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INSTITUTO SUPERIOR DE ECONOMIA E GESTÃO

Organisational Maturity and Information Systems and Technology Projects in Healthcare: The Mediation of Project Management

Jorge Manuel Vareda Gomes

Orientador: Professor Doutor Mário José Batista Romão

Tese especialmente elaborada para obtenção do grau de Doutor em Gestão

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"Do the difficult things while they are easy and do the great things while they are small. A journey of a thousand miles must begin with a single step."

Lao Tzu (531-604 BC)

Abstract

The challenges that health organisations face today is to get better organisational performance, reliable information, faster quality services at prices that should be affordable to the entire population. To fulfil this important goal, health organisations require more comprehensive and integrated approaches such as, but not limited to, optimise their available resources, eliminate inefficiencies and achieve the planned benefits from investments in Information Systems and Technology (IS/IT). Healthcare organisations must improve their management practices and internal procedures to answer the increasing demand of managers, health professionals and the public in general, for more and better information. Health organisations adopt a patient-centred care approach and invest massively in IS/IT, hoping that these investments will improve medical care and patient needs. The main objective of our research is to analyse how the Organisational Maturity affect IS/IT Project Success in Healthcare and if that success is enhanced by using Project Management practices. There is evidence that there is a direct relationship between these variables and that Project Management practices can mediate it, helping to increase the effectiveness of IS/IT projects. Furthermore, the application of the Project Management practices can also improve confidence that the results of these investments meet stakeholders' expectations, both by the benefits accomplishment and by adding a perceived value to organisations. This study develops and validates an instrument to analyse the data collected from a survey to professionals' perceptions about the IS/IT Project Success in Healthcare organisations. The results confirm that Project Management has a mediating effect on the relationship between Organizational Maturity and success of IS/IT projects and higher levels of Organisational Maturity will generate more successfully IS/IT projects, although the presence of the mediator Project Management can, in specific situations, affect negatively the correlation between Organisational Maturity and IS/IT Project Success.

Keywords: Organisational Maturity; Project Management; IS/IT Project Success; Health IS/IT investments; Healthcare Information Systems.

Resumo

Os desafios que enfrentam atualmente as organizações de saúde estão diretamente relacionados com o fato de ambicionarem um melhor desempenho, mais e melhor informação de saúde, serviços de qualidade mais céleres. a custos acesíveis à maioria da população. Para o total cumprimento deste desiderato as organizações de saúde têm investido em soluções tecnológicas mais abrangentes e integradas de forma a otimizar os recursos disponíveis, eliminar ineficiências e atingir os benefícios plenos dos investimentos em Sistemas e Tecnologias da Informação (SI/TI). As organizações de saúde procuram melhorar as suas práticas de gestão para dar resposta a uma crescente procura de informação de saúde por parte de gestores, profissionais e público em geral. As organizações de saúde adotaram uma abordagem centrada no paciente e realizaram significativos investimentos em SI/TI na expetativa de que estes trouxessem melhorias ao nível assistencial e na satisfação das expetativas dos seus utilizadores. O principal objetivo deste trabalho é analisar como a Maturidade Organizacional afeta o sucesso do projeto em SI/TI em saúde e se esse sucesso é potenciado pela utilização de práticas de gestão de projetos. Há evidências da existência de uma relação direta entre esstas duas variáveis e que as práticas de Gestão de Projetos a podem mediar, ajudando a aumentar a eficácia dos projetos de SI/TI. Além disso, a aplicação das práticas de Gestão de Projetos podem melhorar a confiança nos resultados dos investimentos e atender às expectativas das diferentes partes interessadas, tanto pela realização de benefícios quanto pela criação de valor percebido para as organizações. Este estudo analisa os dados recolhidos de um questionário à perceção dos profissionais sobre o sucesso dos projetos IS/IT nas organizações de saúde. Os resultados obtidos confirmam. Os resultados confirmam que o Gestão de Projetos tem um efeito mediador na relação entre Maturidade Organizacional e Sucesso de Projetos de SI/TI e níveis mais elevados de Maturidade Organizacional gerarão projetos SI/TI mais bem-sucedidos, embora a presença do mediador Gestão de Projetos, possa, em circunstâncias específicas situações, afetar negativamente a correlação entre as duas variáveis.

Palavras-chave: Maturidade Organizacional, Gestão de Projetos, Sucesso dos Projetos de TIC, Investimentos TIC, Sistema de Informação de Saúde.

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List of Acronyms

AGFI	Adjusted goodness of fit index
APM	Association for Project Management
ARS	Área Regional de Saúde
AVE	Average Variance Extracted
CAIC	Comissão de Acompanhamento para a Informatização Clínica
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CHWS	Centre for Health Workforce Studies
CMM	Capability Maturity Model
CMM-SW	Capability Maturity Model for Software
CMMI	Capability Maturity Model Integration
CPM	Critical Path Method
CR	Composite Reliability
CSFs	Critical Success Factors
DGS	Direção Geral de Saúde
EC	European Commission
EHR	Electronic Health Record
ERP	Enterprise Resource Planning
EU	European Union
EU27	European Union 27 countries (period 2007–2013)
GFI	Goodness of Fit Index
GDP	Gross Domestic Product
IBM	International Business Machines
IDC	International Data Corporation
IHME	Institute for Health Metrics and Evaluation
ILO	International Labour Office
IPMA	International Project Management Association
IPPD	Integrated product and process development

IS	Information System
IS/IT	Information Systems and Information Technology
IT	Information Technology
ISO	International Organization for Standardization
KPI	Key Performance Indicator
KU	Kurtosis
ML	Maximum Likelihood
MSP	Managing Successful Programmes
NCVHS	National Committee on Vital and Health Statistics
NFI	Normed-fit index
NHS	National Health System
OECD	Organization for Economic Co-operation and Development
OGC	Office of Government Commerce
OPM3	Organisational Project Management Maturity Model
OPSS	Observatório Português dos Sistemas de Saúde
P3M3	Portfolio, Programme and Project Management Maturity Model
PERT	Program Evaluation and Review Technique
PDS	Plataforma de Dados de Saúde
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PSC	Project Success Criteria
PwC	PricewaterhouseCoopers
RMR	Root mean square residual
RMSEA	Root Mean Square Error of Approximation
SD	Standard Error
SI	Systems Engineering
SEI	Software Engineering Institute
SEM	Structural Equation Modelling
SK	Skewness
SPMS	Serviços Partilhados do Ministério da Saúde

SPSS	Statistical Package for the Social Sciences
SRMR	Standardized root mean square residual
SS	Supplier sourcing
SW	Software engineering
TLI	Tucker-Lewis Index
USD	United States Dollar
WHO	World Health Organization

Chapter 1. Introduction

1.1 Overview

Information Systems and Information Technology (IS/IT) has been referred to, as a key instrument in healthcare delivery and public health (Drury, 2005).

IS/IT for healthcare refers to any tool or framework that enhances the communication, processing or transmission of information by electronic means for improving human health (Bukachi and Pakenham-Walsh, 2007).

The use of IS/IT has rapidly grown in several contexts, including healthcare. There have been two major drivers for the IS/IT investments in healthcare (Gomes and Romão, 2016a; WHO[1], 2002, 2011, 2015):

- The ever-increasing burden from chronic disease with costs growing significantly faster;
- The recognition of the need for greatly improved quality and safety in the delivery of healthcare.

Both key drivers have led to very heavy investments in IS/IT to enable timely information-sharing for clinical decisions.

The evolution that is underway in healthcare is mainly driven by demographic changes, which included the increase of the aging population, chronic diseases, cultural changes, progress in sciences and technologies and the recognition of the need for greatly improved quality and safety in the delivery of healthcare (EC[2], 2009; Lymberis and Dittmar, 2007; OECD[3], 2006; Scholtz, 1999; Weingarten et al., 2002: Wilkinson, 2002; WHO, 2011, 2015).

