Influencing Factors for IT Software Project Failures in Developing Countries — A Critical Literature Survey

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Abstract: Software projects still suffer from high failure rates, especially in developing countries. However, no one evaluated the current studies that were conducted in the context of Saudi Arabia (SA), a developing country. We try to fill this gap using a property-based critical literature survey of existing studies. The findings suggest that management/organization factors including lack of top management support, organizational culture, business process reengineering, lack of training, and unavailability of project management office are main factors that influence software project failures in SA. However, technical and financial factors are secondary; this might be due to the extensive government subsidization for IT. Our analysis can assist software project managers in SA, and it may apply to other developing countries in the Middle East.

Key words: software project management, software engineering, success, failure, developing countries.

1. Introduction

Although several researchers have been identifying the factors behind the high rate of failures for software projects, the factors are still divergent and complex [1][2]. In the UK, substantial failures in software development efforts for the London Ambulance System resulted in huge costs [3]. In the US, Hewlett-Packard (HP) lost USD 160 million in 2004 from development system failures [4]. In 2014, Toyota announced a recall of its Prius vehicles to fix a software glitch that could cause its cars to stall [5]. The majority of the Saudi Arabia (SA) software systems in the hospital and healthcare sectors have been classified as failed projects [6]. The problem is then commonplace throughout the world. Meanwhile, there is little agreement concerning the global failure factors [1], [2], [7]. Moreover, while it is well-known and widely used, the term "failure" is difficult to define [1]. SA has one of the highest gross national incomes per capita. Also, it is one of the highest per capita expenditures on IT. Despite the rich body of research on IT failures in SA, failed projects continue to occur. The objective of this paper is to discuss and debate the reasons for software project failures in Saudi organizations and to provide some directions for future research. To this end, we used a property-based critical literature survey of current studies related software project failures in SA. Although several studies have been conducted in SA, no formal study has hitherto been conducted to evaluate the studies already available. This paper attempts to fill this gap. There have several attempts to address the problem throughout the world, in the US, UK, Australia, Japan, Malaysia, and Jordan [5], [8]-[13]. This study focuses on the effort that has been put to address the issue in SA.

2. A Property-Based Critical Survey

A critical literature survey is far more than a simple summary of the literature; it is an analysis and evaluation of the reviewed studies. Therefore, it requires an understanding of the material and the ability to analyze and classify that material using appropriate criteria [14]. Throughout the process of surveying existing works, we discovered a set of properties that can be used to classify and compare such studies. This set of properties is expected to help guide researchers trying to extract the important factors that lead to software project failures. Our proposed properties are discussed below.

- *Objective*: Understanding the objectives is critical for evaluating factors that have an influence on failure. This attribute states whether the study focus was "failure," "success," or both.
- *Definability*: As mentioned in Section 1, such definition of "failure" is not typically clearly stated. Therefore, this property represents whether the study author clearly defined the term failure.
- *Measurability*: DeMarco asserts that "You cannot control what you cannot measure"[15]. The measurability property determines what metrics, if any, were used to measure failure.
- *Perspective*: Failure can be viewed from the perspective of software developers, project managers (PM), top management, users, and clients vs. suppliers.
- *Factors List*: This property describes the resulting factors that influence failure (or success).
- *Methodology*: It specifies the investigation strategy: survey, case study, or experiment [16].
- *Environment*: It determines whether the study conduct in academia, industry, or a mix of the two.
- *Practicality*: This property determines whether the study concentrates on specific IT software project types; for example, knowledge systems and enterprise resource planning (ERP).
- *Sector*: This property determines the business sector and type of firm on which the study was conducted. The sectors include public, private, and non-profit sectors, while the firm type specifies the type of firm studied, such as education, military, or e-government.

3. Evaluation against Properties

Based on the properties discussed in the previous section, we evaluated the works that were conducted in (2011-2015) in a SA context. Tables 1 through 12 discuss twelve works in chronological order.

