Investments in information systems and technology in the healthcare: Project management mediation

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ABSTRACT

Healthcare organisations must improve their business practices and internal procedures in order to answer the increasing demand of health professionals and the general public for more and better information. Hospitals invest massively in information systems and technology (IS/IT) in the hope that these investments will improve healthcare and meet patients' demands. The main objective of our research is to study how organisational maturity, enhanced by investments in IS/IT, project management and best practices, leads to successful projects in public healthcare organisations. The rational of our model is that organisational maturity has a positive effect on IS/IT project success, and that this success is also positively enhanced by the use of project management practices. We emphasise that this combination of approaches can increase the effectiveness of projects. Furthermore, it can also improve the confidence that the results of investments will meet stakeholders' expectations.

INTRODUCTION

Health organisations today are under pressure to provide more health information, and better quality, faster services, with an expectation of lower prices. The challenges facing healthcare organisations require more comprehensive and integrated solutions and efficient resource management as a means to eliminate inefficiencies and to achieve promised benefits (Harrison et al, 2007; Kock, 2006; Lehmann, 2006). The paper-based system was shown to be inadequate to meet healthcare organisation's needs of today (Shortliffe & Blois, 2006), and IS/IT applications have been recognized as being enablers (Vimarlund & Olve, 2005; Olve &Vimarlund, 2005). This means that IS/IT tools offer solutions for the problem of the increasing accumulation of patient data and day-to-day clinical work (Timpka et al, 2007; Friedman & Wyatt, 2006). The use of IS/IT in the healthcare sector is one of the major factors that helps improve services provided to patients (Li et al, 2010). IS/IT has a great potential for improving quality and safety, as well as for reducing costs and creating new service innovations (Shekelle, et al., 2006).

Organisations recognise project management as being a fundamental tool for the development of initiatives that lead to the implementation of their strategies (Crawford, 2005; Hodgson, 2002). The research focuses of this study adopts a combination of both the project management and maturity model approaches as a means of strengthening the final outcomes of IS/IT projects in the public healthcare sector (Gomes & Romão, 2015). It is the authors' belief that this combination of approaches enhances both the success of projects and benefits realisation (Gomes & Romão, 2015). It is also important to emphasise that, by taking advantage of the specific features of each of these approaches, their structure will certainly increase the efficiency and effectiveness of IS/IT projects in the healthcare sector (Gomes & Romão, 2015).

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The maturity models approach provides a framework that helps organisations increase their capability to deliver projects on schedule, within budget, and according to the desired technical performance (Levin & Skulmoski, 2000). Project maturity models assume that project success will increase through standardisation (Milosevic & Pantanakul, 2005). Projects are temporary achievements, which are applicable in a very broad range of business sectors, and are used to solve various types of tasks of variable size (Maylor, 2001). Project management coordinates skills and organisational knowledge, and follows the progress of a set of pre-established activities in order to achieve objectives (Kronbichel et al, 2009). Project management creates value by providing relevant and reliable information which helps organisations improve their business outcomes. Many organisations fail to review whether the planned benefits of IS/IT projects have been achieved, or not, as they do not possess sufficient resources to undertake a benefit review and are constantly under pressure to deliver other projects (Bennington & Baccarini, 2004). A common characteristic of many unsuccessful projects is the vagueness with which the expected benefits are defined (Reiss et al, 2006). Benefits management identifies goals and benefits by combining organisational changes and investments in IS/IT, and by showing the way to achieve them (Gomes et al, 2013; Ward & Daniel, 2006).

The research questions that guide this research are as follows (Gomes & Romão, 2015):

- How does organisational maturity promote the success of projects in IS / IT?
- What tools can be used to improve the chances of success for IS/IT projects?
- What are the critical factors that need to be taken into consideration for the success of these projects?