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[1]World Health Organization
[2] European Commission
[3] Organisation for Economic Co-operation and Development

Health organisations today are under pressure to provide more and better health information, faster services, at prices that are expected to be reduce, as well as complying with the public health regulations in terms of security and many other requirements (Gomes and Romão, 2015a; OECD, 2016; Rechel et al., 2009; WHO, 2012). Externally, these organisations face a scenario of intense competition, coupled with a changing environment which is full of challenges and uncertainty. Internally, organisations must deal with limited resources, whilst at the same time comply with increasing requirements and strategic demands.

Many hospitals around the world are moving away from paper-based health information and implementing technological solutions to facilitate and improve the process of patient care via the generation of electronic health records (Caldeira et al., 2012; Ting-Ting, 2004). The main goal of IS/IT is to manage information from all healthcare-related activities, including planning, monitoring, coordination, and decision making. The real-time access, exchange and receipt of clinical data provided by the system have improved clinical documentation, reduced the duplication of care services, and supported better decision making related to patient care (Mäenpää et al., 2009). IS/IT are designed to support clinicians in accessing and working with a variety of patient information (Gruber et al., 2009) and promoting healthcare quality information sharing (Beuscart-Ze´phir et., 2001).

With the development of IS/IT, the related data have grown larger and faster in the past decade. This information is more operational and complex than previous information. However, larger and more complex data are not necessarily better data. The most important issue in this field is the use of high-quality information to improve patient care. Implementations of IS/IT in the healthcare industry are one of the main assets that has helped improve the end-users care and proved to be essential for professionals and managers alike in decision making (Bindakheel and Rosnah, 2010).

Nowadays projects are regarded as an important tool for value creation in the organisations (Gomes and Romão 2016b; Ingason and Jónasson, 2009; Williams and Samset, 2010; Winter et al., 2006), improve business success (Forsberg, et al., 2000; Pinto, 2002; Poli and Shenhar, 2003), and for helping the process of change and that when used timely, it can lead to the problem solving of critical issues for an organization (Clarke, 1999).

The term project is described in different ways in the research literature (Appendix A), although some topics are common, namely, be unique in their output, having a definite starting and ending point, are temporary in nature and are carried out to develop the organisation's strategic objectives (Ali, 2010).

There is a significant growth in the adoption of project management disciplines to accomplish work in different sectors and industries (Winter and Szczepanek, 2008). Project management approaches are required for the success of healthcare IS/IT projects, especially initiatives that involves the integration of complex systems. Project management coordinates a set of competencies, skills and organisational knowledge, and carries out the monitoring of pre-established activities to evaluate the project progress (Kerzner, 2013; Kronbichel, et al., 2009). These skills enable project managers to achieve the pre-defined objectives. Project management also creates value and provides relevant information to help organisations respond quickly and more effectively to customers, thus improving their own performance (PMI[4], 2015; Zwikael and Smyrk, 2011).

As organisations are continuously looking at improving project management practices, they have increasingly adopted maturity models even though these have received numerous criticisms (Albrecht and Spang, 2014). The basic concept of maturity drives organizational processes to continuous improvement and so requires a thorough understanding of an organization's current position and where it aims to be in the future. The maturity models are based on the premise that entities (people, organisations, functional areas or processes) evolve through a process of growth or development towards a more advanced maturity, across several distinct stages (Becker et al., 2009). Maturity will affect the value which an organization can gain by implementing project management (Shi,

[4] Project Management Institute

2011). Given the numerous *best practices* and capabilities involved, improving maturity requires a properly structured action plan (Crawford, 2005).

As the success of a project depends on the perception of the different stakeholders, *the absolute success* of a project does not really exist, but only *the perceived success* (Baker et al., 1988). The project success concept has evolved over the past few decades, and a new understanding of the concept is emerging which gives it a wider and more comprehensive definition (e.g. Atkinson, 1999; Dvir at al., 1999; Globerson and Zwikael, 2002, Ika, 2009; Ika, 2015; Shenhar et al., 2001; Senhar, Dvir and Levy, 1997; Senhar & Dvir, 2007).

The focus of this study, analyse the relation between different variables through a mediation model based on a survey perform on a health professional simple. The goal is to understand how practices of Project Management has a mediation effect on the relation between Organisational Maturity and IS/IT Project Success in healthcare sector. To fulfil this goal, the research follows several steps documented ahead.

1.2 Research context and motivation

Does IS/IT spending's in fact lead to higher productivity? This is a fundamental issue that has been studied by scholars and practitioners over the last four decades and became known as *productivity paradox*? (Brynjolfsson, 1993; David, 1990; Dewan and Kraemer, 1998).

The inability to realize value from IS/IT investments is in part due to the lack of alignment between organisations' business and IS/IT strategies (Henderson and Venkatraman, 1993). 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 and Kohli, 2003; Henderson and Venkatraman, 1993; Melville, Kraemer and Gurbaxani, 2004).

The business value of investments IS/IT is predicted to remain, one of the major topic for the researchers (Dehning et al., 2004; Roztocki and Weistroffer, 2008). Some early studies (Dos Santos et al., 1993; Hitt and Brynjolfsson, 1996; Im et al., 2001; Rai et al., 1997; West and Courtney, 1993) doubt from the economic value of IS/IT, the vast majority of authors find empirical evidence and theoretical arguments in favour of both the operational and strategic relevance of IS/IT (e.g. Aral et al., 2007; Beccalli, 2007; Dedrick et al., 2003; Dehning et al., 2003; Dehning et al., 2008; Han et al., 2011; Kim et al., 2009; Kohli and Grover, 2008; Lee et al., 2011; Lin and Shao, 2006; Mahmood and Mann, 2005; Neirotti and Paolucci, 2007; Peslak, 2003; Ramirez et al., 2010; Santhanam and Hartono, 2003; Shin, 2006; Swierczek and Shrestha, 2003; Zhang, 2005).

The last years have seen the publication of several articles about maturity models (Wendler, 2012). Maturity models have become an important evaluation tool for measuring the internal and external organisations capabilities, providing a framework which helps organisations to increase their ability to deliver projects on schedule and within the established budget, according to the technical requirements and the agreed levels of quality (Levin and Skulmoski, 2000). Mature organisations exhibit specific elements that reflects their *maturity*, namely in the levels of performance, degrees of competence and focus on the customer satisfactions (Barber, 2004; Cooke-Davies and Arzymanow, 2003; Jung and Wang, 2006). Mature organisations have ability to manage initiatives based on the standardized and defined management processes (AXELOS[5], 2016). Organisations with higher maturity levels are expected to be more successful in terms of project effectiveness and efficiency and also have a superior competitive advantage in the marketplace although the current research offers little to support this argument (Yazici, 2009). Measuring the maturity of organisations is a difficult and somewhat subjective task; as such an audit process focuses mainly on individuals' tasks (Andersen and Jessen, 2003). Evaluating the current performance, skills and capabilities of an organization is not easy to do; in fact, the use of maturity models simplifies our interpretation of the entire organization and makes this task possible (Kalantjakos, 2001). In IS/IT context, maturity is considered to be a measure for evaluating an organization's capabilities (De Bruin and Rosemann, 2005).

[5] AXELOS is a joint venture company, created in 2013 by the Cabinet Office on behalf of Her Majesty's Government in the UK and Capita plc, to manage, develop and grow the Global Best Practice portfolio.

Skulmoski (2001) reinforces the idea in which competence and maturity should be linked and focused on project success. Atkinson (1999) notes that while there may be differences in project management definition, the authors agree on the inclusion for the achievement or accomplishment of the project objectives of cost, time and quality in their definitions. The essence of project management is to support the implementation of temporal initiatives, under the organization's strategy framework, to successfully deliver the expected outcomes (Milosevic, 2003; Shenhar and Dvir, 2007). The main purpose of using a project management framework is to increase organisational value (Dalcher, 2012). There is a significant growth in the adoption of project management disciplines to accomplish work in different sectors and industries (Winter and Szczepanek, 2008).

Determine whether a project is a success, or a failure is something which is very complex. Success is perceived differently by the different project stakeholders (Freeman and Beale, 1992; Egorova et., 2009). The differences in success criteria definition should reflect the different interests and points of view, which leads to conclude that project success is a multidimensional approach with interrelated technical, economic, behavioural, business and strategic dimensions (Bannerman, 2008; Cao and Hoffman, 2011; Freeman and Beale, 1992; Ika, 2009; Jugdev and Müller, 2005; Shenhar et al., 2001; Pinto and Mantel, 1990; Thomas and Fernandez, 2008).

