused on Enterprise Resource Planning (ERP) in the health industry, English language, full text availability, human research, ERP challenges, and ERP potential solutions in the healthcare industry.

Exclusion Criteria

Exclusion criteria included the lack of focus on the challenges, unrelated to the ERP in the healthcare industry, unclear definitions of the challenges and their solutions, and lack of comprehensiveness of challenges and solutions mentioned in the studies.

Retrieval of References

Resources were extracted using the following procedure: At first, 29 sources from PubMed, 892 from Scopus, 149 from IEEE and 136 from Web of Science were retrieved. After reviewing the titles and abstracts of the retrieved sources, 231 duplicate sources were excluded. The remaining 975 sources were selected according to the inclusion and exclusion criteria; finally, 24 articles were

selected for analysis and carefully studied by the researchers. The results of the search to extract resources are visible in the Figure 1.

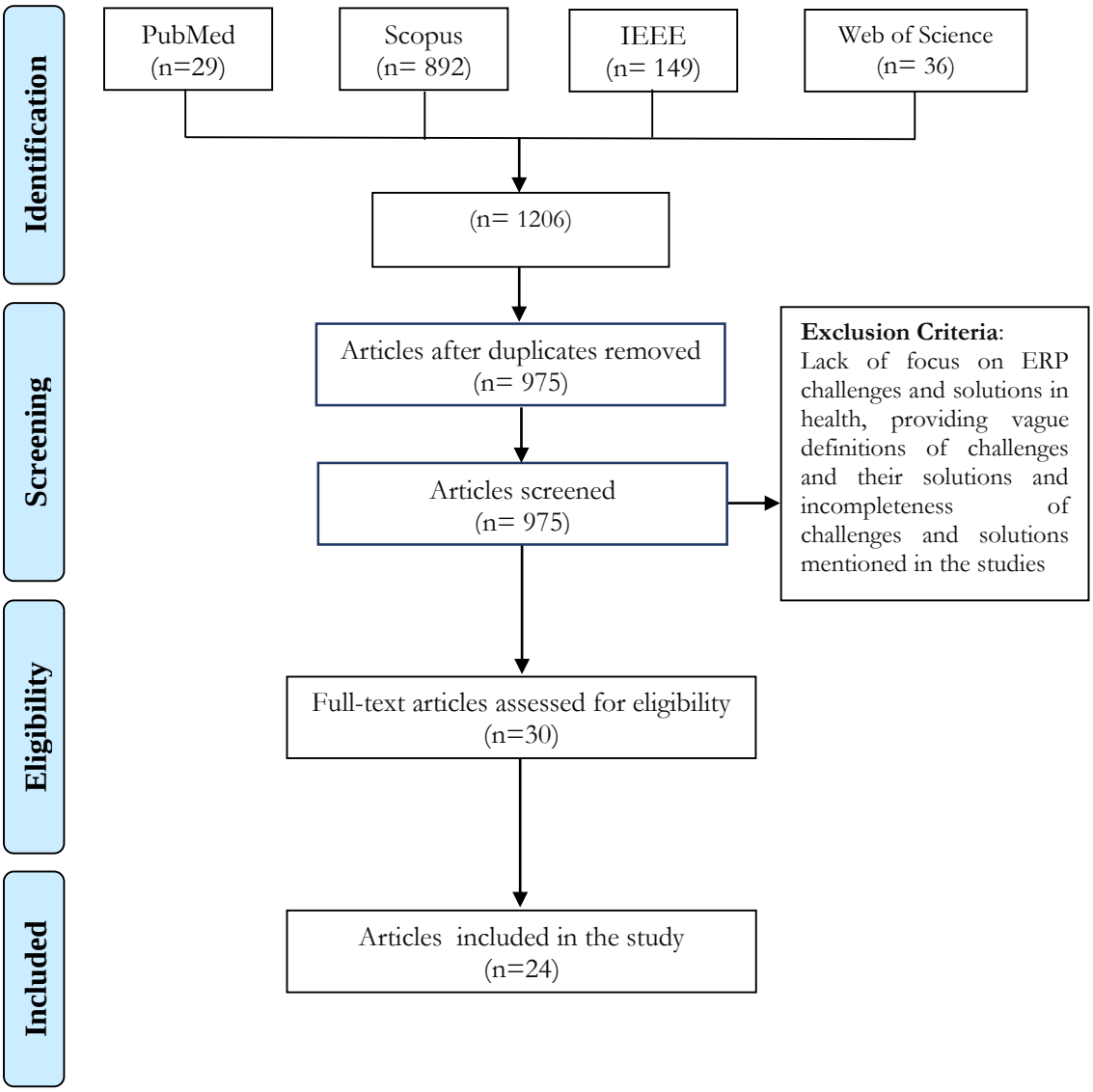

Figure 1. Diagram study selection process

Articles Analysis

1. The benefits of using ERP were extracted, categorized, and coded from selected articles. The results of this classification are seen in Table 2.