LITERATURE REVIEW

Henderson and Venkatraman (1999) state that the inability to realise value from IS/IT investments is in part due to the lack of alignment between organisations' business and IT strategies. Whilst there is general agreement that IS/IT does indeed contribute to adding business value, there is uncertainty as to how these contributions were really obtained (Devaraj & Kohli, 2003; Melville et al, 2004). Although many studies have focussed on the consequences of IS/IT investments, fewer studies have examined the factors that impact the capability of IS/IT (Devaraj & Kohli, 2003).

According to the Project Management Institute (PMI, 2012), a project is a limited effort in time, undertaken to create a product, service or result. The essence of project management is to support the implementation of these temporal initiatives under the framework of an organisation's competitive strategy, in order to successfully deliver a particular outcome (Milosevic, 2003; Shenhar & Dvir, 2007). Project management is thus a set of management activities that is required to ensure that projects that are defined, planned and monitored, are able to proceed and achieve agreed objectives and benefits (Devaraj & Kohli, 2003). Kerzner (2013) highlights the importance of project management in the planning, organisation and control of organisations' resources, and in helping to achieve, not only short-term goals, but also broader, temporal objectives.

Success is perceived differently by the different parties involved in the project (Freeman & Beale, 1992), and therefore, determining whether a project is a success, or not, is not an easy task. The differences in success criteria definition should reflect the different interests and points of view, which leads us to conclude that project success is a multidimensional approach (Shenhar et al, 2001). Success criteria known as the 'iron triangle' have been criticised for their exclusive focus on the project management process, to the detriment of excluding the vision and goals of the different stakeholders (Atkinson, 1999; Baccarini, 1999; Bannerman, 2008). According to Bannerman (2008), research on the concept of project success has been developed around three major directions: (1) identifying the factors contributing to project success (Cooke-Davies, 2002); (2) identifying other contingent variables which can influence the results of a project (e.g. Shenhar et al, 2002), and; (3) defining the criteria by which a project is considered to be a success, or a failure (Atkinson, 1999; Baccarini & Collins, 2004; Chan et al, 2002).

The improvement in the success of projects results from increased maturity and organisational competence (Sergeant et al, 2010; Skulmoski, 2001). Higher levels of maturity will, in most cases, lead to improved project outcomes (Nieto-Rodriguez & Evrard, 2004). Projects which have multiple stakeholders, with different perspectives about the purpose of the project, usually have different expectations as to what the project should achieve. Success has many dimensions, such us: effectiveness, efficiency, organisational commitment, professionals' satisfaction, patient satisfaction—and not all parties agree about which dimension should be the most relevant (Berg, 2001). Success is a multi-dimensional concept, which can be

defined rather differently by the different parties involved, which evolves over time (Berg, 2001). Kagioglou et al, (2000) highlight that project success relies on the right people having the right information, at the right time, and that this is supported by the active involvement of all participants, especially during the early phase of a project. There is little evidence to suggest that process capability improvement results in improved project success, although a few studies are promising in this respect (Mullaly, 2006; Lee & Anderson, 2006).

The last two decades have seen a significant collection of articles and papers on organisational maturity (Wendler, 2012). The maturity models approach has become an important evaluation tool for measuring the internal and external capabilities of organisations. The main objective of a aturity models approach is to provide a theoretical framework to improve the business outcome of an organisation, for assessing their strengths and weaknesses, and to allow comparisons with the sector's good practices through benchmarking with similar organisations (Combe, 1998; Ibbs & Kwak, 2000).

Several studies focus on the recognition of the benefits of investment in project management skills in organisations (Ibbs & Kwak, 1997, 2000; Ibbs & Reginato, 2002) whilst discuss the correlation between the level of maturity and the performance of projects (Mullaly, 2006; Jiang et al, 2004; Ibbs & Kwak, 2000). In an IS/IT discipline, maturity is considered to be a measure for evaluating an organisation's capabilities (Roseman & de Bruin, 2005). Measuring the maturity of organisations is a difficult and somewhat subjective task; as such an audit process focusses mainly on individuals' tasks (Anderson & Jessen, 2003). Skulmoski (2001) recommends a vision in which competence and maturity are linked and focussed on project success. The Office of Government Commerce (OGC, 2010) establishes a set of reasons why organisations choose the use of maturity models, examples being: to justify investment portfolios; to improve project management; to gain recognition for the quality of their product or service, and, to gain a better understanding of their strengths and weaknesses, in order to better resolve their inefficiencies.

