Review Article

Success Factors in the Implementation of Healthcare Information Systems (HIS) among Developing Countries

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ABSTRACT

Developing countries face significant challenges establishing healthcare information systems (HIS) due to inadequate government regulations and outdated technology infrastructures. For example, the lack of digital patient data collection in Bangladesh exacerbates the accessibility to quality healthcare. Standardizing hospital healthcare systems could streamline patient management, potentially servicing more patients effectively. This study utilizes a systematic literature review (SLR) to consolidate key factors enhancing HIS in such regions. By reviewing 4014 studies from databases like IEEE Xplore and Science Direct, the research identified 12 success criteria organized into four main themes, emphasizing the crucial role of resource allocation in deploying effective HIS.

Keywords

Healthcare Information Systems; Developing Countries; Systematic Literature Review; Success Criteria and Resource Allocation.

INTRODUCTION

Healthcare is a fundamental human right, crucial globally [1]. Governments typically invest heavily in health systems, though Bangladesh's spending decreased from 6.2% to 4.3% of total expenditure [2]. Information systems (IS) are integral across sectors, from education to healthcare. Developed nations have demonstrated that information technology can boost productivity and accelerate socio-economic development in less developed countries [3]. The WHO recognizes the transformative role of ICT in healthcare , contrasting the advanced IS usage in industrialized nations with the struggles in developing ones, where the deployment of IS is vital despite limited resources [4, 5].

Research highlights the challenges in implementing health information systems (HIS) due to organizational, cultural, and technical factors [6]. Further studies and evaluations are essential for improving HIS adoption in underdeveloped regions [7, 9]. While wealthy nations prioritize universal healthcare, countries like Bangladesh face significant barriers due to a lack of centralized healthcare data, affecting patient care.

Literature Review

In the academic discourse, HIS, may be defined as a framework clarifying the complex interaction between people, processes, and administrative entities, all intended to provide crucial data that improve the quality of healthcare provision [10]. In a broad sense, a health information system (HIS) encompasses all standardised health-related data, from data collection to knowledge generation, with the overarching objective of enhancing healthcare service delivery and advancing public health initiatives within a country's purview [11]. It is crucial to emphasise that the effectiveness of health planning and policy creation, as well as the standard of healthcare provided, depends on the availability of reliable and quick access to data, which in turn acts as the cornerstone for thoughtful decision-making processes.

Although the countries that make up the Organisation for Economic Cooperation and Development (OECD) have made significant

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economic development, their healthcare systems continue to face several difficulties [12]. Even though these OECD nations have made tremendous socioeconomic progress, several areas of their healthcare system continue to receive little attention. For instance, when looking at nations like Mexico and Turkey, whose healthcare expenses per capita are below 500 US dollars at purchasing power parity exchange rates, several difficulties within their healthcare system come to the fore [13, 14]. These problems include a lack of qualified medical personnel about the population, a lack of comprehensive health insurance, cases of payment bribery for medical services, lengthy wait periods for doctor appointments, and barriers to healthcare access.

Hurst further argues that despite continual initiatives to improve the state of healthcare in OECD nations, persisting difficulties continue to undermine the calibre of healthcare services. However, a significant change occurred in 2015 when the OECD updated its rankings of South Asian nations. Due to its excellent efforts to strengthen economic resilience and promote steady growth, Bangladesh was promoted to a rating of 5 out of the 7 South Asian countries [15].

The management structure included in the healthcare information system has a significant impact on how services are delivered. According to 16, the health information system is essential for improving patient care, reducing expenses and mistakes, and bolstering the security of patient data. Many countries manage healthcare services using a decentralised approach that allows community members to participate in healthcare-related decision-making processes [16].

Information and communication technology (ICT) has the ability to produce the required results inside healthcare systems, according to the prestigious World Health Organisation (WHO) in an official statement [17]. Health Information Systems (HIS) are a crucial component of the healthcare delivery system, and their continued development is crucial for improving patient care, controlling costs, and operating efficiently. It is crucial to emphasise that medical ethics must be practised from the beginning of a healthcare professional's career, starting with the internship stage. Additionally, as a concentrated effort should be made to develop high-calibre medical practitioners, including medical ethics in the curriculum is of utmost importance [18].