2. The challenges of applying ERP were extracted, categorized, and coded from selected articles. Then, in order to find a solution for each of the challenges, a search was conducted, and a suitable solution was obtained for each challenge. The results of this classification are seen in Table 3.

3. Based on the development level of the countries, the countries under study were classified in three: developed (including US, Canada, Netherlands, Spain), semi-developed (including Greece, South Korea and India) and developing countries (including Saudi Arabia, Egypt and Jordan). Note that developed countries can be considered equivalent to the first world, the semi-developed countries to the second world, and the developing countries to the third world.

4. Each case study of a country was reviewed based on the country development. Then, the advantages and the challenges of each case study were identified by selecting the relevant codes from Tables 1 and 2. The results are seen in Table 4.

Finally, the contributions from the findings of Table 4 were discussed based on the extent of countries' development.

It should be noted that all the acronyms related to the key concepts discussed in this study are defined in Appendix 1.

Results

The benefits of using ERP in health organizations are listed in Table 2. According to this table, the benefits of using ERP in health care organizations were divided into 12 categories.

Table 2. Advantages of using ERP

Code	Advantage	Reference
1	Integration of the active subsystems' data of the health care organizations and interactive systems of the external organization	[19, 20]
2	Increasing the flexibility of the organization in the face of new changes (for example, the acceptance of technologies in the organization)	[16, 20]
3	Focusing on the strategy of the patient care and treatment personalization	[16]
4	Instant access to the needed data by dashboards designed for different levels of use	[13, 17, 19]
5	Standardizing the processes and centrality in control and planning	[17, 19, 21]
6	Decreasing the operating cost of the organization	[22, 23]
7	Applying the decision supporting systems to care and treatment of patients and decreasing the medical mistake	[10, 21]
8	Increasing the speed of the information flow between different parts of the hospital	[10, 17]
9	Optimal use of organization resources	[12]
10	Increase in productivity and profitability of the organization	[10, 23]
11	Receiving the valuable management reports	[10, 20]
12	Beneficiaries' satisfaction such as patients, medical staff, office staff, etc.	[21]
13	Competitive advantage in the market	[21]

Challenges of ERP implementation and its solutions are listed in Table 3. According to this table, ten categories of challenges were identified. A total of 21 solutions were presented for these ten categories. Most of the challenges were related to code 6 [1, 3, 25]. Most solutions were related to challenges with codes 1, 6, 8 and 9. The least solutions were related to challenges with codes 2, 3 and 4.

The main findings of this study were reviewed in the following two categories.

A) ERP Benefits Based on the Extent of Countries' Development

Sharing the benefits of using ERP from Table 3 reflects the fact that some of the benefits are more pronounced in countries' classification. For example, "integration of data from active subsystems of the health care organizations and interactive systems of the external organizational" is a common advantage between countries in all three groups included in the study. Besides, "increasing the flexibility of the organization" is one of the most important advantages of using ERP in developed countries.