The success criteria known as the *iron triangle* or *triple constraint* have been criticised for their exclusive focus on the project management process, to the detriment of including the vision and goals of the different stakeholders (Atkinson, 1999; Baccarini, 1999; Bannerman, 2008; Meredith and Mantel, 2000; Papke-Shields et al., 2010; Pinto and Slevin, 1987). Kerzner (2013) has described a successful project when several characteristics, the Critical Success Factors (CSFs) were met:

- The planned time;
- The predicted budget;
- The alignment with expected performance accepted by the client;
- The agreed scope;

- Minimizing the impact on the work flow of the organization;
- Reducing the effect on the corporate culture.

The improvement in the project success projects results from increased maturity and organizational competence (Sergeant et al., 2010; Skulmoski, 2001). Higher levels of maturity will in most cases lead to an improvement of project outcomes (PwC, 2004).

The results of Atkinson (1999) study on the success of IS/IT projects revealed that the success can be categorized in the following four areas:

1. Project performance: time, cost, and quality;
2. Project results; system maintainability, reliability, validity and information-quality use;
3. Benefits for the organization: improved efficiency, improved effectiveness, increased profits, strategic goals, organisational learning and reduced waste;
4. Benefits for the stakeholders: satisfied users, social and environmental impact, personal development, professional learning, content project team, and economic impact on the surrounding community.

Kagioglou et al. (2000) claimed that project success relies on the right people having the right information, at the right time, supported by the active involvement of all participants, especially during the early phase of a project.

Miller and Oliver (2015) highlighted that the participation of different stakeholders' groups in the design and development process can be essential for a project's success. 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.

The present research aims at fulfilling the existing gap in the literature regarding to the relation between the organisational maturity, project management practices and project success in healthcare sector.

1.3 Research objective and research questions

Based on the health professionals' perceptions the study aims at contributing to clarify the understanding of the following research topics:

- The concept of Organisational Maturity and IS/IT project success for health organisations;
- The degree of dissemination of Project Management practices on the health organisations;

And, in meanwhile answer to the following questions:

1. *How Organisational Maturity affected IS/IT Project Success in Healthcare?*
2. *How Project Management affected IS/IT Project Success in Healthcare?*
3. *How Organisational Maturity affected the Project Management?*
4. *How Organisational Maturity affected IS/IT Project Success through the effect of Project Management on IS/IT Project Success?*

1.4 Relevance of the study

Today's technology plays a significant role, permitting the storage and rapid retrieval of patient records and other important information. At the same time, patients expect that their sensitive personal information to be handled appropriately, to ensure accuracy and confidentiality (Hall, 2014). Healthcare organisations become more and more challenged on how to assure a fair return from investments in IS/IT. 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 and Vimarlund, 2007).

The improvement of the projects results is mostly due to improved maturity of organisations (Skulmoski, 2001; Sergeant et al., 2010) although, here is little evidence to suggest that process capability improvement results in improvement of project success, some studies are promising in this respect (Mullaly, 2006; Lee and Anderson, 2006).

Several works recognized the benefits of investment in project management skills in organisations (Ibbs and Kwak, 1997, 2000; Ibbs and Reginato, 2002) and discussed the correlation between maturity and the projects performance (Mullaly, 2006; Ibbs and Kwak, 2000; Jiang et al., 2004).

A key to success is the successful management of organisational projects. Organisations recognise project management as being a fundamental tool for the development of initiatives that lead to the implementation of their own strategies (Crawford, 2005; Hodgson, 2002).

Our research focuses on the exploration of the project management practices and organisational maturity, as a means of strengthening the final results of IS/IT projects in the healthcare sector.

1.5 Dissertation structure

The dissertation is structured into eight chapters. A summary of these chapters is given below:

- Chapter 1. Introduction – A brief overview of the context, research objective, research questions, motivation and relevance of the study.
- Chapter 2. Literature Review – Presents a comprehensive review of the literature related to the main theoretical topics and provides the theoretical and empirical background for the identification of research issues and the development of the research questions.
- Chapter 3. Philosophical Perspective and Research Approach – Discussing the research paradigm and the philosophical perspective.
- Chapter 4. Research model, hypotheses and constructs - Present the research model, hypotheses and the constructs.
- Chapter 5. Research methodology and design - Research methodology and design that was used to carry out this research.

- Chapter 6. Survey – Procedures and analysis of data from the application of the questionnaire.
- Chapter 7. Discussion – Discuss the key findings from the collected data. Implications of the results analysis.
- Chapter 8. Conclusions – Summarises the overall research context, comprises the research conclusions, contributions, limitations and future research opportunities.

Chapter 2. Literature Review

2.1 Overview

The literature review is a comprehensive reading and analyses of the published and unpublished work from secondary sources around interest for the research (Sekaran and Bougie, 2009). It represents an autonomous process with the objective of critically analysing the existing literature, providing the foundations for the research (Palvia et al., 2006). The literature review produced four main outcomes:

1. Assessment of the current state of research on a topic. This is probably the most valuable aspect of the literature review.
2. Identification of the experts on a specific area or topic. One of the additional benefits is that it will quickly reveal which researchers have written the most on a topic.
3. Identification of key questions about a topic that need further research. In many cases, it´s possible to discover new issues that need further exploration.
4. Determination of methodologies used in past studies as a means of determining what approaches might be of most benefit in further developing a topic.

Upon completion of the literature review, the researcher should have a solid knowledge of the area or topic and a good feel for the direction any new research should take. Reviewing the literature critically provides the basis upon which your research will be built (Saunders et al., 2009). The literature review encompasses the following topics:

- Project Management (2.2);
- Maturity Models (2.3);
- Project Success (2.4);
- IS/IT Challenges (2.5);
- IS/IT Project Success (2.6);
- Healthcare Sector (2.7);

Much of the work in this dissertation was submitted for peer review in academic journals, national and international conferences, and doctoral consortia (Appendix B).

2.2 Project Management

2.2.1 Overview

In nowadays, there is a need to work with faster and more flexible organisational structures, which force companies to operate through projects which usually help them to successfully achieve their objectives (Gomes and Romão, 2014a). Furthermore, in an increasingly competitive business environment, it is necessary to ensure that the successful results of one project can be extended to future initiatives and investments, using standardised procedures.

Organisations need to deliver more complex solutions, in a better, faster, and cheaper way. The business problems addressed today require enterprise-wide solutions that call for an integrated approach and effective management of all the organisational resources to achieve the expected objectives and related benefits. In a competitive environment, organisations need flexibility to meet customers' demands, by offering customized and high-quality products and services.

Last decades have showed an increased interest for project management in many organisations, due to increased project work in all types of industries (Besner and Hobbs, 2006; Jacques, Garger, and Thomas, 2008; Shim and Lee, 2001; Söderlund, 2005; Turner and Müller, 2005)

There is an emerging body of literature that identifies project management as a powerful, generic management approach with broad application beyond projects (Laszlo, 1999; Pinto and Rouhiainen, 2001).

Pinto and Rouhiainen (2001) also recognized the power and flexibility brought to organisations and the constraints and challenges that accompany the role of project manager. Project management has been increasingly viewed as a part of overall organisational management practices, similar in importance to other practices in the financial, marketing, or human resource management areas (Kenny, 2003).

Managing projects, organizing people and working in an appropriate way seems to be a key success factor. In view of this challenge experienced by organisations in implementing their strategies, projects have been used as a facilitator in these developments (Dietrich and Lehtonen, 2005; Grundy, 2000; Meskendahl, 2010).

The last decade has witnessed an increase complexity of projects being undertaken by organisations in both the public and private sectors (Baccarini, 1999; Williams, 2002).

2.2.2 Project Management background

Changes in technology and in the business environment has meant that greater demands are required from traditional management models, which have difficulty in giving a rapid response to changing markets. Three main key characteristics of modern organisations and society which reflects the increased adoption of project-based work across several industrial sectors are the following (Lundin and Söderholm, 1998; Midler, 1995; Sydow and Staber, 2002):

- Rapidly changing environments and markets;
- The increasing complexity of products and services;
- The knowledge intensity in production processes.