Table 1. Study of (Aldayel *et al*. 2011) [17]

Prop.	Comments
Obj.	Success—to identify the CSFs of ERP systems through exploring the literature on ERP implementation
Def.	The used CSFs are those proposed by [18][19] were used
Meas.	No mention
Persp.	Technical perspective and user perspectives
Factors	PM, ERP selection, and the training offered to the end users
Methgy.	Two questionnaires were designed, (1) for staff working on Madar to find the CSFs from a technical prospective; Likert Scale was used, and (2) for the end-users to find the user satisfaction; Guttman scale and Rating scale were used. 130 questionnaire requests were distributed manually and via email; response rate was 29%. SPSS was used to test results.
Env.	Academic
Pract.	Madar system, an ERP system developed at King Saud University
Sector	Public – Educational institutes

Table 2. Study of (Al-turki 2011) [20]

Prop.	Comments
Obj.	Success— to identify best practices and factors affecting successful implementations of ERP systems.
Def.	No mention
Meas.	It was used a category evaluation system; complete success; partial success; and complete failure
Persp.	Implementers and vendors
Factors	Human related factors such as leadership, change management and training. The results suggest having business leadership rather than IT leadership accompanied by extensive change management and training programs
Methgy.	A questionnaire distributed over different types of Saudi organizations (local, foreign, multinational,

	conglomerates, SMEs). 93 organizations were responded.
Env.	Academic
Pract.	ERP
Sector	Public and private

Table 3. Study of (Abouzahra 2011) [6]

Pr	Comments
Obj.	Failure— to study healthcare software project causes of failure compared to other types of project.
Def.	Failure is defined as failing to meet the objectives in terms of project scope, schedule, or cost [9].
Meas.	No mention
Persp.	Managerial
Factors	Unclear scope, undefined risks, undefined stakeholders, and communication.
Methgy.	A 4-year study of the healthcare software projects in 6 hospitals in (2007-2011). The author was able to study those projects (29 projects) closely and in person as a PM consultant for the hospitals.
Env.	Industry
Pract.	HIS (healthcare information systems)
Sector	Public

Table 4. Study of (Alfaadel *et al.* 2012) [21]

Prop.	Comments
Obj.	Success & failure— (1) to find the most important reasons for the failure and success of software projects (2) to question about the definition of project success.
Def.	For success, one of the study objectives is to find the best definition of success. For failure, the taxonomy of the reasons for failure developed in [alahmad] was used.
Meas.	No mention
Persp.	No mention
Factors	Three failure factors (1) not having clear, complete and stable requirements (2) organizational culture and conflict of interest (politics) (3) poor planning. Three success factors (1) clear statement of requirements (2) top management support (3) proper project planning.
Methgy.	The questionnaire was distributed online using esurveyspro.com web tools, which send email invitations. Respondents were given 40 days to complete the questionnaire. a number of incomplete responses were rejected. A total of 308 responses were collected and analyzed, which represents a 17.6% response rate.
Env.	Academic (2) and industry (1)
Pract.	IT projects
Sector	Public sector (64%) and private sector (36%)

Table 5. Study of (Sharief 2012) [22]

Prop.	Comments
Obj.	Success & failure— to assess the key challenges of the e-government implementation
Def.	No mention
Meas.	No mention
Persp.	Organizational and technical
Factors	From 11 challenges, the greatest importance factor was citizen trust in e-government challenges. Followed with legal and regulatory challenges; and information and data challenges
Methgy.	The selected firms had already implemented the e-government projects. The questionnaire was handed to 50 experts (varying in sex, education, and experience years) working on different e-government projects
Env.	Academic
Pract.	e-government projects
Sector	Public

Table 6. Study of (Alfarraj *et al*. 2013) [23]

Prop.	Comments
Obj.	Success & failure— to identify the factors influencing the implementation and development of e-government in SA
Def.	No mention
Meas.	No mention
Persp.	Cooperation & collaboration
Factors	Cooperation & collaboration factors which include (1) cooperation of government sectors with Yesser program1, (2) cooperation of government sectors with e-services developers to developer electronic services, (3) cooperation of government sectors with each other to transfer the required data for developing electronic services, (4) cooperation of the top managements with their departments within organizations to facilitate the implementation and development of e-government, (5) cooperation of financial departments with other internal departments within government sectors to facilitate funding the projects of IT, and (6) the cooperation of Yesser program and government sectors with researchers and research centers to conduct studies about e-government implementation and its issues
Methgy.	21 unstructured qualitative interviews were conducted with different groups of