Table 3. Challenges of ERP implementation and its solutions

Code	Challenge	Ref.	Solutions	Ref.
1	Managers and physicians' resistance to change traditional or manual systems to ERP systems	[6, 10]	Motivating the managers and physicians to improve service quality Training the managers and physicians and improving their computer literacy Using Technology Acceptance Model(TAM)	[5, 7, 10]
2	The possibility of directing the organization towards irregularity among different sections of the organization	[1]	Using the change management practices step by step Using Top Management Commitment (TCM)	[1,6]
3	Lack of continuous training systems for users to prevent entering the correct information to system.	[6]	Correct and continuous training of the staff	[6]
4	High cost of implementation (including staff training, testing, software, system and support customization)	[9, 28]	Using the open source ERP system and its localizing	[18]
5	Increase in additional costs due to late receipt of profits	[4, 6]	Applying the spiral implementation method. Project Management (PM)	[6, 11]
6	Require Process Reengineering (BPR) before ERP implementation or during implementation for ERP localization	[1, 3, 24]	Adjusting the organization process diagram with predefined ERP processes and estimating the change extent. Utilizing the strategic management and risk management Providing mental support for employees to guarantee their survival	[12 ,24, 25]
7	Social and cultural barriers to use ERP Some of these barriers include: lack of staff readiness for change, lack of cooperative spirit, lack of recognizing the system benefits, fear of job loss, lack of technology knowledge	[7, 24]	Creating a positive attitude in the staff of the organization before implementation Using Technology Acceptance Model	[22, 7]
8	Non correspondence of ERP modules with main organization processes	[23]	Identifying the main processes of the organization that are not covere. Customizing the system processes according to health industry standards	[23]
9	Failing in servicing the patients	[5]	Specifying the strategic management Patient Engagement (UI) and users during implementing ERP Evaluating the services being offered	[13, 26]
10	Problems with ERP interaction with other systems	[5]	Applying the standards such as the Health Level Seven (HL7) Use of nationally valid ontologies	[4]

"Making the information flow between different parts of the hospital" and "increasing the productivity and profitability of the organization" and "receiving the valuable management reports" are in first and second ranks, respectively, among the advantages of ERP deployment in semi-developed countries. On the one hand, "decreasing the costs of an organization's executive operations" is an overwhelming and shared advantage between the developed and semi-developed

countries. For developing countries, "standardizing the processes and centralizing the control and planning" is the most important advantage of using ERP.

It is noteworthy that developed countries have been more advanced in achieving the benefits of ERP than semi-developed countries. Similarly, semi-developed countries have been ahead of developing countries in achieving the benefits of ERP. This finding reflects the fact that the valuable level of ERP advantages is enhanced by definite deployment and continuous execution.

It should be noted that among the developed countries, the most challenges were related to the USA (n=4) and then Canada (n=3). Among the semi-developed countries, Greece had the most challenges. Also, among the developing country, Saudi Arabia had the most challenges.

B) ERP Challenges Based on the Extent of Countries' Development

Observing the experiences of the studies under study shows that "the physicians and managers' resistance to move from traditional or traditional systems to ERP systems" is a common challenge of all countries with different developmental stages.

Besides, "the lack of continuous education systems for users that prevents entering correct information into the system" is a major challenge for developed and developing countries. In developed countries, however, "failure to deliver services to patients" is one of the challenges of implementing ERP.

The observations indicate that the most important challenges in semi-developed countries are "high cost of implementation and maintenance", "lengthy process to achieve profitability" and ERP modules are not in accordance with main processes of the organization" and re-implementation of the engineering process organization processes.

"Social and cultural barriers to use ERP" is other identification challenge in developing countries. This challenge includes employees are not ready to change, non-cooperative morale, lack of recognition of the system benefits, fear of losing their job position. lack of knowledge of the ERP system.

Other findings of this study show that "business process reengineering" (BPR) is recognized as one of the important factors in the success of ERP implementation. Therefore, it seems that the failure of the proper and successful implementation of the BPR leading to the failure of ERP establishment is one of the major challenges the countries will face. Because of the technological improvement level in different classes, obviously, the developing and semi-developed countries are facing this problem more seriously.

These findings indicate the fact that the challenges of using ERP in developing and semi-developed countries are more related to the level of ERP establishment in the organization and the challenges of using ERP in the developed country is related to the provision level of quality level of the services.

Table 4. Studies about using EPR in different countries

Experiences from ERP implementation	**Challenges**	**Advantages**	**Reference**	**Hospital/ city name**	**Country name**	**Development status of each country**
1. System support is essential for successful ERP implementation. 2. The main reason for the successful ERP implementation is the quality of staff and the appropriate training provided to them. 3. The main and important factors in the success of implementation are management and high commitment.	1 3 9 10	1 2 5	[20, 28]	-	USA	**Developed countries**