Organisations have adopted the project form as an important economic and social process on which the emerging knowledge economy has been supported (Cleland and Ireland, 2006; Meredith and Mantel, 2009).

Project management is the process within organization where temporary endeavours are undertaken for beneficial change and added value (Nokes, 2007), requiring a multi-dimensional set of skills and a professional practice of managerial knowledge (Hodgson, 2002; Kerzner, 2013).

Project management has experienced a very important growth and its economic impact is considerable in different sectors, industries and countries (Turner et al, 2010; Winter et al, 2006). The projects have become a tool for organizing and structuring work in most of the organisations on which they depend (Bakker, 2010), constituting one of the most important organisational developments of the last decades (Winter et al., 2006).

One main reason for this diffusion seems to be that the project-viewed as a task-specific and time-limited form of working – is perceived as a controllable way of avoiding all the classic problems which most the organisations are struggle (e.g. bureaucracy) (Cicmil et al., 2009; Packendorff, 1995; Hodgson, 2004).

The origin of project management is strongly linked to the demands of planned military projects in the United States, and it emerged during the post-war period, as there was a need to coordinate a wide range of activities. In this way, traditional project management skills were developed from the requirements of construction and defence industries to plan, control and manage large and complex *tangible* projects (Bourne and Walker, 2004; Morris, 1994).

Several writers attribute the roots of research and project management knowledge to various types of planning techniques, such as CPM[6] or PERT[7] (Packendorff, 1995).

The PMI (2016) defined project management as “the application of knowledge, skills, tools and techniques in activities project to meet project requirements” (p.9). Kerzner (2013) and APM[8] (2012) highlighted the importance of project management in planning, organizing and control the organisations resources to accomplish short-term targets to complete specific goals and wider objectives. Project management is then the process of applying the skills, knowledge and techniques and tools to assure that the project meets the required standards.

[6]Critical Path Method
[7] Program Evaluation and Review Technique
[8] Association for Project Management

Practices and techniques of project management are recognised by many organisations in various industries as being essential skills, which benefit businesses and conducted the project to an end of success (Shenhar and Dvir, 2007). Project Management received increasing attention in the business and academic world, as projects are important tools for change and organisational development. In an environment where projects are increasingly becoming the fundamental component of the business, project management has recently been the subjected to a closer scrutiny.

Over the last decades, more organisations are employing project management as a way of developing a competitive advantage, although projects do not always progress as planned (Grant and Pennypacker, 2006).

A survey performed by KPMG in 600 organisations across 22 countries showed that project complexity, in the IS/IT domain, increased in 88% and budgets increased in 79% on the organisations surveyed. The study also finds that 86% of respondents had project outcomes that are not within the planned expectations (KPMG, 2005).

Although some improvement has been seen in terms of project success, a relatively high frequency of project failures has been reported elsewhere as well (Cicmil and Hodgson, 2006; Pich et al., 2002; Xia and Lee, 2005).

Traditionally project management success focused on the development of the process dimensions of time, cost and quality (Redmill, 1999; Globerson and Zwikael, 2002). Further research found that the achievement of those requirements was not sufficient to measure project management success and evaluated dimensions such as the quality of the project management process or the satisfaction of the project stakeholder's expectations (Baccarini, 1999; Schwalbe, 2012).

This process should be careful planned, and actions monitored until objectives and benefits were achieved to fulfil the project successfully. Project management should be able to identify the goals and benefits, and the right combination of organisational changes and IS/IT investments to clearly mapping the way to get them (Gomes, Romão and

Caldeira, 2013a; Ward and Daniel, 2006). These approaches require an integrated business-oriented methodology and focusing management attention to IS/IT throughout the investment life cycle. Developing this competence within an organization also requires the integration of several specialized areas of knowledge, such as change management, risk management, project management, systems development, investment evaluation or portfolio management.

The underlying assumption is that the use of commonly accepted Project Management practices will enhance project performance (Papke-Shields et al., 2010. Although previous studies provide evidence of the relationship between using project management practices and improving project performance, a more thorough review is needed (Thomas and Mullaly, 2007).

Project performance targets are tied to the well-coordinated control of project activities, with relation to schedule, cost and quality, so that project can be fulfilled within the planned scope of the project (Taderdoost and Keshavarzsaleh, 2016).

2.2.3 Project Management: Limitations, trends and challenges

Traditionally, project management relies on several bodies of knowledge that make a description of what is generally recognized as good practice (e.g. PMI, IPMA, APM). Traditional project management approaches refer to a structured, mechanistic and top-down, system model-based that rely on systems design, tools, methods, and procedures (Blomquist et al., 2010). A growing body of literature, as well as a growing body of empirical evidence and the voices of numerous practitioners indicate that accepting and applying this widely-promoted project management of *good practice* standards does not eliminate project failures, nor does it guarantee project success (Williams, 2004). Hodgson and Cicmil (2008) claimed that the paradox of project management as universal solution to the acknowledged challenges of the new economic and social era becomes apparent. Over the past few years, an alternative to the best practice approach has been argued.

Cicmil and Hodgson (2006) argue that the iron triangle criterion, one of the important streams of research in projects, *disturbs* the research in project management. Smyth and

Morris (2007) complaint the weaknesses of the dominant research methodologies frequently used in project management studies. Cicmil (2006) stated that project theory should be served by a qualitative approach with a critical interpretive approach that could generate alternative understandings of what goes on in project practice and how managers participate and manage the complex organisational arrangements. Ivory and Alderman (2005) argued that project management theory needs to distance itself from prevailing rationalistic assumptions. Bresnen, Goussevskaia and Swan (2005) conclude that there is still much to discuss about project organization and events that are relevant to understanding organisational change. Bredillet (2005) highlighted the need for studies that focus on *who we are* and *where we are going.* Cooke-Davies (2004) argued that the underlying theory of project management practice is rarely articulated. Project management is an immature field of research, and many of the normative and traditional contributions lack substantial support when it comes to understanding what is actually occurring in projects (Winter et al, 2006).

Studies provide important insights into the multiplicity of potential benefits that executives, practitioners, and consultants found with the implementation of project management but make no effort to quantify these values (Thomas et al., 2002). Empirical evidence does exist, although, fragmented and incomplete (e.g. Bryde, 2003; Cooke-Davies, 2002; Ibbs et al., 2004; Kwak and Ibbs, 2000; Mullaly, 2004; Reginato and Ibbs, 2002).

Kolltveit et al (2015) based many years of practice observed the existence of several *perspectives* applied to project management:

- The *task perspective* – The focus is on the project object that should be delivered as specified within budget and on time. Planning and control. A dominant theory is based on the Scientific Management[9] (Gray and Larson, 2003; Maylor, 2010; Meredith and Mantel, 2009; Turner, 2008).

- The *leadership perspective* - The focuses is on the leadership aspect of project management and human processes. This perspective is based on theories of leadership, communication, process, organisational change, and team organization (Kerzner, 2013).
- The *system perspective*- This perspective implies that problems should be solved by considering the total rather than individual components. The system theory dominates this perspective (Kerzner, 2013; Senge, 2006; Schoderbek et al., 1990).
- The *stakeholder perspective* - The focus is on the effective management of the relationship between the project and its stakeholders. The agency theory is dominant in this perspective (Håkansson and Snehota, 1995; Savage et al., 1991)
- The *transaction cost perspective* - Based on the assumption that a project can be considered an economic transaction. The main theories that influencing this perspective are the incentive theory, contract theory and the theory of innovation (Winch, 2006).
- The *business by project perspective* - Focuses on project investments and benefits. The main theories are the strategy theory, the financial theory, the investment theory, the portfolio theory and the marketing theory (Artto et al., 1998; Turner, 2008).

Academic research confirms the tendency to increase the numbers of new developments and new initiatives being pursued through projects and programmes (Whittington et al., 1999). Recent industry report highlighted the growing adoption of

[9] Scientific management is a theory of management that analyzes and synthesizes workflows. Its main objective is improving economic efficiency, especially labor productivity. One early approach to scientific management is known as Taylorism (Mitcham, 2005).

project management standards and practices across large numbers of organisations (KPMG, 2013).