[1] Yesser program is an umbrella for all e-government activities, procedures, legislations and other related issues and acts as the government's controller. (www.yesser.gov.sa)

	participants involved in the development and implementation. Grounded theory techniques were employed to analyze data.
Env.	Academic
Pract.	e-government
Sector	Public

Table 7. Study of (Almajed and Mayhew 2013) [24]

Prop.	Comments
Obj.	Success— to identify the success factors from chief information officers' (CIOs) perceptive.
Def.	No mention
Meas.	No mention
Persp.	CIO
Factors	Organizational: top management support and commitment strategic planning, project management office (PMO), conflict of interest, top management stability. Process: management of (project, change, stakeholders, risk, supplier, communication, and knowledge) plus business process reengineering (BPR[2]). Resource management: competency, infrastructure, training & education, reward & recognition.
Methgy.	A semi-structure interview. Invitations were sent to 20 CIOs in the field who had at least five years' experience of IT management; only 10 agreed to participate. The researchers conducted the interviews using the VoIP such as Skype.
Env.	Academic
Pract.	IT software projects
Sector	Public

Table 8: Study of (Altahtooh and Emsley 2013) [26]

Pr	Comments
Obj.	Success & failure— to discover the role of a PMO on success and failure.
Def.	They believed the definition is tricky so that researchers have tried to find success factors to lead projects to success
Meas.	No mention
Persp.	Managers perspective
Factors	PMO
Methgy.	Questionnaires were sent to 173 participants by post and email. The response rate of sample size was 34.1%. The sample frame was distributed across five geographical areas in SA (Dhahran, Riyadh, Jeddah, Yanbu and Madinah). SPSS package was used in data analysis.
Env.	Academic
Pract.	IT projects
Sector	Public (42%) and private (58%)

Table 9. Study of (Saleh *et al.* 2013) [27]

Prop.	Comments
Obj.	Success— to fill the gap between western countries and middle eastern countries especially SA in conducting studies about CSFs of ERP implementation
Def.	No mention
Meas.	No mention
Persp.	Organizational
Factors	Vendor & user support, consultant competence, and BPR. Top management was not significant
Methgy.	A sample size of 150 organizations varying sizes, activities, ownership were chosen in this study. Response rate was 49.3%
Env.	Academic
Pract.	ERP
Sector	Public and private

Table 10. Study of (Alateyah *et al.* 2013) [28]

Prop.	Comments
Obj.	Success & Failure— to identify the challenges that face adoption of e-government in SA
Def.	No mention
Meas.	No mention
Persp.	Stakeholders, culture, and technical
Factors	Quality of service, diffusion of innovation, computer & information literacy, culture, lack of awareness, technical infrastructure, website design, security, privacy, and trust.
Methgy.	(1) Citizens' questionnaire had 15 closed-ended questions distributed online (2) Government employees' questionnaire had 23 closed-ended questions handed in person (3) Experts' interview had 29 closed-ended questions which interviewed in person, and the results were tested using SPSS
Env.	Academic
Pract.	e-government
Sector	Public

Table 11. Study of (Almajed and Mayhew 2014) [13]

Prop.	Comments
Obj.	Success— to compare the CSFs for software projects between SA and Malaysia
Def.	No mention
Meas.	No mention

[2] BPR is the analysis and redesign of workflow within and between enterprises [25]

Persp.	CIO
Factors	In both countries, success was influenced by PM; and not influenced by competency. In SA, success was influenced by top management support while it is influenced by communication management in Malaysia. In SA, organizational culture moderates the relationships among top management support, PM, and IT project success. In Malaysian, organizational culture moderates the relationships among communication management, PM, and IT project success.
Methgy.	A survey questionnaire was sent to 140 CIOs (varying in age and education) directly or indirectly using email and LinkedIn social network. The response which was 52%. SPSS and SmartPLS packages were used for analysis
Env.	Academic
Pract.	IT projects
Sector	Public

	could lead to failure
Def.	From the participants responses, a failed project is a result (product or service) of unprofessional management practices (related to plan and process) employed by the project team (people)
Meas.	IT project failure may be linked to the following elements in PM knowledge: process, plan, people and product (3Ps = P); the relationship between these elements of 3Ps = P could be shown as follows: IT project = [(Plan * Process) / People] = Product
Persp.	Managerial (72% of factors), technical and financial (28% of factors)
Factors	Factors were classified into four groups: P1 that happen in the planning stage – such as unclear objectives, P2 that happen in the execution stage – such as poor communication, P3 that are relating to the persons involved in a project, such as conflict among users, and P4 that happen after delivering a project. As a result, very high risk factors can fall in (P2) then (P1)

