# Successful IS/IT projects in Healthcare: Pretesting a questionnaire

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**Abstract**

Over the last decade, health systems have faced growing challenges, due mainly to population-ageing and an increase of chronic diseases, which lead to a significant rise in costs and difficulties in accessing healthcare. Countries have made a huge effort that has mainly consisted in significant increase in health financing  the expansion of health services facilities, the adoption of new information systems and technology (IS/IT), improving access to medicines, and continued endeavours to enhance organizational management and the sustainability of healthcare services. IS/IT will undoubtedly represent an important tool for providing adequate answers to all these challenges and these systems have the potential to reduce healthcare costs, as well as to improve outcomes. The recognition of project management and maturity models has been evidenced over the last years by the large investments made by health organizations to develop competencies and skills. This paper proposes a new approach, which assumes that project management will mediate the relationship between organisational maturity and the success of IS/IT projects. The questionnaire developed for this research was pre-tested. The advantages of this procedure are discussed in detail. The results allowed for a more reliable definition of the three scales that support the analytical model.

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## 1. Introduction

The ageing population and the growth of related health problems nowadays require particular attention and greater care[1]. The demand of professionals, managers, policy-makers and the public in general for more reliable and accurate information puts pressure on national budgets to their limits[2]. On the other hand, public policies appear to systematically fail users' expectations[3]. IS/IT in healthcare play a central role in modern societies, helping managed the costs and improving healthcare[4]. The introduction of IS/IT in organizations offers health professionals great opportunities to enhance the efficiency and effectiveness of care[5]. Several studies have shown that users want more and better information, in order to decide about their own health and their families[6]. The new challenges that face the public health sector required dramatic changes and improvements in internal procedures, which lead health organisations to investment largely in IS/IT, with a huge spending of public financial resources. The health sector has experienced a significant shift in the use of IS/IT systems, especially the internet, remote health monitoring, online consultation, e-prescriptions, e-clinic, and patients' information access. To overcome paper-based medical records that are easily misplaced and can cause serious problems, such as the need for repeated diagnostic tests or delays in the planning of care, hospitals have started to use IS/IT to facilitate the process of patient care through the generation of electronic health records[7]. These systems were designed to support clinicians in accessing and working with a variety of patient information[8] and for enhancing health care quality by coordinating information sharing[9]. Real-time access and the exchange and receipt of data provide by IS/IT have improved clinical requests, have reduced the duplication of care services, and have supported better decision making related to patient care[10]. The use of IS/IT in health care aims to help professionals' day-to-day activities, increasing their efficiency, supporting specialised services, incrementing quality, and also reducing medical errors[11]. This study aims to investigate whether health institutions' maturity has a positive influence on the success of IS/IT projects implementation, and whether the application of management practices mediates this relationship. The research is based on the collection of healthcare professionals' perceptions through a national survey.

## 2. Literature Review

The increasing changes in technology and business environment changes has meant that greater demands are required from traditional management models, which have difficulties in providing adequate answer to stakeholders' expectations. IS/IT have been recognized over last decade as being an important factor for the achievement of the objectives of access, efficiency, effectiveness and transparency[12]. Remarkable progress has been made in the field of medicine, as well in information technology[13,14], due to their impact on health care organizations, as well as the potential advancement of hospital information systems[15]. Project management has been developed to be able to meet these challenges[16]. The practices and techniques of project management are recognised as being essential skills which benefit organisations[17]. Traditionally, project management success has focussed on the development of the process dimension of time, cost and quality[18]. Further research has found that the achievement of these requirements was not sufficient for measuring project success and it evaluated other dimensions, such as; service or product quality and/or stakeholder satisfaction[19]. Organisations have adopted project management and maturity models approaches to enhance projects' performance[20,21,22]. The approach of maturity models has become an important tool for the management of both internal and external capacities, which describe organization development overtime[23]. Over the past few decades, the maturity models approach has been developed and applied in diverse sectors and industries, including healthcare[24]. According to Farrokh and Mansur[25], some important benefits are recognized to mature organizations: managing projects effectively[26]; continuously improve project performance[27]; the ability for managing projects based on standards[28,29]; Tailoring the project management processes to meet the specific needs of individual projects[28,29]; enable the organization to advance its strategic objectives through the application of principles and project management practices[28,30,31]. The success or failure of a project is perceived differently by different stakeholders of the project[32,33,34]. The understanding of the concept of project success has evolved over recent decades, and a gradual understanding is now emerging that project success requires a broader and more comprehensive definition[34,35]. Several stages were identified for the evolution of project success, namely[36]: the triple constraint method; the stakeholder's satisfaction dimension, the organisation specific strategic view, and finally; the strategically-oriented view in responding to increasing globalization. Regarding the success of the initiatives in