Maturity assessment usually involves variation over five stages of development (Jugdev & Thomas, 2002). Through an assessment procedure, organisations understand their current position and the determinants of their future direction. The assumption that underlies the maturity model's approach is that there is a relationship between higher levels of maturity and project success (Gomes & Romão, 2015).

THE HEALTHCARE SECTOR

Over the last decade, there has been a considerable demand for health-related information by the public and professionals, and the Internet has gained ground as a central source of such information (Baker et al, 2003; Eysenbach & Kohler, 2003). Today, healthcare organisations are increasing focussing on the need for investment in IS/IT, with the goal of achieving the minimum level of benefits that these projects can attain (Gomes & Romão, 2015). However, in spite of the enormous investment in IS/IT, no convincing evidence of their overall benefits has been produced (Littlejohns et al. 2003). The study of the success, or failure of these initiatives has become vitally important for the performance of these organisations (Delpierre et al, 2004; Rahimi & Vimarlund, 2007). Since the 1990's, the health sector has sought to improve its effectiveness and efficiency by adopting IS/IT to increase the levels of quality of healthcare (Raghupathi & Tan, 1999). Since then, IS/IT usage has started to become increasingly common in healthcare environments (Shortliffe & Blois 2006), and the improvements in the speed and processing power of computers, computer networks, and the Internet has led to an increase in the accessibility and availability of information for healthcare professionals to support their decision-making processes (Vimarlund et al, 2008; Rose et al, 2005; Winkelman & Leonard 2004). These systems provide an important support for specialised services, and increase the efficiency, quality and safety of patient care, and also reduce medical errors (Low & Chen, 2012).

IS/IT has the potential to dramatically change the way individuals or society see the healthcare sector, and it provides tremendous opportunities for supporting professionals, and for improving effectiveness and efficiency in the health sector (Ammenwerth et al, 2006). There is a growing consensus that organisational factors are far more critical for the successful implementation of IS than technical considerations (Markus et al, 2000). Achieving successful change is much easier if all stakeholders are committed, and the earlier this commitment is achieved, the smoother is the path to a successful outcome (Bradley, 2006). These profound changes implicate important ethical challenges. For decades, patients have been sharing relevant personal data with their doctors, in order to facilitate a correct diagnosis. Accumulated medical records represents a significant source of information, which includes personal identification, medical history, and records of treatments and medication, together with an analysis of psychological profiles and the subjective assessments of patients' personality or mental state, amongst others (Mercuri, 2004). This information can be shared, in order to improve the efficiency of the healthcare system, and can be used to carry out research for the

advancement of medical science (Hodge, 2003). However, it can also be used by other healthcare providers, such as clinics, laboratories, the pharmaceutical industry, health authorities, and insurances companies, which raises some issues about the protection of this strictly personal information (Grimson et al, 2000).