The critical role of cost-effectiveness analyses in the growth and development of Bangladesh's Health Information Systems (HIS) [19]. Notably, Bangladesh still has a low incidence of private health insurance, and there is a noteworthy lack of governmental authority over the private healthcare industry.

According to a study conducted by Ahmed et al [20], the primary obstacle to the development and progress of Health Information Systems (HIS) in Bangladesh is the presence of budgetary limitations. A significant increase in the global burden of mental health disorders over the past two decades [20, 21, 22]. This upward trajectory has also been made worse by the COVID-19 pandemic.

It is essential to have a solid knowledge foundation that can be carefully tailored to different situations, resource limitations, and patients' particular circumstances and preferences. The development of ethical sensitivities, which acknowledges that illnesses have no respect for the identities of doctors or their patients, is a basic premise. While medical practice should ideally be supported by empirical data, it should also be flexible enough to make required alterations in unusual circumstances [23].

The recent outbreak of COVID-19 has shocked the world and brought a challenge for researchers [24]. Numerous actions have been taken as part of a disaster preparedness strategy in response to this situation, which include improving clinical skills, boosting laboratory capacity, reinforcing surveillance systems, and using the potential of artificial intelligence and technological applications for contact tracing [25].

Research Objectives

1. Identify barriers to accepting and successfully implementing Health Information Systems (HIS) in developing countries.
2. Analyze factors supporting effective HIS adoption and deployment within Bangladesh's healthcare industry.

Research Question

What established elements support Bangladesh's successful adoption and deployment of Information Systems (IS) in the healthcare sector?

Research Methodology

The systematic literature review (SLR) technique is the most common method for locating, analysing, and synthesising available information [26]. SLR is a flexible

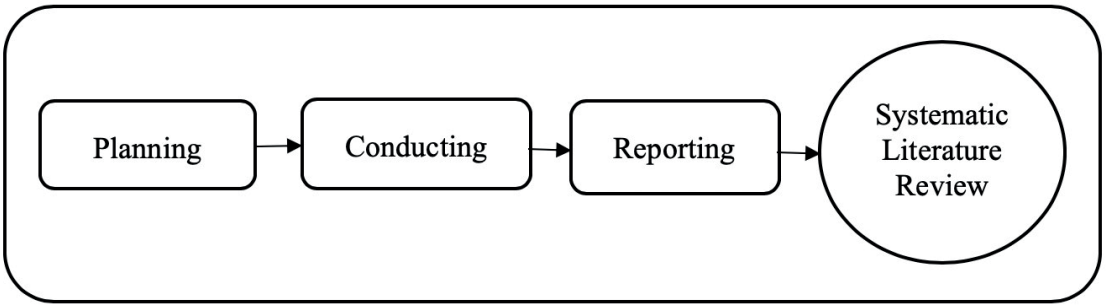

Figure 1 Systematic literature review process [26]

strategy that may be used to solve certain research objectives and a widely accepted and used in fields like software engineering and health information systems.

The main focus of SLRs is empirical data, which may be gathered using various research methods [27]. The main goal of an SLR is to give a thorough synthesis of the body of literature that is relevant to a certain research issue. The planning phase, the review execution phase, and the review reporting phase are the three main steps of the systematic review process.

The first planning phase of an SLR has three consecutive steps. These phases entail locating knowledge gaps in the literature, developing explicit research questions, and defining a review procedure. The latter involves carefully picking relevant keywords and search phrases. Many crucial procedures occur during the conducting phase. These phases include developing a thorough search strategy, allocating adequate resources, establishing inclusion and exclusion criteria, selecting primary studies wisely, rigorously assessing research quality, and synthesising gathered data. The production of the review report itself and the subsequent confirmation of its contents are part of the final phase, also known as the report review phase.