Experiences from ERP implementation	Challenges	Advantages	Reference	Hospital/ city name	Country name	Development status of each country
1. Finally, the manager reported that no expected profit was achieved. 2. Management and medical staff are critical factors to success. 3. Attitudes and how different groups use ERP in a hospital center have a direct impact on ERP implementation. 4. Organizational resistance is evident during implementing ERP. 5. ERP implementation depends not only on the technical characteristics of the system but also on the executive power, organizational culture, and amount of organization investment.	1 3	1 2 3	[17]	A public hospital in western Netherlands/ Netherlands	Netherlands	
1. Understanding "the ease of use" and "Understanding the utility" are effective for changing people's attitudes toward accepting a system. 2. Training before using ERP has a significant effect on understanding the ERP usefulness. 3. Previous experience of using information technology affects the attitude of employees towards using ERP. 4. The staff age affects the attitude and acceptance of ERP, Younger employees are more likely to perceive the benefits and acceptance of the system.	1 7	1 6 10	[24]	A public hospital in Spain /Madrid	Spain (Southwest Europe)	
1. Integrating the data is critical in order to manage that ultimately decreases the costs and improves administrative decisions.	4 6 9	1 3 6	[21]	Canada	Canada	
1. Using supply chain in hospital 2. Effective communication between nurses and warehouses keepers 3. Changing the usual way and improving the implementation of the main processes	1 2	1 4 6 8 11	[20]	-	Greece (Southeast Europe)	**semi-developed countries**
1. Improved pharmacy and warehouse performance 2. Generating a list of clinic orders automatically 3. Increasing the accuracy of the billing process 4. Changing the organizational culture needed for successful use	1 4 5 7 8	1 6 7 8 10 11	[10]	Papageorgio, Public hospital of Thessaloniki, Northern Greece	Greece (Southeast Europe)	

Experiences from ERP implementation	Challenges	Advantages	Reference	Hospital/ city name	Country name	Development status of each country
1. The Multi-criteria Decision Support Model (MCDM) provides a practical way to accept ERP in an organization. 2. Multi-criteria Decision making Model (MCDM), in particular a combination of Analysis Hierarchical (AHP) and Goal Planning (GP) in the ERP system, is a useful tool to help make decision in healthcare.	8	8 5 12 13	[29]	Fatima Hospital	South Korea	
1. The main factors for the success of ERP implementation in hospitals include senior management commitment, user involvement in system deployment, business process reengineering, project management, and teamwork.	4 5	4 9	[11]	Bengaluru	India	
1. Committed senior management and business process reengineering are key to critical success factors (CSFs).	1 3 4 5 7	1 5	[20]	Private hospitals across Saudi Arabia	Saudi Arabia	**Developing country**
1. The effects of the ERP system on employees are greater than other physical and non-physical aspects of the organization.	1 7	1 4 5	[18]	Health Organizations in Egypt	Egypt	
1. Significant improvement was observed in the organization's data management as well as the organization's performance. 2. Training, ease of use, user satisfaction, and management support are the main elements of successful implementation in the enterprise resource planning system.	1 3 7	1 12	[30]	Health Organizations in Jordan	Jordon	

Discussion

The results of this study indicate that there are different challenges and advantages of ERP in different countries. In fact, since there are different infrastructures in the countries under study based on the level of development, the barriers for getting the benefits are different. is certain that health care organizations can achieve the successful deployment of health systems by using ERP when designing and deploying health systems. Using the ERP solution improves the infrastructure and creates the ability to adapt to external changes. This advantage is necessary and inevitable to enter the world of e-commerce and use the web and the Internet to facilitate affairs and use the virtual world. Also, ERP solutions improve the organization's ability to control processes by creating uniform standards and processes. In other words, organizations use ERP to receive information more quickly and accurately. Fiaz and Ikram, by examining the perception of healthcare professionals in improving the quality of services in healthcare centers by deploying the ERP platform, concluded that the use of ERP has a positive effect on individuals, the quality of organizational information and the quality of the system in health services [26]. Tavana et al. Examined the challenges, open issues, applications, and architecture of the IoT-based ERP. They concluded that smart devices that provide online data (on product, quality, shipping, etc.) to the organization could also affect customer service

and better management of the entire organization [27]. Also, Saatçıoğlu examined the effects of benefits, barriers, and risks on user satisfaction in ERP. Their study showed that although ERP has many benefits, but business organizations need to overcome barriers to the use and implementation of ERP systems, because if these barriers are not removed, there will be many risks [28].