Studies have identified high failure rates in IS/IT projects in various sectors, including that of healthcare, particularly in hospitals (Kaplan & Harris-Salamone, 2009; Wears & Berg, 2005). Internal factors for project failure involving the project management processes and project team dynamics represent the major cause of project failure, which is larger than the external factors involving customers and other external entities (Lu et al, 2010). The results of the implementation of IS/IT projects in healthcare have revealed a waste of financial resources in acquiring large-sized systems, which are totally ineffective (Heeks, 2006; Heeks & Davies, 1999). Heeks (2006) discusses that many studies of IS/IT implementations have just focused on successful cases thus missing out on generating knowledge from existing failures. The implementation of IS/IT in the health sector is distinct in the various aspects from other projects, and in other industries. The key aspects are related to the environment, the diversity of systems, and the devices needed to work, together with the challenge of integration and interoperability that is required to meet the expectations of different stakeholder groups regarding what constitutes project success (Abouzhara, 2011). Human and organisational issues are important factors that need to be taken into account for the development and implementation of IS/IT, as has been emphasised in the literature (Yusof et al, 2008; Yusof et al, 2007; Kaplan & Shaw, 2004). Healthcare projects are a complex undertaking, which depend largely on the quality of existing information (Bose, 2003). Proper training is a major determinant for the success of the adoption of IS/IT by health professionals, and it has a great influence on the integration of technologies in clinical practice (Allen et al, 2000). The effectiveness of interventions aimed at integrating IS/IT applications in the practices of health professionals tends to be influenced by several factors, which are related to individuals, professional groups, organisational and contextual characteristics, and also the nature of the intervention 'per se' (Grol et al, 2007; Aarts et al, 2004). The management of stakeholder's is an essential part of any project management. Stakeholder's needs and requirements are crucial to ensure project success (Miller & Oliver, 2015). One of the most critical factors recognised by the academic literature is resistance to change by healthcare professionals, particularly amongst doctors (Lapointe & Rivard, 2006; Phansalker et al, 2008). The complexity of systems, together with organisational diversity and the volume of investment required, as well as failure in adopting IS/IT, are all justified largely by the way IS/IT is implemented, and by the need to identify best practices and to act on a number of critical factors in order to reduce the chance of failure (Davenport, 1998; Olson & Zhao, 2007).

Several authors point out that critical success factors are particular elements of the organisation of both the internal and external environment, which is necessary to assure goal attainment and the success of a project (Reyes-Alcázar et al, 2012). According to the same authors, the critical success factors that need to be considered for the health sector are the following: (1) a patient-centred approach – any intervention or initiative must be based on the needs and expectations of end-users and patients (Mead & Bower, 2000); (2) leadership - clinical leadership is central to the strategies in hospital management. Studies show the importance of this factor in improving the quality of healthcare (West et al, 2004); (3) team work - a patient-centred approach, which involves a multidisciplinary process, focussed on a healthcare team that shares common goals in an integrated organisational model (Mickan, 2005); (4) autonomy and responsibility – with the ability to make decisions about the use of clinical resources. There is a widespread feeling that there is a need for a greater degree of autonomy amongst health professionals, not only in order that they can improve their skills in routine activities, but also for their personal and motivational development (Harrison & Dowswell, 2002); (5) an integrated view of healthcare - the quality of patient care as perceived by end-users is a key element, which results in enhancing the reputation and reliability of the service provider (Torres Olivera, 2003); (6) professional skills – including promoting skills that encourage professional development, and also the process of innovation and dissemination of knowledge (Harrison & Dowswell, 2002); (7) results focussed - health facilities should establish mechanisms that allow for the measurement and evaluation of clinical performance, hospital management and end-users satisfaction (Patton, 1997); (8) internal and external audits – reinforcing the concept of continuous quality improvement, which is widely applied in the business world, and has now gradually migrated to the health sector (Chovil, 2010; Hyrkäs, & Lehti, 2003; Le Brasseur et al, 2002), which has produced significant results.

Several consequences were reported from the IS/IT healthcare implementations (Rahimi et al, 2009), such as: not taking into consideration the professional and social cultures of healthcare organisations (Littlejohns et al, 2003); an improvement in information management and a reduction in expenditure (Ruland & Ravn, 2003); the end-user perception of inadequate training (Malato et al, 2004); resistance by doctors and from within the organisation (Poon et al, 2004); a lack of confidence in using advanced information technology,