It is crucial to determine the need for a Systematic Literature Review (SLR) before starting one on a given topic. This requires explaining the justification for the SLR during the planning stage. As mentioned, the planning process is divided into three stages, each identified by different standards. Creating a review protocol specifying the strategic approach used during the review process is key to this step. A preliminary survey of the literature in the field of information systems was carried out to provide an example of this. This preliminary analysis served to outline the main elements of the review procedure. The researcher's fundamental knowledge of healthcare systems in underdeveloped nations was greatly influenced by these important publications, which helped to shape the review process.

Research questions: The following are the proposed research questions for this study: What have been the documented success factors for adopting and deploying Information Systems (IS) in healthcare settings in developing nations?

Development of review protocol: The next phase is the painstaking construction of a review protocol after determining the necessity of the review and formulating the research questions. The review protocol acts as a guide that specifies the rules guiding the whole review process, guaranteeing the gathering of unbiased and thorough data [26]. The development of a search strategy, the selection criteria for studies, the evaluation of research quality, and other steps are all included in this protocol's multiple stages [27]. A thorough explanation of the review procedure used for this study is provided in Appendix A. It is advised that the review methodology goes through professional and seasoned researchers' examination.

Data sources and search strategy: Finding relevant papers that are closely connected with the current research topics is the goal of the search approach. The need to develop a neutral and unbiased search strategy as a key component of this approach [29]. Three electronic databases have been specifically chosen to assemble the pertinent studies:

- IEEE Xplore
- ScienceDirect
- Ebsco Databases

These databases were chosen for several convincing reasons. First off, they are frequently used in the context of information systems and enable complex query searches. Notably, IEEE Xplore and ScienceDirect both include sizable collections of articles that have undergone peer review, providing full-text access to publications. In particular, ScienceDirect is recognised as a reliable source of information on scientific, technological, and medical research. EBSCO databases provide a wide range of topics and an SFX link function, allowing users to check on the status of electronic goods and get immediate access to full-text material.

The current research questions were the foundation for creating the search string, which was then applied to the selected databases. The preliminary searches served the twin purposes of locating current systematic reviews and evaluating the possible relevance of relevant articles. A different collection of pertinent material was produced by each of the chosen databases. The Figure 8 in the research shows the search technique in visual form.

Table 1: Search query, databases and results for this study

Search Query	Database	Date/Time	Results from first hit	Results after refining by years. (2017-19)
("Information systems" OR "information technology" OR "ICT") AND ("Adoption factor" OR "success factor" OR "impediment") AND (Healthcare OR Health services) AND ("Developing countries" OR "Less developed countries")	IEEE Xplore	5th September '18 @ 21:36	1901	277
	EBSCO host	5th September '18 @ 23:21	101	15
	Science Direct	5th September '18 @ 23:46	2012	437
	Total		**4014**	**729**

Study selection process: There were nine crucial phases in the tough and exhaustive method for choosing research. Table 2 provides a thorough, detailed breakdown of this rigorous procedure for openness and clarity.

Table 2: The steps of selecting primary studies

Process steps	Number of excluded studies.	Number of studies left.
Step 1: Look for September 2018		**4014**
Step 2: By year (2017-2019) exclude	3285	**729**
Step 3: Exclude all periodicals, books, chapters, and courses.	107	**622**
Step 4: elimination of duplicates	3	**619**
Step 5: Not available in English	1	**618**
Step 6: Based on the title and abstract, exclude	551	**67**
Step 7: No full text available.	2	**65**
Step 8: Based on thorough text scanning and quality evaluation, exclude	46	**19**
Step 9: exclude research based on obstacles	7	**12**
Total Included		**12**

The initial database search in the study's Phase 1 involved the specified search query and produced 4,014 papers.

There were 729 fewer studies in Phase 2 due to the results being revised based on publication years between 2017 and 2019.

The pool was then reduced to 622 studies in Phase 3 after eliminating 107 studies that comprised periodicals, books, chapters, and courses. The online reference management application RefWorks received these 622 studies in a methodical manner.

The elimination of 3 duplicate studies from RefWorks during Phase 4 left 619 unique studies.

Only one research from Phase 5 remained untranslated since all other investigations were discarded. 618 studies were kept as a result.

After eliminating 551 research based on the substance of their titles and abstracts in Phase 6, 67 papers were left to be further examined.