White and Fortune (2002) performed a survey over project managers and the results showed that most of the respondents used a limited number of methods, tools and techniques. The *Gant Charts* are the most used techniques between project managers. A half of the respondents reported drawback to the methods, tools and techniques they had employed. The criteria to judge the project success most cited is directly related with the *iron triangle*.

In contrast to the substantial increase in importance and dissemination of projects, its conceptual basis for project management model and methodology has remained rather static (Koskela and Howell, 2002) and has been dominated by a technocratic and rationalist point of view (Morris et al., 2011, Packendorff, 1995). Resuming some criticism highlighted by academics and professional:

- As a subject, is highly prescriptive and frequently ignores context (Maylor, 2001);
- Methodologically inconsistent (Meredith, 2002);
- The based-theory is obsolete (Koskela and Howell, 2002);
- Highly normative (Sydow, Lindkvist, and DeFillippi, 2004).
- The failure to recognize and provide guidance in managing different types of projects, particularly for projects with a high degree of uncertainty (Lenfle and Loch, 2010).

Particularly influential is the Scandinavian School of Project Studies (Sahlin-Anderson and Söderholm, 2002) which raises several vital themes which move beyond traditional understandings of projects and their management, positing among other things the conceptualisation of projects as temporary organisations (Lundin and Söderholm, 1995) and the recognition of the historically-embedded nature of projects (Kreiner, 1995; Engwall, 2003).

The most dominant strand of project management thinking is the rational, universal, deterministic model, emphasising the planning and control dimensions of project management (e.g. Morris, 2002; Winch, 2004; Yeo, 1993). Another strand more theoretically based and emerged in the late 1960s and 1970s from the literature on organisational design, which focused on organisational structure as a means of achieving integration and task accomplishment (e.g. Galbraith, 1973; Lundin and Soderholm, 1995; Mintzberg, 1983; Sydow et al., 2004; Toffler, 1997).

Researchers have argued that the benefits of project management practice are not all captured by ROI metrics. The underestimation of the impact on innovation (Turner and Keegan, 2004), process improvements (Winch, 2004) or on personnel (Thamhain, 2004), could be a possible reason for the past research has failed to identify the factors that truly determine project success. Although this issue is certainly complex, current research efforts should help clarify this issue. More recent perspectives explored the interplay between projects and the strategic direction of the business enterprise (Morris and Jamieson, 2004; Flowers, 2004) and a view of projects as information-processing systems (Winch, 2002). A review of practices issues identified topics of increasing interest to include: portfolio management; programme management; integrated performance metrics; governance, project leadership, project sponsorship, strategy, value management and benefits management; building enterprise-wide project management competence and capability (Morris, 2004).

To determine the *state of art* of project management research and identifying the key trends, a study reviewed more than 3,500 articles, journals, and papers reemphasized the focus at project processes, technology and skills, as the major key trends, namely (Kloppenborg and Opfer, 2002):

- Processes and tools standardization;
- Web-based technologies for communication and collaboration;
- Use of generally accepted project management practices and philosophies required through specific language in contracts;

- Outsourcing of project management by major companies;
- Challenges of non-traditional projects, such as volunteers, fund-raising, etc.;
- Project manager's role;
- Super projects analysis;
- Refinement of project scope focuses on business requirements and measurable benefits;
- Evolution of project selection and prioritization as a key issue;
- Emphasis on formal project management training and accreditation;
- Emphasis on risk management and more opportunities for project managers to receive risk management training;
- Focuses on communications and communications planning, particularly stakeholder management.

Söderlund (2011) in a literature review of the 305 articles published over the last five decades in thirty top management journals, proposes a categorization into seven schools of thought concerning the main focus, project concept, major research questions, methodological approaches and type of theorizing:

- *Optimization School* – Included diverse fields, such as, network planning research and systems analysis. The contributions share a common view on projects as complex activities to be planned by management-science techniques and models (e.g. Cooper, 1976; Eppinger, 2001; Holloway et al., 1979; King and Wilson, 1967; Taylor and Moore, 1980).
- *Factor School* – Gather the contributions of the research on the criteria for project success and, also the factors that lead to either success or failure in projects and project management (e.g. Avots, 1969; Bryson and Bromiley, 1993; DeCotiis and Dyer, 1997; Ericksen and Dyer, 2004; Grewal et al., 2006; Hoegl and Weinkauf, 2005; Müller and Turner, 2007; Pinto et al., 1993, Pinto and Prescott, 1988, 1990; Shenhar et al., 2001).
- *Contingency School* - Contributions that seek a balance between developing the theory of project management and its applicability to a wide variety of projects.

Contingency School draws on a long and strong tradition in organisational theory relating to a variety of contingency dimensions affecting organizational design and structure (e.g. Dailey 1978; De Meyer et al., 2002; Dvir et al., 1998; Lawrence and Lorsch, 1967; Kolodny, 1979; Middleton, 1967; Nutt, 1982, 1983; Pich et al., 2002; Shenhar, 1998, 2001; Shenhar and Dvir, 1996).

- *Behaviour School* – A stream of research in organization-theory, namely research on project organization, organisational behaviour and organization processes. Research at this school typically recognizes the process and the dynamic nature of the project and investigates time pressure, confidence, problem solving, learning, dimensions to accommodate an analysis of the nature and process of project behavior (Brady and Davies, 2004; Gemmill and Wilemon, 1970; Engwall, 2003, Goodman and Goodman, 1972, 1976; Kim and Wilemon 2007; Lundin and Söderholm, 1995; Melcher and Kayser, 1970).
- *Governance School* - Contributions on the use an economics approach on projects and project management. The Governance School aims to analyze why there are projects and define the appropriate government project mechanisms as a particular type of administrative problem and complex transaction (Roman, 1964, Gerwin and Ferris, 2004; Goodman, 1967; Hodgetts,1969; Lorenzen and Frederiksen, 2005; Meinhart and Delionback,1968; Winch at al., 2000).
- *Relationship School* – The research draws on alternative theories taken primarily from the fields of inter-organisational relations and marketing The Relationship School gives an alternative to the conventional static view of projects and stresses the relational embeddedness of projects and its social construction (Cova and Hoskins, 1997; Elias et al. 2002; Hellgren and Stjernberg, 1995; Larson and Wikström 2007; Skaates et al. 2002; Starkey et al., 2000; Staber 2004; Welch, et al., 1996; Welch, 2005).
- *Decision School* - Contributions to explain why projects that do not follow a rational model work successfully and why some projects that seem to be unwise get implemented despite the bad indicators. Decision School research focuses primarily on the early stages of projects and underlines the value of in-depth

analysis of single cases. (Davis, 1985; Lovallo and Kahneman 2003; Matta and Ashkenas 2003; Ross and Staw 1986, 1993; Staw and Ross 1978).

2.3 Maturity Models

2.3.1 Overview

Academic literature has paid a considerable attention to the concept of maturity models (Clarke, 1999; Crawford, 2002; Kerzner, 2005: Kwak & Ibbs, 2002, Pennypacker & Grant, 2003).

“Maturity models have become an essential tool in assessing organisations' current capabilities and helping them to implement change and improvement in a structured way” (Jia et al., 2011, p. 834). Maturity model is a set of characteristics, attributes, indicators, or patterns that represent progression and achievement in a specific domain or discipline (Caralli et al., 2012).

Maturity models provide an assessment framework that enables an organization to compare, for instance, its project delivery with best practice criteria. More generally, that assessment allows the organization to gauge its value against competitors, ultimately defining a planned and structured route to improvement (Ghorbanali et al., 2010).

The use of maturity models provides a framework for continuous improvement in many areas of business. They drive strategically-linked continuous improvement and require a prior thorough understanding of an organization’s current position and an idea of where it aims to be in the future (Brookes and Clark, 2009). Maturity models aim to integrate, assess and improve project management practices. Maturity models are designed to provide a framework that an organization needs to develop its capabilities, to deliver projects successfully in the long term (Jugdev and Thomas, 2002; Mittermaier and Steyn, 2009). Recognition of the maturity models approach is also evidenced by the large investments made by businesses, governments and the third sector in developing skills and abilities in this area (Söderlund and Maylor, 2012).