healthcare IS/IT, the academic literature emphasizes two main aspects; the slowness of the adoption of IS/IT, and the resistance of professionals to change[37]. Murray[38] highlights several important factors for IS/IT project success, such as: the commitment of the project's senior management; proper project funding; proper project requirements and specifications; proper commitment of time; a comprehensive project plan that incorporates time and flexibility to anticipate unforeseen difficulties; an accurate reporting of the status of the project; a critical assessment of the risks inherent to the project; the development of appropriate contingency plans, and; an objective assessment of the ability and willingness of the organization to stay the course of the project. The ability of IS/IT to radically affect health care organizations is recognized, and also their results and operations[39]. The implementation of electronic patient records is an example of a solution that offers healthcare professionals access to a vast amount of patient-related information, decision support systems, clinical support, and knowledge servers that allow direct access to updated information of clinical knowledge that support evidence-based medical practice[40]. The effective integration of IS/IT applications tends to be influenced by various factors, which are related to individuals, professional groups, organisational and contextual characteristics, as well as the nature of each intervention[41,42,43,44]. The success of IS/IT projects in healthcare is closely linked to user satisfaction, system usage, perceived usefulness, and the quality of the technical solutions[45]. Reyes-Alcázar et al[41] identify a number of critical success factors which should be considered for healthcare IS/IT projects, such as: the satisfaction of the needs and expectations of end-users[42]; the importance of improving the quality of healthcare[43]; sharing common goals by a multidisciplinary process that is focussed on a healthcare team[44]; increasing autonomy amongst healthcare professionals[45]; the perceived quality of care that is experienced by end-users[46]; promoting skills and encouraging professional development[41]; the evaluation of service levels and end-user satisfaction[47], and; continuous quality improvement[48,49]. There is generic evidence of the failure of a significant majority of IS/IT projects in both the private sector and public sector[50,51] and the more comprehensive the technology or the wider the span of the implementation, then the more difficult it appears to be able to achieve success[52,53]. A common definition of project failure in healthcare is that both the timeline and the budget overruns, there is under delivery of value, and outright termination before completion[52,54]. Improving project performance by means of ensuring the successful management, development and delivery of IS/IT projects remains the top priority of most organisations[55]. The use of IS/IT in healthcare is recognised as being a major factor for the promotion of improving patient care[56], clinical practices, and supportive care[57]. Indeed, IS/IT is usually widespread in any modern hospital[58] as a key instrument for healthcare delivery and likewise for public healthcare[59]. The complexity of systems, organisational diversity, and the amount of investment needed and the difficulties in achieving successful IS/IT adoption, are all largely justified by the way that IS/IT is implemented, and by the need to identify best practices and act on a number of critical factors, in order to reduce the chance of failure[45]. To date, the most important issue for successful IS/IT projects is the acceptance and use of technology by the end users[60].

## 3. Conceptual Model

   As mentioned before the aim of the study is to investigate whether health institutions' maturity has a positive influence on the success of IS/IT projects and whether the application of management practices mediates this relationship (Fig. 1).
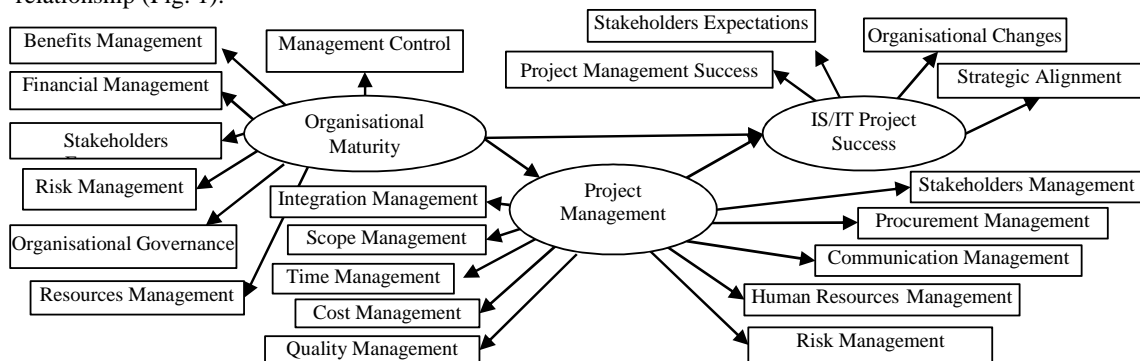