Phase 7 removed all but 65 of the papers that lacked full-text access.

In Phase 8, the remaining studies were scrutinised through full-text analysis and quality evaluation, producing 19 appropriate publications for data analysis and reporting.

Phase 9 excluded articles with identified impediments, leaving a final group of 12 papers for in-depth research and outcome reporting.

Results

To rigorously address the research questions, 12 primary studies were meticulously selected, detailed in Appendix B. This chapter elucidates the outcomes from these studies, categorizing them for easy cross-referencing within our Systematic Literature Review (SLR) using unique identifiers [P1] to [P4], etc. The primary studies listed in Appendix B employ diverse research approaches. The breakdown includes 9 journal papers (75%) and 3 conference articles (25%).

Research Methods

Twelve primary studies were chosen, and various research strategies were used, as exhaustively described in Table 3. This methodology included action research, literature review, interviews, surveys, and design science research. Eight of these studies, or nearly 67% of the total, are empirical, according to the analysis of all the research, while the other four studies, or roughly 33% of the total, are non-empirical.

Table 3: Classification of the 19 key studies' research techniques

Research Type	Number of primary studies	Percentage	Reference
Survey	7	42%	[P2], [P3], [P5], [P7], [P9], [P10], [P11]
Systematic literature review	4	37%	[P4], [P6], [P8], [[P12]
Action research	1	5%	[P1]

Table 4: Classification of study types

Type of study	Survey	Action Research	SLR	Total
Empirical	7	1		**8**
Non-empirical			4	**4**

Table 4 shows a noteworthy finding in the context of eleven empirical investigations that used three distinct research approaches. The survey method was largely preferred; two studies adopted the design science research (DSR) methodology, while one study entered the action research field by particularly evaluating preparedness across several organizations in Kenya.

Research Countries

The main studies encompassed projects in developing nations such as Bangladesh, Ghana, Iran, Kenya, Malawi, Namibia, and South Africa, extending to regions like Latin America and Sub-Saharan Africa, underscoring the global scope of the research. Three studies specifically explored Information Systems (IS) deployment in the healthcare sector without referencing specific countries. These papers were selected for their relevance to developing nations' unique challenges. Table 5 in our research provides a detailed geographic distribution of these studies, emphasizing their diverse national focuses.

Table 5: List of nations cited in 19 main studies

Country/Region	Number of studies	Reference
Bangladesh	1	P[7]
Ghana	2	P[2], P[3]
Iran	1	P[5]
Kenya	1	P[1]
Malawi	1	P[10]
Namibia	1	P[11]
South Africa	1	P[9]
Latin American's developing countries	1	P[12]
Sub Saharan Africa	1	P[8]
Developing countries	1	P[6]
Overall countries	1	P[4]

Technology Focus

This research categorizes primary studies by technological focus, from electronic health records (EHR), mobile health (m-health), and telemedicine. EHR features in five studies and HIS in six, spanning both Health and Hospital Information Systems. The remainder, labelled "others" in Table 6, cover diverse technologies, including three studies on m-health.

Table 6: Classification of original research based on its emphasis on technology

Technology name	Number of studies	Reference
HER	3	P[1], P[3], P[8]
HIS	3	P[4], P[5], P[11]
m-health	3	P[6], P[2], P[9]
Others	3	P[7], P[10], P[12]

Characteristics of Each Study

Table 9 provides a thorough overview of all primary studies, outlining crucial details like publication year, paper classification (designated by 'C' for conference papers and 'J' for journal papers), research methodology (classified as 'E' for empirical and 'NE' for non-empirical), study typology, geographical context (country/region), research focus, and the particular technology under investigation.