Table 12. Study of (Altahtooh and Emsley 2015) [29]

Prop.	**Comments**
Obj.	Failure— to identify IT project risk factors that
Methgy.	Semi-structured in-depth interviews using the critical incident technique –CIT (Woolsey 1986). The sample size of CIT was 15 IT project managers who were interviewed in SA, discussing about 30 projects
Env.	Academic
Pract.	IT projects
Sector	Public and private

4. Observations

Based on these analyses, our observations associated with the influencing factors as follows:

- Most studies did not truly define the terms failure. Each researcher should have provided the questionnaire participants with specific definitions of failure. Because this did not happen, answers to the questionnaire questions are debatable because answers were supplied based on the personal definition of the terms failure of each participant, and their definitions may differ from that of the interviewers or researchers. This issue, as we explained in section 1, is not related solely to SA studies but applies equally as well to studies worldwide. We think dealing with failure as if it were white and black is unfair. It is difficult to consider an entire project as a failure simply because cost violations or scheduling failures occurred. The same is true of a successful project: a project cannot be considered a success solely based on customer satisfaction without considering the full scope or the objectives of the project. According to Schwalbe [30], there are three criteria that indicate when a project is not success: (1) when it has not met the triple constraints of scope, cost, and schedule, (2) when the customer or sponsor is not satisfied, and (3) when the results do not meet the main objectives. Some studies defined failure and success using grading scales: complete success, partial success, and complete failure [20].
- Although the failure issue occurs primarily in industry as opposed to academia, almost all the reviewed studies were conducted by academics, which is indicative of a gap between industry and academia in SA. However, working with real-world cases or systems from the industry or market is a common problem in much IT research. Another observation is about the existence of research barriers in the private sector compared with the public sector. In SA, no study was conducted in the non-profit sector, and the number of studies conducted in the private sector was small compared to those conducted in the public sector.
- We classified the factors affecting software project failures in SA into three main perspectives: technical, end-user, and management/organization. Figure 1 shows various influencing factors from those three perspectives. Although PM is part of the managerial/organizational perspective, we separated it because it has become a separate, independent branch.