The concept of process maturity was born out of Total Quality Management, where the application of statistical process control techniques showed that enhancing the maturity of any technical process leads to a reduction of the inherent variability in the process and to an improvement in the mean performance of the process (Cooke-Davies, 2002). Maturity models focus on the organization *know-what*, codifying the explicit knowledge and formally documented internal processes (Jugdev and Thomas, 2002).

The value of a generic methodology like the maturity models lies on the ability to develop a model which is characterized by a high generalisability and standardization, rather than in a specific stage-model (De Bruin and Rosemann, 2005). Use of a standard methodology enables a state of model development to be reached and for incremental improvements to be made over time. The value to organisations of applying such a model lies in the ability to measure and assess domain capabilities at a certain point in time, thus achieving sustainability (De Bruin and Rosemann., 2005). Overall, maturity models reflect the characteristics of an organization as they move through different stages in a change cycle, providing conceptual guidelines on essential requirements and components at each stage, including key success drivers and indicators (Duffy 2001; Kim and Grant, 2010)

The assessment procedures helped an organization understand where they have been, where they are now, and what processes they need to implement, to continue their implementation of management methodologies. As organisations *mature* in business and project management processes, and their use of information technology, they implement centralized solutions to facilitate these processes (Smith, 2010). Working with different types of projects within an organization requires standard models to deliver successful future projects repeatedly, improve both the quality of future projects and gain knowledge and learn from past successes and mistakes (Hellered, 2010).

Change management is a central topic as well as ways of measuring long term achievement for the organization’s customer satisfaction through delegation of responsibilities and coordination between several projects (Gomes, Romão and Caldeira, 2013a; D’Ortenzio, 2012). For achieving a high maturity rating within project management, frequent collection and analysis of the performance metrics should be made for improvement of future projects.

2.3.2 Maturity Models background

Maturity models approach has become a popular way for organisations to build capabilities ever since the CMM[10] was developed in 1991 (Paulk et al., 1993). Conceptually, most of models are based on the CMM from SEI[11] (Rosenstock, Johnston and Anderson, 2000; Skulmoski, 2001).

Maturity models are widely accepted by the bodies of the project management knowledge (e.g. PMI or IPMA[12]), however the evidence of the extent of use and impact of the models is in some way limited (Brooks and Clark 2009).

The purpose of the maturity models is to provide a framework for improving an organization's business result by assessing the organization's strengths and weaknesses, enabling comparisons with similar organisations, and a measure of the correlation between organisations (Combe, 1998; Gomes and Romão 2014b); Hartman, 1997; Ibbs and Kwak, 2000; Hillson, 2001). The object of these comparisons is to gain critical information that enables an organization to become more competitive in the marketplace (Kerzner, 2001). Organisations can use maturity models to compare their capabilities with a standard and identify areas for improvement and development (Jugdev and Thomas, 2002). The proposition behind most maturity models is that organisations develop capabilities by achieving each level of capability in a sequence across a range of capability dimensions (Crawford, 2006). The activities improvement required guidance on how to improve and what efforts are required (Mullaly, 2014).

Levin and Skulmoski (2000) point out that the maturity models provides a framework to help enable organisations to increase their capability to deliver projects on schedule,

[10] Capability Maturity Model, a tool for assessing processes in organisations during software development
[11] Software Engineering Institute, located at Carnegie Mellon University, USA
[12] International Project Management Association

within budget and according to the desired technical specifications. Working with different types of projects within an organization requires standard models to deliver successful future projects repeatedly, improve both the quality of future projects and gain knowledge and learn from past mistakes. A survey conducted in 30 countries collected 200 respondents among top, senior and project managers' professionals and draw the following main conclusions (PwC[13], 2004):

- Organisational maturity is directly correlated with organisational success;
- Higher maturity yielded higher performance within the five key performance indicators (quality, scope, budget, time, business benefits).
- Organization with higher maturity levels enhances overall project performance;
- Project fails because of organisational issues and project managers have little influence on these failures;
- Organisational structure has a big influence in overall project performance;
- Staff development and professional certification enhance overall project performance;
- A systematic approach to change management in projects is fundamental for superior performance;
- Projects become more efficient and effective with higher levels of maturity and that eventually contributed to successful projects.

Maturity models have become an important evaluation tool for measuring the internal and external organization capabilities and describe the development of an entity over time (Klimko, 2001). Maturity models represent a structured collection of elements which highlight the characteristics of effective processes at different stages of development (Pullen, 2007). Maturity models approach is the evolutionary progress in demonstrating the specific ability or accomplishment of a target from an initial to a final desired stage (Mettler and Rohner, 2009).

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[13] PricewaterhouseCoopers

Skulmoski (2001) and Sergeant et al. (2010) recommend a view where competence and maturity should be linked together for project success and not focusing only on action and where competence should be regarded as a combination of knowledge, skills and attitudes that supports performance. In general, three specific objectives can be attributed to maturity models (Becker et al., 2009, De Bruin and Rosemann., 2005, Maier et al., 2009):

- *Descriptive*: a maturity model has a descriptive purpose when it is applied to the assessments as-is, where entities' ability under current observation are evaluated against certain criteria (Becker et al., 2009).
- *Prescriptive*: a maturity model has a prescriptive purpose when it allows identifying desirable levels of maturity and provides guidance on improvement measures (Becker et al., 2009).
- *Comparative*: a maturity model presents a comparative view when adopted to allow a comparative analysis internal or external.

AXELOS (2016) highlighted a set of reasons why organisations might need to use maturity model to assess their current performance, such as:

- Justifying investments in portfolio;
- Justifying programme or project management improvements;
- Gaining recognition of service quality to support proposals;
- Gaining a better understanding of their strengths and weaknesses to enable improvement to happen.
- Assist organisations after a merger or acquisition
- Reduce costs and delivery benefits

The maturity models approach has tools for evaluating organisations on various aspects, (Wetering and Batenburg, 2009; Duffy, 2001; Sharma, 2008) such as:

- Identifying when and why the organization should follow a specific orientation;
- Providing relevant information about necessary actions;
- Setting goals to achieve and measure progress.

Crawford (2006) defines maturity as being the stage at where an organization finds itself, after assessing its efficiency in performing tasks and the level of development of its practices, processes and behaviours which can impact on results.

The main focus of investment in IS/IT lies not only in technology implementation, but mainly in improvements in organisational performance and business efficiency, in other words, improving processes and changing the ways the work is performed. Concerning the IS/IT environment, maturity is regarded as a measure to evaluate the capabilities of an organization (De Bruin and Rosemann, 2005). Maturity models in IS/IT are understood as tools that facilitate internal and/or external benchmarking while also showcasing future improvement and providing guidelines through the evolutionary process of organisational development and growth (Mettler et al., 2010).

In project management for IS/IT projects, various stages of growth have been presented by researchers to map the organisational evolution (Galliers and Sutherland, 1991; Nolan, 1979).