Table 7: Explanation of each research in detail

Primary study	Year	Conference (C) / Journal (J)	Research Method	Empirical (E)/ Non-empirical (NE)	Country / Region	Adoption (A)	Technology
P1	2017	J	Action Re-search	NE	Kenya	A	EHR
P2	2017	J	Survey	E	Ghana	A	m-health
P3	2017	J	Survey	E	Ghana	A	EHR
P4	2017	J	SLR	NE	Overall coun- tries	A	HIS
P5	2017	J	Survey	E	Iran	A	HIS
P6	2018	J	SLR	NE	Developing countries	A	m-health
P7	2018	J	Survey	E	Bangladesh	A	e-health, telemedicine
P8	2017	J	SLR	NE	Sub-Saharan Africa	A	EHR
P9	2018	C	Survey	E	South Africa	A	m-health
P10	2017	C	Survey	E	Malawi	A	Geographic IS
P11	2018	C	Survey	E	Namibia	A	HIS
P12	2018	J	SLR	NE	Latin Ameri-can's developing countries	A	Internet of medical things

It is crucial to stress that every study in our analysis is clearly connected to a certain technology domain. For instance, P[10] explores Geographic Information Systems (GIS), which are computer-based systems used for mapping and data analysis [30]. Due to its amazing capacity to handle enormous amounts of information with surprising efficiency, GIS plays a crucial role in the healthcare area in easing data integration and allowing complex visualisation techniques [29].

Analysis of Results

In the following sections, we go into more detail about the conclusions drawn from the Systematic Literature Review (SLR) about the barriers to and supportive factors influencing the adoption of information systems in the healthcare sector of developing countries.

Success Factors

The twelve success elements for the adoption of information technology in healthcare in developing countries have been meticulously organised inside this inquiry. These twelve success characteristics have been methodically divided into four different thematic areas, and Table 8 provides a handy overview of these divisions for your convenience.

Table 8: Characteristics that are frequently successful in first research

Success Factors	Primary Resource	Frequency
The use of resources and financial considerations 8 (42%)		
Available resource power	P1, P3, P4	3
Connectivity to the power supply	P1, P11	2
Accessible source	P9, P11	2
Inexpensive price	P7, P8, P9, P12, P11	5
Lower costs	P9, P10	2
Cultural and political issues 7 (37%)		
Social implication	P2, P5, P9, P7	4
Governmental influence	P1, P6, P8	3
Relations between management and workers Superior managerial ability	P4	1
Setting of use Place in the world	P4	1
	P11	1
Education, instruction, and knowledge 6 (32%)		
Education and Training Awareness	P3, P4	2
Skilled personnel	P8 P5	2
Awareness	P8, P7,	2
Skilful Staff	P9	1
Quality of the system 6 (32%)		
Simplicity of usage	P2, P4, P6, P7	4
Distant patient access	P6, P9	2
Patient Secuirity	P9, P12	2
Private and dependable components of systems	P2, P3, P4, P9, P12	5

Five key elements for success identified are resource availability, reliable power, seamless connectivity, cost-effectiveness, and prudent resource allocation based on historical usage [P1, P3, P4].

Resource availability is vital for effective Electronic Medical Records (EMR) use, requiring balanced resource allocation and dedicated personnel for specific tasks [P1, P3, P4]. Power and connectivity are essential, with a 75% daily power supply needed for EMR installation, and connectivity critical for m-health in developing regions [P1, P9].

Affordability is a major concern, affecting healthcare information systems significantly in developing countries. Reasonable pricing is essential for e-health use in Bangladesh and sub-Saharan Africa, and cost is a key factor in adopting electronic health records and the Internet of Medical Things in Latin America and Namibia [P7, P8, P9, P11, P12].

Cost reduction through smart resource use, such as reusing staff and assets, is critical, with potential cost savings driving e-healthcare adoption [P9, P10].

Cultural and Political Issues:

Social Influence: Community leaders play a significant role in supporting information system implementation, with cultural influences crucial in assessing hospital information systems [P2, P5].

Governmental Influence: Government support is crucial for adopting EMR and m-health services, with government incentives important in sub-Saharan Africa [P1, P6, P8, P11].

Education, Training, and Awareness:

Training is crucial for EHR user acceptance, requiring ongoing, iterative sessions [P3, P4, P8]. Education in computer skills is vital for medical students, enhancing EHR system use [P5, P8]. Awareness, promoted through

targeted advertising, motivates m-health success [P7, P9].

Competent staff is essential, with skilled employees capable of innovating and efficiently using their skills [P4].