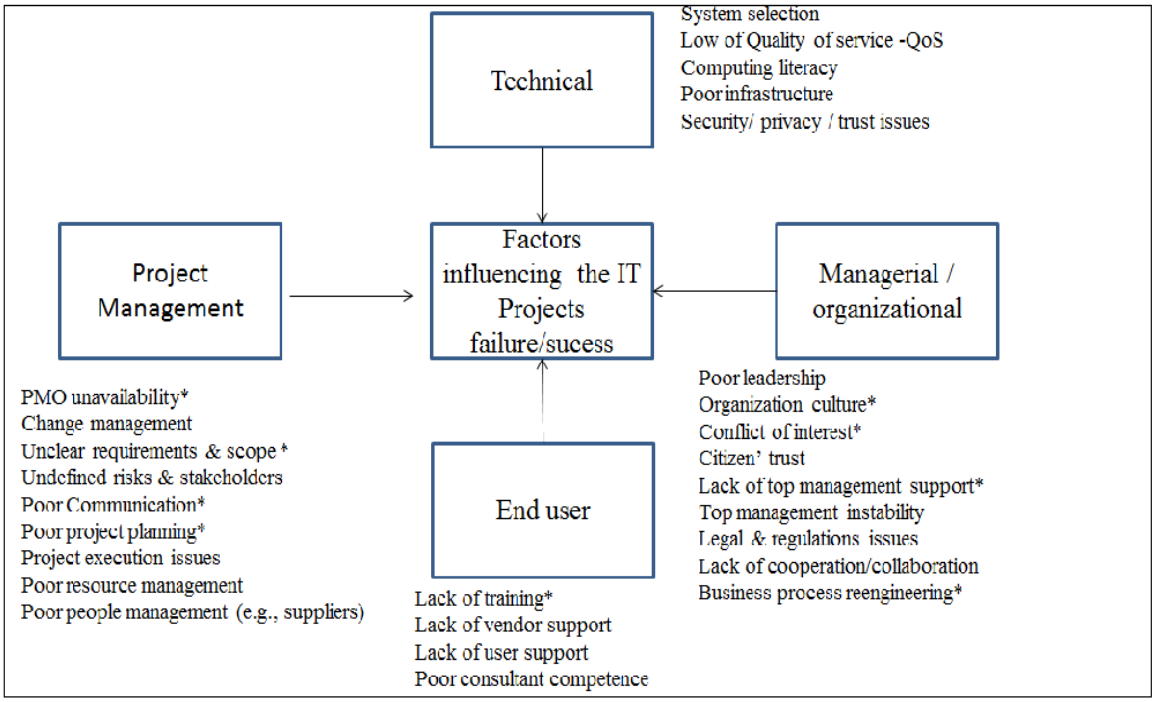

Fig. 1. Classification of factors based on three main perspectives.

From Fig. 1, the most influential factors are located under the management/organizational and PM perspectives. Those marked with an asterisk were mentioned in more than one study, which usually means they are more important. It is noteworthy that all the factors with asterisks belong to the managerial/organizational and PM groups except the training, which belongs to the end-user perspective. The following are general comments about the important factors:

- It makes sense that the early stage in managing a software project is particularly important. This stage guides the execution of the entire project because it is responsible for maintaining a workable plan to ensure that the project addresses the organization's needs. Therefore, when the early stage works out for the best, problems such as unclear objectives, unclear requirements, poor planning, undefined risks, and undefined stakeholders (all listed under the PM group in Figure 1) can be expected to disappear.
- Organizational culture plays a vital role in the success or failure not only in SA but also in other Middle Eastern countries. Even in fully industrialized countries such as the US, the organizational culture is a prime reason for some failures, such as the well-known failure of the FBI VCF management system [10].
- From the end-user point of view, vendor support is critical in avoiding failures. From our experience, the reason might be that IT software projects in SA and in the other Gulf states currently depend largely on commercial products rather than on systems developed in-house. This is true in the public sector.
- All the factors listed in the PM group belong to one or more of the nine PM knowledge areas: integration, scope, time, cost, quality, human resource, communication, risk, and procurement management [30].
- Costs (or budget) have no clear direct impact on failure. This fact confirms the results of some previous studies that showed the low influence of cost in the success or failure of projects in SA. We expected that result because of the huge influence SA governmental financial support has in the IT sector. The problem in SA, however, lies with the business environment, which still

suffers from many managerial and organizational issues. Like other developing countries, the business environment in SA is characterized by centralization and autocratic leadership. Consequently, BPR as shown in Figure 1, affected the software projects in SA. A disturbing fact about SA is that poor management occurs not only in the IT field but also in other fields such as construction projects [31]. In the near future, the negative impact of this problem is expected to diminish, especially in the public sector because Saudi organizations have recently been required to establish PMOs to raise efficiency and improve project delivery [26]. In turn, that has implications for decreasing the failure rates. According to Altahtooh and Emsley [26], the initial results of forming PMOs in SA and other developing countries indicated that this concept is still at an immature stage compared with developed countries.

- Our findings were confirmed by the past and current literature not only in SA but also in other countries. In general, management/leadership skills and organization culture were cited by [13][17], [20], [24], [26], [29],[32] as an important success criterion in IT projects.

5. Conclusion and Future Work

Many organizations around the world suffer from the high rate of software projects failure. There has been a number of studies conducted to address this issue in Saudi Arabia (SA), a developing country. However, there has been lack in evaluation of these studies. This paper has tried to fill this gap by carrying out a property-based critical literature survey aims at identify the factors affecting the software project failures in SA. Main factors have been found to be more human related than technical or financial factors. In particular, lack of top management support, organization culture, business process reengineering, lack of training, and unavailability of PMO. The technical and financial factors however have low influence because of the strong financial capabilities in total. The paper is important for software engineering community in the developing countries. We found that despite all the studies discussed the high failure rate of software projects in SA, no study presented any real world case. For this, we are planning to present a real-world failure case in SA. In addition, we are planning to perform a wide survey on public and private organizations in SA regarding factors leading to failure. The results of both studies (i.e., survey and a real-world failure case; which are going on) would be compared among the results coming up here and in the other studies.

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