Fig.1. Conceptual Model[66]

Organisational maturity and project management have both an effect on project success[61,62,63,64,65]. However our research is supported by a more complex model since in addition to considering the direct effect of organizational maturity in the success of a project it also includes an indirect effect. Our main assumption is that the project management functions as a mediator, as it transmits the effect of the organizational maturity on IS/IT project success. We support our research on the examination of the healthcare professionals' perceptions concerning these issues. Our main hypothesis is that project management works as a mediator, to the extent that it accounts for the relation between organisational maturity and the success of a project.

## 4. Method

### 4.1. Participants

The participants were healthcare professionals from seven different hospitals, which are geographically distributed across Portugal. The professionals' profile was controlled, in order to select the respondents most qualified to answer the questionnaire. This process was supported in several exploratory interviews which lead to the conclusion that the most appropriate profile for the respondent would be based on the two main characteristics of: possessing a comprehensive knowledge of the organization's operational processes, and having participated in some form with the implementation of an information or technology system.

### 4.2. Instruments

The final version of questionnaire has four different sections:

1. **Participant's Profile**. Collects personal and professional data (gender, age, formal education, and role in the organisation).
2. **Organisational Maturity**. Improvements in the success of project results from increasing maturity[62,67.] Higher levels of maturity, in most cases, lead to improved project outcomes[68]. A self-assessment questionnaire from the P3M3 framework[69] was applied, which comprised 7 items, whereby participants were asked to rate the level of maturity on a 5-point Likert scale, from 1 (awareness of process) to 5 (optimized process).
3. **Project Management**. A set of managerial activities needed to conduct a project to an end with success[70]. This was evaluated by a 10-item scale, answered on a scale ranging from 1 to 7 (1=never; 7 =always). The questions highlight the main issues of the PMBOK Guide knowledge areas[71].
4. **Project Success.** Project success also refers to stakeholder satisfaction, system use, perceived usefulness, and system quality[72]. This was assessed with an 18-item scale, asking participants to evaluate health professionals perceptions concerning the success of the IS/IT projects on a 7-point scale, from 1 (never) to 7 (always).

These last three sections of the questionnaire correspond to the dimensions of the conceptual model.

### 4.3. Procedure

The questionnaire described above was strictly developed for this research, and various procedures were developed to ensure its accuracy. First, it was important to certify respondents' ability to interpret the issues appropriately, in accordance with the objectives of the questionnaire. To ensure this target, exploratory interviews were carried out with healthcare professionals to validate the questions' content. After concluding the questionnaire design, a pre-test was applied. As is well-known, pretesting tools can be used to improve the quality of survey data[73]. The pre-test allows for the identification of problems regarding question content, namely the misinterpretation of individual terms or concepts, in order to list what can be eliminated, or what needs to be redone. Questionnaire formatting is particularly relevant for self-administered questionnaires. At the end of the pre-test, each respondent gave their opinion about interpretability issues, completeness, size, and time spent in filling it out. We applied the initial version of the questionnaire on a small sample (n = 29), which had a similar profile to that of the final sample. The implementation of the final questionnaire is currently ongoing.

*4.4. Data analysis*

In order to close the final version of the questionnaire, special attention was given to data collected through the pre-test. Firstly, a screening of data was made prior to the analysis of each scale's reliability. Frequency analyses were performed to assess the distribution of each item and to characterize its variability. Skewness and kurtosis measures and respective standard errors were considered to examine the distribution of the distribution. Box-plots were also used for checking the presence of outliers. Finally, the internal consistency of each scale was assessed using Cronbach's alpha[74,75] and the values of the "alpha if item deleted" were also checked. Data analysis was conducted by using BM-SPSS Statistics 22.0.

## 5. Results

Initially, a descriptive analysis was conducted to obtain information about outliers, skewness and kurtosis of the distribution of the 48 items included in the first version of the questionnaire. The 7-item scale of Organisation Maturity, and the 20-item scale of Project Management showed symmetrical and mesokurtic distributions (Table 1) due to the fact that the ratio skewness/standard error (SK/SD) and the ratio kurtosis/standard error (KU/SD) error were <|2|. No outliers were detected in the distribution of the items of these two scales.