compounded with a lack of training (Bryson et al, 2005), and; a lack of integration. Inadequacies of personnel, equipment, working space, storage space, trained staff, and management support (Odhiambo-Otieno, 2005) decreased the overall time spent per patient during clinical sessions and quality improvement (Pizziferri et al, 2005). Furthermore, users generally showed good acceptance of the system (Kamadjeu et al, 2005), reduced clinical productivity due to extra work (Scott et al, 2005), and, reduced work efficiency. Poor content design, system function, and system integration (Lee, 2007) was also detected, and the level of resistance varied and became sufficiently large to lead to major disruptions and system withdrawal (Lapointe & Rivard, 2006). Paré et al (2006) demonstrate that encouraging and cultivating a positive attitude towards the new system significantly improves doctors' overview of patients' current status in different clinical situations during the clinical process, based on the doctors' actual needs (Møller-Jensen et al, 2006), and organisational issues within hospitals that cause problems and delays during the transmission of reports came to light (Machan et al, 2006), generating more and new work for doctors. Generation of new kinds of errors (Ash et al, 2007) was also in evidence, and doctors' have the perceptions that IS/IT usage negatively affected their workflow (Samoutis et al, 2007).

In alignment with what has been happening in other European countries, the Portuguese reality has shown a growing concern by end-users, the public in general, health professionals, managers and policy makers, to obtain more and better health information. These concerns have led to the implementation of integrated health IS/IT systems, with the aim of improving the delivery of healthcare services and of satisfying the demands of the various players, and of complying with European laws and edicts (Andreassen et al, 2007). These IS/IT systems are required as a means of providing answers for the varied strategic guidelines of the sector, such us: resource accessibility, fairness in the provision of care, improvement of care practices, integration of public health management, system sustainability, and management transparency. The models implemented advocate a patient-centred approach during its life cycle, and integrated disease management, which contributes to achieving more and better health for all citizens in a sustainable manner (Andreassen et al, 2006). The implementation of an integrated solutions aims to respond to the sector challenges, by enabling the consultation of patients' clinical data anywhere in the country. Of particular importance is the sharing and integration of information for end-users and health professionals, which enhances gains in health, and facilitates the diagnosis process, and the continued treatment of patients. However many uncertainties and challenges still exist, as well as constraints, ranging from a lack of funding, through to the diversity of subsystems, the installation of different technological solutions, interoperability, and also other restrictions that may well prevent the successful implementation of this platform. The full implementation of these projects promotes a multidimensional organisational transformation and leads to a revolution in terms of culture, procedures, human resources, systems and technologies, infrastructure and organisation, whilst maintaining the focus on achieving primary goals, such as: access to updated information for all end-users, better communication and information sharing among stakeholders, and the sharing of information with all users.

CONCEPTUAL MODEL

Supported by the literature review, we propose the following conceptual research mediation model (Figure 1), which is based on Baron and Kenny's (1986) definition of a mediator being a variable, to the extent that it accounts for the relationship between the independent variable and the outcome variable.
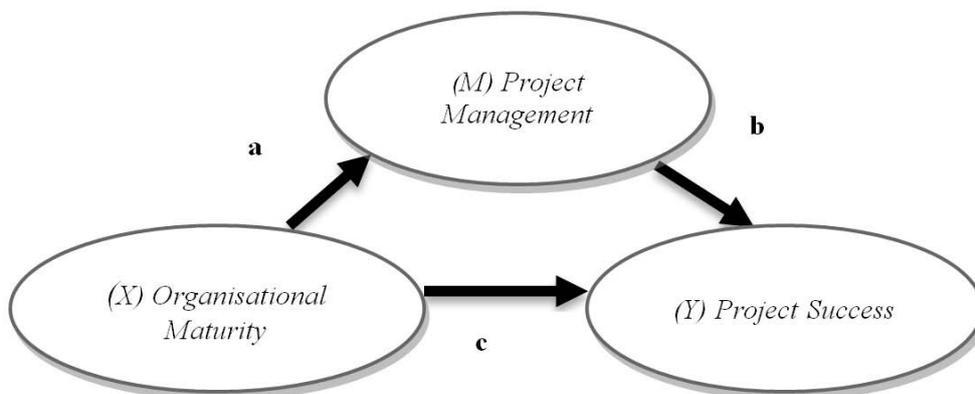