System Quality

Usability is a key motivator for adopting m-health and e-health systems, influencing user attitudes and intentions [P2, P4, P6, P7, P9]. Remote access to patient data drives m-health use in developing countries, with security and privacy critical for user approval [P6, P9, P12]. System features should include ease of use, responsiveness, customizability, good interface design, and accuracy [P2, P3, P4, P9, P12].

DISCUSSION

This study's systematic literature review identifies 19 key success criteria across four themes: Resource Utilization (42%), Cultural and Political Dynamics (37%), Education and Training (32%), and System Quality (32%). These factors highlight the challenges of deploying healthcare Information Systems (IS) in developing countries, emphasizing cost-effectiveness and effective management for successful HIS implementation [P1-P12]. The study also compares these findings with the DeLone and McLean IS success model, noting the neglect of systems quality in developing countries' HIS adoption models [P1-P12].

Table 9: HIS success elements and the D&M IS success model are contrasted

D&M success model	Success aspects according to my evaluation
Systems Excellence	System quality: 1. User friendliness 2. Remote patient access 3. Security and privacy 4. properties of systems
Information Excellence	-
Willingness to utilise	**The use of resources and financial considerations** 1. Accessibility 2. Power 3. Connectivity 4. Reasonable cost 5. Cut costs
Customer happiness	-
Personal effect	**Knowledge, education, and awareness** 1. Instruction 2. Education 3. Conscience 4. Professional staff
Impact on the organisation	**Political and cultural concerns** 1. Social implication 2. Governmental influence 3. Management and employee relationships 4. Top management leadership 5. Use context 6. Geographic location

Recommendation for Successful IS Implementation in Healthcare in Developing Countries

Based on the success factors identified for Information Systems (IS) implementation in healthcare within developing countries, key recommendations are:

1. **Resource Utilization and Monetary Factors**: Healthcare organizations should use resources judiciously, optimize infrastructure, and seek affordable IS solutions fitting their needs.
2. **Cultural and Political Issues**: Address barriers by promoting ethical governance and stability, ensuring collaboration between healthcare and government bodies.
3. **Education, Training, and Awareness**: Implement training to boost digital literacy among healthcare workers and run campaigns highlighting IS benefits.
4. **System Quality**: Focus on high-quality, user-friendly IS solutions by involving end-users in the selection process.
5. **Strategic Planning**: Develop long-term, adaptable plans for IS implementation considering local challenges.
6. **Financial Support and ROI**: Facilitate government and organizational collaboration for financial backing and clear ROI assessments to secure funding and support IS adoption.

Direction for future research

Future research should explore the practical impacts of key success factors for Information Systems (IS) implementation in healthcare in developing countries. It is vital to conduct empirical studies and detailed case analyses to assess the real-world effectiveness

of these strategies, particularly in navigating cultural and political challenges across diverse regions. Understanding the role of local healthcare policies, governance, and economic conditions in IS success is also critical. Additionally, examining the influence of government support levels on IS adoption and outcomes could provide essential insights for policy-making. Ongoing research and collaboration are crucial for leveraging IS to improve healthcare accessibility, quality, and efficiency, benefiting providers and communities in developing countries.

CONCLUSION

This study identifies key success factors for implementing Information Systems (IS) in healthcare across developing countries. Critical factors include allocating resources wisely, addressing cultural and political challenges, providing extensive education and training, and choosing high-quality systems. Effective IS implementation requires long-term dedication, meticulous planning, adequate financial backing, and political stability. Despite existing hurdles, these success factors offer a blueprint for healthcare organizations and governments to navigate obstacles and harness IS for better healthcare delivery and patient outcomes. Developing countries can bridge the healthcare technology divide and improve care quality by optimising resource use, raising awareness, and encouraging collaboration.

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Authors' Contributions: Shafiqur Rahman was responsible for the study's conception and design, as well as data collection and analysis. Aminul Islam drafted the research paper and verified the data. Both authors critically reviewed and approved the final manuscript. Shafiqur Rahman submitted the final version.

Ethical Clearance: This research utilized only secondary data; no primary data were collected. Thus, no ethical clearance was required.

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