The study found that the importance of ERP implementation problems in developing countries was observed in cultural and technological problems group and those in semi-developed countries was found in economic and technological problems group. Lengnick-Hall et al. Noted that ERP has the potential to limit or expand the company's strategic opportunities. It seems that the probability of improving competitive advantage depends on how the information system integrates with the organization's culture and learning abilities [29]. Also, The present study found that the severity of the problems for the developed countries was in educational and the quality of the services received from the software. Due to the existence of different infrastructures in three groups of countries (developed, semi-developed and underdeveloped), the existence of this set of problems are logical and justifiable. The important point in this regard is to pay attention to the key factors of success in order to prevent the failure of ERP projects in different organizations. Therefore, it should be said that like any other project, the use and implementation of ERP projects will be associated with different problems. The important point in this regard is to pay attention to the key factors of success in order to prevent the failure of ERP projects in different organizations. Also, regarding the deployment of ERP in hospitals in order to take advantage of it, it is suggested that senior managers of health organizations, in addition to using technical consultants, consider the problems ahead and consider the criteria for successful implementation of health systems, the necessary incentives to accept ERP Create. Also, while creating a culture for the use of ERP and providing the necessary infrastructure, support and monitor all stages of ERP use.

One of the major limitations of the present study was the lack of review of existing non-English studies, which may lead to an incomplete understanding of the subject matter. Therefore, if non-English studies are also considered, the challenges and benefits of using ERP will become more apparent. In addition, the articles that presented the challenges and benefits did not use a single approach to reporting these cases, so some may not even have thought about some of the challenges or benefits. Also there is a risk of reporting bias. Some authors might diminish their problems, and praise with their success, in order to keep a good external image. The magnitude of this bias cannot be estimated, but it is an important problem. The importance of many advantages or challenges, is very subjective. The measuring of such things is highly problematic, and subjective. Thus less trustful. Probably the reported challenges are more trustful than the advantages.

Conclusions

Although in many cases implementing and applying ERP fails, awareness about different challenges that countries are faced based on their development level and paying attention to the appropriate strategies to each challenge and its risk management leads to successful ERP implementation. Regarding the deployment of ERP in hospitals, it is suggested that senior managers of health organizations, in addition to using expert consultants and factors for successful software implementation, create the necessary motivation for acceptance of ERP by physicians, users and other stakeholders. Also, in addition to creating the necessary culture and infrastructure, senior managers of health organizations should support and monitor all stages from the beginning to the establishment and final use of ERP.

List of abbreviations

Table 5. Terminology

Terms	English Definition	Description
TAM	Technology Acceptance Model	It is designed as a compact, predictive, and powerful model to explain and predict the behavior in decision making and accepting the use of a particular technology. This model claims that people's decision to use the technology depends on two particular behavioral beliefs, including perceived usefulness and perceived ease of use.
TCM	Top Management Commitment	It is recognized as a critical factor for ERP success. Top management should control the project from the start of implementation to the final establishment of ERP, and provide developers with resources.
UI	User Involvement	It is positively associated with ERP success and includes two aspects: 1- User participation in defining system needs 2- User participation in system implementation.
HL7	Health Level Seven	It is a set of international standards for the transfer of clinical and administrative data between software programs used by different healthcare providers.
MCDM	Multi criteria Decision-Making Model	A mathematical model for the decision-making process allowing the decision maker to choose the best option among a number of options based on different criteria.
AHP	Analytic Hierarchy Process	It is one of the most popular multi-criteria decision making techniques turning the complex problems to simple one to solve it. The hierarchical analysis process is used when the decision-making process is faced with several options and decision criteria.
GP	Goal programming	It is a mathematical programming model facing with multiple opposing goals and it obtains a specific numerical goal for each goal and forms a goal function. The model then searches a common solution to minimize the sum of deviations from these goals.
CSF	Critical Success Factors	Important and critical factors for success in project implementation, which are essential before identifying ERP.
BPR	Business Process Reengineering	Fundamental modification of business processes to achieve significant improvement in organizational performance criteria such as cost, quality, service and speed.
PM	Project Management	Controlling and managing the processes, coordinating the different activities, scheduling, turning points, equipment, workforce and budget, etc. to achieve the system's goals.
TWC	Teamwork and composition	The most important part of the ERP cycle is a combination of consultants and internal staff.

Conflict of Interest

The authors declare that they have no conflict of interests.

Authors' Contributions

SA and KM: Conceptualization; Data curation; Formal analysis; Investigation; Software; Roles/Writing - original draft. MM and NA: Conceptualization; Formal analysis; Investigation; Roles/Writing - original draft; Funding acquisition; Methodology; Project administration; Resources; Supervision; Writing – review & editing. SA and KM: Conceptualization; Investigation; Methodology; Validation; Writing – review & editing.

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