Maturity models has been used in diverse application areas encompassing product development, software management, project management, patient safety culture, information management, risk management and others (Maier et al., 2009; Becker, 2009; Mettler and Rohner, 2009). In a systemic mapping study concerning relevant publications of journals and IS conferences from 1993 to 2010, Wendler (2012) found 237 articles showing that current maturity model research is applicable to more than 20 domains. The study also revealed that most publications deal with empirical and development studies identifying gaps in evaluating and validating the developed maturity models. Examples of maturity models' applicability:

- Business process management (Rohloff, 2011; Van Looy et al., 2011)
- Business development maturity model (BDII, 2003).
- Collaboration (Fraser et al., 2003; Fraser and Gregory, 2002; Maier et al., 2012);
- Contract management (Garrett and Rendon, 2005);

- Enterprise risk management (Abrams et al., 2007; Zhao, Hwang and Low, 2013);
- Healthcare usability maturity model (HIMSS, 2011);
- Innovation (Aiman-Smith et al., 2005) ;
- IS/IT risk management (Carcary, 2013, Elmaallam and Kriouile, 2011);
- IT in the engineering and construction industry (Hinks et al., 1997);
- Knowledge management (Isaai, 2006)
- Leadership (Hogan, 2008).
- Legal assurance process (Buglione et al., 2009);
- People capability maturity model (Curtis et al., 2009);
- Product development (Dooley et al., 2001; McGrath and Romeri, 1994);
- Product reliability (Sander and Brombacher, 1999; Tiku, et al., 2007);
- Project management (AXELOS, 2016; AIPM, 2004; PMI, 2003; OGC[14], 2010a) ;
- Project success (Skulmoski, 2001) ;
- Quality management (Crosby, 1979, 1996; Maier et al., 2012) ;
- R&D effectiveness (Berg et al., 2000 ; 2004 ; 2006) ;
- Risk management (Hillson, 1997) ;
- Risk Management Capability Maturity Model (Yeo and Ren, 2009);
- Software development process (Niazi et al., 2005 ; Paulk et al., 1993 ; Zhou, 2003);
- Strategic management (De Vries and Margaret, 2003) ;
- Supplier relationships (Done, 2011; Lockamy III and McCormack, 2004);
- System safety analysis maturity levels (Gunderson, 2005).

Studies have shown significant correlation between maturity and tangible and intangible values (Thomas and Mulally, 2008), which reinforces the value of applying this tool. Due to their nature maturity models are an important managerial tool, and while they

[14] Office of Government Commerce. UK Government Office established as part of the HM Treasury.

have been used extensively in information system development, they offer important insights into health information systems (Kim and Grant 2010; Wetering and Batenburg 2009; Crawford 2006). Sharma (2008) describes an immature healthcare organization as one that is reactive, with personnel focussing on solving immediate crises, with no objective basis for judging product quality or solving process problems. Haux (2006) has proposed seven different stages in the development of health information systems:

1. Shift from paper-based systems to computer-based processing and storage and increased data processing;
2. Shift from local to global information system architectures;
3. Health information system used by professionals and patients/consumers;
4. Data used for patient care and administration, and also increasingly used for healthcare planning and clinical research;
5. Shift of focus from technical health information system problems to change management and strategic information management
6. Shift from alpha-numerical data to clinical images and data on a molecular level
7. Steady increase in new technologies for continuous monitoring of health status.

Each stage of a maturity model represents greater expectations and complexity of environments, as well as tracking improvement and transformation over time and the capabilities at each stage (Wetering and Batenburg, 2009; Sharma, 2008).

2.3.3 Maturity Models: Benefits, limitations and challenges

According to Caralli et al., (2012) some benefits are recognized to the maturity models:

- Using a standard measurement approach based on the model content, organisations can determine where they are in their improvement process and set targets for future investments in performance improvement.
- By taking measurements against the model over a period, organisations can use the model as the basis for continuous performance improvement.

- Organisations can not only compare their performance against peer organisations but also determine performance profile.
- Maturity models often create a consistent way of thinking and communicating about a certain domain.

Maturity models help integrate traditionally separate organisational functions, set process improvement goals and priorities, provide guidance for quality processes, and provide benchmark for appraising current processes outcomes (Gomes, Romão and Caldeira, 2013a). There is little evidence suggesting that process capability improvement results in improved project success although a few studies are promising (Mullaly, 2006; Lee and Anderson, 2006). No studies have been able to show that using maturity models or assessing project management maturity results in a sustained competitive advantage for an organization (Jugdev and Thomas, 2002).

Lee and Anderson (2006) used a Delphi study to research factors not covered by maturity models, which influence project management capability. One of the most widely cited maturity studies asserted no statistically significant correlation between maturity and performance (Kwak and Ibbs, 2000), whereas Jugdev and Thomas (2002) could not find a correlation between process capability and project success for many maturity models. A longitudinal study of maturity in organisations demonstrated no credible link between maturity and organisational performance and highlighted significant concerns about the challenges of sustaining organisational maturity over time (Mullaly, 2006). The outcomes expected by adhering to the practices of maturity models are unable to support or demonstrate that they will bring successful outcomes (Killen and Hunt, 2008).

Maturity models claim to represent all processes available for a project to be successful (Sergeant et al., 2010; Kerzner, 1998). Unfortunately, this assertion is not supported by evidence, with many models either lacking empirical evidence to support the use of specific measures or lacking a theoretical basis (Anderson and Jessen, 2003; Jugdev and Thomas, 2002). Many factors that impact performance is not specifically addressed by maturity models (Sergeant et al., 2010; Lee and Anderson, 2006).

Another underpinning assumption is that an improvement in process maturity will yield an improvement in overall organisational maturity. Neither of these assumptions has been empirically tested. Maturity models are characterized as *step-by-step recipes* that oversimplify reality and lack empirical foundation (Benbasat et al, 1984; De Bruin and Rosemann, 2005; King and Kraemer, 1984; McCormack, et al, 2009). Maturity models should be configurable because internal and external characteristics may constrain a maturity model's applicability in its standardized version (Iversen, Nielsen and Norbjerg, 1999; Mettler and Rohner, 2009). Gareis and Hueman (2000) reject the notion of a maturity ladder of stages: the argument being that a ladder model might be too rigid. Instead he goes for a spider web presentation to allow for more differentiation in describing the needed competencies in handling the specific processes of the project-oriented organization.

No statistically significant correlation was demonstrated between process capability and project success, project management maturity and project success, based on cost and schedule performance, or in terms of contributing to the organization's success as a means of competitive advantage (Grant and Pennypacker, 2006; Ibbs and Kwak, 2000; Jugdev and Thomas, 2002; Mullaly, 2006).

Andersen and Jessen (2003) highlighted that the maturity models have in some way a rigid structure for performing assessment of project management standards and practices. Mullaly (2014) concluded one of major weakness of using maturity models was that all presume that the projects within an organization must be performed and managed in a similar way. Studies have shown that more than a hundred different maturity models have been proposed (De Bruin and Rosemann, 2005). Albeit with some criticism, maturity models have still to be adopted in organisations for the improvement projects management (Albrecht and Spang, 2014).

To mitigate this criticism, research increasingly deals with maturity models from a design process and a design product perspective (Röglinger et al., 2012). Concernig the design process approaches several models have been proposed (e.g., Becker et al., 2009, de Bruin et al., 2005, Maier et al., 2009, van Steenbergen et al., 2010, Solli-Sæther and

Gottschalk, 2010, Mettler, 2011). For maturity models as design products, Simonsson et al. (2007) suggested qualities particularly geared to capability assessment models/methods. According to Simonsson et al. (2007), a good capability assessment model/method must be valid, reliable, and cost efficient. As for the components of maturity models, de Bruin et al. (2005) suggest to structure maturity models hierarchically into multiple layers.

Although the maturity models are now worldwide spread, it must be acknowledged that maturity models are not a silver bullet and do not in themselves result in success or performance improvements to an organization (Young et al, 2014).

2.3.4 Project Management Maturity

Not surprisingly, the concept of maturity was also diffused to the project management field. Different views exist on maturity related to project management. A significant number of competing perspectives attempt to describe mature project management practices (Cooke-Davies and Arzymanow, 2003; Hillson, 2003a; Ibbs and Kwak, 2000; Jachimowicz, 2003; Mullaly, 2006; PMI, 2003; Sawaya and Trapanese, 2004; Skulmoski, 2001).

These approaches assume that increases in project management maturity will lead to more consistent and more successful project outcomes. Many project maturity models emerged last decades and have been described in project management literature (Hillson 2001; Kerzner 2001; Crawford 2006; Ibbs et al., 2004).

Some studies have discussed the correlation between the level of project management maturity and project performance (Ibbs and Kwak 1997; Jiang et al., 2004; Ibbs and Kwak 2000). The theory highlighted that investment in project management increases an organization's project management maturity standing and this improvement results in enhanced project performance that should translate into cost saving and other benefits (Ghorbanali et al., 2010).

There are several attempts to link the project management maturity models to project success. The concept of project management maturity varies within the project management literature (*Table 1*).