Figure 1. Mediation model (Gomes & Romão, 2015)

The mediation model offers an explanation for how, or why, two variables are related, where an intervening or mediating variable, M, is hypothesised to be intermediate in the relation between an independent variable, X, and an outcome, Y (Fairchild & Mackinnon, 2009). In the mediation model, the direct effect, path c, is examined on the direct relationship between organisational maturity and project success, and the partial mediation is examined for the same previous relationship, but with project management acting as the mediator. According to the mediation perspective, an intervening variable exists between one or several antecedent variables and the consequent variable. Project management is an intervening variable between organisational maturity and project success. Accordingly, we developed the following hypothesis:

(H1) - There is a direct relationship between organisational maturity (X) and the success of a project (Y) which is mediated by project management (M).

In order to establish mediation, it is necessary to verify the following four steps (Baron & Kenny, 1986): 1) whether the causal variable (X) is correlated with variable (Y), using Y as the dependent variable in a regression equation, and X as an independent variable - testing path c; 2) whether the causal variable (X) is correlated with the mediator (M), using the variable M as a dependent in the regression equation, and X as independent - testing path a; 3) whether the mediator (M) affects the dependent variable (Y), using Y as the dependent variable in a regression equation, and X and M as independents - testing path b, and; 4) finally, M completely mediates the relationship X→Y, when the X→Y effect is zero. The effects of both (3) and (4) are estimated in the same equation. If all four steps are completed, then the data are consistent with the hypothesis that the variable M completely mediates the X↛Y relationship. However, if only the first three stages are completed, then there is only partial mediation.

METHODOLOGY

The study will follows a positivist approach, which considers that knowledge can be codified without being influenced by the researcher. As the scientific rigour in this kind of research paradigm is of crucial importance, in order to truthfully explain the social reality under research, the study will develops a research model and a set of hypotheses from the existing literature and theories, which will support and orientate the research. Hypothesis testing will allows for an understanding of the nature of the relationship between study variables. This research is primarily quantitative and confirmatory in nature, rooted in research model hypothesis testing. Therefore, a qualitative phase was first performed, through a set of exploratory interviews with experts, which was aimed at defining and validating the central constructs of the research model. The qualitative results of this exploratory study allowed for the validation of the model variables, and served as inputs for the preparation of the questionnaire. Subsequently, a pre-test process was carried out to validate the consistency of statistical variables. The study will be based on a cross-sectional survey, as this explicitly excludes the dimension of time. The cross sectional design entails the collection of data from several cases, at a single point in time, in order to collect a set of quantitative data which is related with more than two variables, which are then subsequently examined to try and detect patterns of association (Bryman & Bell, 2003).

EXPECTED RESULTS

Although project management and maturity model approaches emerge as two of the main tools that are employed to strengthen an organisation's outcomes, yet there is no strong evidence that these approaches contribute to a successful implementation of IS/IT projects in organisations, namely in healthcare. This study has as its main objective the ability to show that the maturity level of organisations has a positive influence on the success of IS / IT projects, and that the systematic application of best project management practices can mediate this relationship. It is expected that this mediation effect enhances the development and implementation of successful projects. The application of project management practices facilitates the achievement of a broad set of processes that are crucial to achieve the expected results and the promised benefits, notably by means of the following main aspects: (1) involvement of different stakeholders in setting goals , expectations and benefits; (2) creating a greater awareness of how to achieve this objectives and the corresponding benefits; (3) the establishment of a formal method to plan and evaluate goals and expectations according to initial requirements, and finally; (4) creating a learning and improvement environment. The proposed model will try to prove that it is easier to implement best project management practices in organisations with higher organisational maturity levels, and that an appropriate combination of investments

in IS / IT and best management practices can be a positive influence, leading to successful projects. We also expect to conclude that organisations that provide higher maturity levels have a greater influence on how projects are conducted, and thus provide a greater contribution to their success.

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