The analysis of the SK/SD ratio allowed for the identification of 8 in 21 items in the Project Success scale, with a highly negatively skewed distribution ($-4.571 \leq$ SK/SD $\leq -2.688$). Approximately 1/3 of the items had a more than 50% response at a single point on the Likert scale. The KU/SD ratio showed 3 in 21 items with a leptokurtic distribution ($2.688 \leq$ KU/SD $\leq 4.669$). The distributions of these mentioned items also presented 2 to 3 moderated outliers.

Table 1. Summary statistics for items distribution

| Original scales (on pre-test) | Range of ratio (Skewness/Standard error) | Range of ratio (Kurtosis//Standard error) |
|---|---|---|
| 7 items in Organisational Maturity | -1.115 to 0.387 | -1.587 to -0.617 |
| 20 items in Project Management | -1.521 to 0.002 | -0.862 to 1.237 |
| 21 items in Project Success | -4.571 to 2.082 | -1.449 to 4.669 |

The internal consistency of the three scales was assessed by using the Cronbach reliability coefficient (Table 2). Cronbach's alpha values were 0.86 for Organisational Maturity, 0.97 for Project Management, and 0.94 for Project Success, demonstrating an excellent reliability of the instruments[76]. However, the Project Management scale presents a particularity, as it was known that the two items per indicator for this scale would be much correlated, and this would imply redundancy. Taking into account the global dimension of the questionnaire, and also the time that respondents took in the pre-test, we chose to include only one item per indicator. The internal reliability remained excellent for the reduced Project Management scale ($\alpha = 0.94$). With regards to the Project Success scale, 3 items were excluded that presented extremely negatively skewed and leptokurtic distribution. The Project Success scale with 18 items maintained a very good consistency ($\alpha = 0.93$).

Table 2. Internal consistency of the scales

| Original scales | Cronbach's alpha | Final scales | Cronbach's alpha |
|---|---|---|---|
| Organisational Maturity (7 items) | 0.86 | Organisational Maturity (7 items) | 0.86 |
| Project Management (20 items) | 0.97 | Project Management (10 items) | 0.94 |
| Project Success (21 items) | 0.94 | Project Success (18 items) | 0.93 |

## 6. Discussion

The questionnaire for validating the contents was performed exactly the same way in the pre-test, as it will be administered for the main study. Some ambiguities and difficult questions were identified. Whether each question gives an adequate range of responses was also verified, and any questions were re-worded that are not answered as expected. Some were shorten and revised. It was perceived that there was a degree of lack of familiarity of the respondents about certain theoretical concepts presented in the pre-test. In general, healthcare organisations do not invest in engaging or motivating healthcare professionals about the advantages that IS/IT solutions could bring to the organisations and themselves, and consequently, it was difficult to catch their attention. The IS/IT projects followed have low participation and little involvement from healthcare professionals, and thus the majority of the projects were largely unknown to most people. A final issue concerns the specificity of the theoretical questions, which required the respondents to have both a comprehensive knowledge of their own organisation, and a cross-sectional view of the topics covered. Findings from the pre-test mainly showed a lack of symmetry in the distribution of various items. Given that the pre-test data was still under review, this was admitted to be a greater error and, as suggested by Hair et al[77], it could be possibly up to 10%. Therefore, in line with this criterion only three items were excluded, ensuring the same internal consistency of the scale. Another dropout exercise was made in order to define a more parsimonious scale, thus avoiding redundancy between items. A lack of variability was also in evidence, particularly in one part of the items. According to several authors, using longer Likert scales could minimize this problem[78,79]. Thus, the analysis of the pre-test results also led to adopting a 7-point Likert scale, instead of the 5-point scale.

## 7. Conclusions

Although project management and maturity models emerged as being one of the main frameworks employed by organisations to provide a roadmap for strategic improvement, there is no strong evidence in the literature of the success of any of the available approaches for the successful implementation of IS/IT in healthcare organizations.

Pre-testing is extremely important for validate the questionnaire because enable us to improve the questions and to verify the professionals' ability to answer the questions. The results let us to conclude that the three scales of the conceptual model were reliable. Some improvements were even made to reduce redundancy in the Project Success scale, and also to increase the variability of responses to such items. The complexity of concepts suggests the need for a better control of the respondents' profile.

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