Project Management Maturity concept	**Authors**
Project management maturity is the organizational receptivity to project management.	Saures (1998, p.362)
Maturity shows how an organization has progressed in relation to the adoption of project management as a way of working, thus reflecting its effectiveness in completing projects.	Dinsmore (1999)
Project management maturity is focusing mainly on what organisations and people do as operational activities	Ibbs and Kwak (2000)
Project management maturity assessment provides the basis for a larger and more significant initiative, serving the basis for guiding a subsequent project management improvement effort.	Levin and Skulmoski (2000)
The maturity in project management represents the implementation of a standardized methodology supported in well-developed processes in such a way that it promotes the occurrence of repeated successes	Kerzner (2001).
Most companies consider using practices and support tools which are applicable for project management processes, as they permit them to adapt to changing business environments, yet they need a reference model for the efficient implementation of such tools.	Kwak and Ibbs (2002)
Evaluate project management's capacity to generate long term competitive advantage. They claimed that maturity models do not in themselves generate advantage as they are easily copied. From a small sample of an exploratory study, she asserted that project management may be an enabler rather than a strategic asset.	Jugdev and Thomas (2002)
The maturity of the project means that the organization is properly prepared to handle its projects.	Andersen and Jessen, (2003)
Project management maturity is the sophistication level of an organization's current project management practices and processes.	Ibbs, Reginato and Kwak (2004)
Maturity in project management consists of developing repeatable processes and systems which lead to project success.	Jugdev and Müller, (2005)
Project management maturity models assumes that the success of projects will increase through standardisation and the incremental process of improvement.	Milosevic and Patanakul (2005)
Project management maturity is generally used as an indicator or as a measure of an organization's ability to deliver projects successfully.	Adenfelt (2010); Isik et. al. (2009)

Project management maturity model is a formal tool used to assess measure and compare an organization's own practices against best practices or those employed by competitors, with the intention to map out a structured path to improvement.	Grant and Pennypacker (2006)
Organisational project management maturity and competency seem to be promising variables which are both related to project success.	Suikki, et al. (2006)
Project management maturity model offers a uniform approach for measuring and guide the improvements on the maturity level of an organization.	Brooks and Clark, (2009); Wheatley (2007)
Maturity in project management processes is strongly associated with a high project success rate. The participation of the project manager during the front end of the project is shown to be one of the principal factors discriminating high-performing organisations delivering innovation projects.	Besner and Hobbs (2008)
Maturity models for project management are used to measure the degree to which an organization is executing project management by comparing its project management practices against practices in general or best practices.	Ghorbanali et al. (2010)
Project management maturity helps organisations address fundamental aspects of managing projects, improve the likelihood of a quality result and successful outcome and reduce the likelihood of risks impacting projects adversely.	OGC (2010a)
Maturity will affect the value an organization can gain by implementing project management. Therefore, maturity in project management turns out to be pursued by different organisations as tools through which an organization could move toward perfect development in project management by conducting a progressive maturity process within the organization.	Shi (2011)
Project management maturity is the degree of an organization's ability to deliver the desired strategic outcomes in a predictable, controllable, and reliable manner.	PMI (2013a)
Project management maturity assessment identify how to improve project performance and project management structure.	Albrecht and Spang (2014); Brookes et al. (2014)
Project management maturity assumes that better process delivery improves project outcomes, or, in other words, it assumes that increasing project management maturity will lead to more predictable, consistent results and, consequently, projects with greater success.	Mullaly (2014)
Project management maturity models emerge which provides companies with the necessary mechanisms to allow them to identify the key areas for opportunity and improvement in project management tasks.	Gomes and Romão (2015b)

Table 1 - project management maturity definitions

Kwak and Ibbs (2000) examined the relationship between cost performance and schedule performance and the level of maturity of the organization. Their research outcomes supported the assumption that there is a positive correlation between maturity and project success; however, this was not statistically significant, most probably because of the small sample size (e.g. Mullaly, 2006). Additionally, these models serve to develop comparative indicators for the application of project management practices and techniques across organisations which operate in the same business environment or sector (Gomes and Romão, 2015b). These skills are measured using benchmarking process[15]. Ibbs and Reginato (2002) and Dooley et al. (2001) found that, on average, higher levels of project management maturity are associated with better cost and schedule results. More generally, project management maturity models provide several main advantages:

- A normative description of good practices. That is, the maturity levels set an ideal standard that organisations can strive for (Tiku et al., 2007).
- A discussion tool for engaging interviewees and enabling reflection on the current status of an organization (Jugdev and Thomas, 2002).
- The resulting identification of strengths and weaknesses provides a logical path for progressive development and a strategic plan for advancing project management improvement within the organization (Crawford, 2006).
- Benchmarking against *best practices* (Marshall, 2010).

Maturity has been expressed by organisations as a potential key factor for increasing performance, for achieving goals and for being successful. Several studies recognize the benefits from investments in project management skills in organisations and others have discussed the issue of the correlation between level of maturity and the performance of projects (Ibbs and Kwak, 2000; Ibbs and Reginato, 2002; Mullaly, 2006). There are two main reasons for organisations to adopt a maturity model for their project management (Ghorbanali et al., 2010):

[15] The benchmarking process aims to diagnose strengths and weaknesses, to measure the current capacity and to identify areas for improvement (Hillson, 2003a).

- Helping to build the necessary infrastructure to delivery projects successfully. This includes processes, methods and techniques, governance structures, and competences of people and tools;
- Acquiring knowledge into their strengths and weaknesses and to be able to prioritize its actions to make the necessary improvements.

Identifying the maturity model in the change domain suggests that many of the ideas developed to address broader business change are applicable to the project management environment. Higher maturity levels are related to higher levels of predicted project performance (Ibbs and Kwak, 1997, 2000; Ibbs and Reginato, 2002; Kwak and Ibbs, 2000, 2002). There are relatively few empirical works that included project, programme and portfolio management maturity across multiple organisations or industries.

In a 2004 study, Pricewaterhouse Coopers (PwC) identified the average level of maturity for project management was 2.5 and most government organisations (56%) were at level 1 (PwC, 2004). The studies performed using different maturity models show that lower levels of maturity are more common (*Table 2*).

Study	**Project Management**	**Programme Management**	**Portfolio Management**
Ibbs and Kwak, 2000	3.26	-	-
Andreson and Jessen, 2003	3.34	3.28	3.25
Pennypacker and Grant, 2003	2.4	-	-
PwC, 2004	2.5	-	-
Grant and Pennypacker, 2006	2.5	-	-

Table 2 - Empirical studies of project maturity

Higher maturity scores are hypothesized to correlate with higher levels of predicted project performance. 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 (PwC, 2004). The PwC survey showed that higher levels of maturity result in superior performance in terms of project delivery and business benefits. It is also found that the standardization and optimization of the processes increase the maturity level of the organization which in turn increases their success (PwC, 2004).

Indeed, research studies have shown significant relationships between maturity and tangible and intangible values (Thomas and Mullaly, 2008), which reinforces the worth of applying this tool. The general opinion is that organisations with higher maturity levels are expected to be successful in terms of project effectiveness and efficiency and have a competitive advantage in the marketplace (Cooke-Davies and Arzymanow, 2003). The underlying assumption is that the improvement in process maturity will yield an improvement in overall organisational maturity, which means that there is a relationship between higher levels of maturity and the project success (Young et al, 2014).

2.3.5 Maturity Models examples

Immature organization differs from mature because it acts reactively, has a lot of problems with time and quality assurance while mature organization uses standardized methods and effectively copes with project management (OGC, 2010a). Organisations with a mature project management report more project success and less money lost due to project failure (PMI, 2013c). The project management maturity concept has been presented for the first time in the late 1980s from a joint effort of the United States government and Software Engineering Institute (SEI) to find a tool for successful software development (Larson and Gray, 2011).

Maturity is commonly measured in discrete stages and across several dimensions. Most of these models adopt a five-level framework following the original idea developed by Crosby (1979) and extensively publicized in the CMM-SW[16] (Paulk et al., 1993). All of them assume that better process delivers improved the outcomes or in other words they assume that increasing project management maturity will lead to more consistent results and projects with greater success (Mullaly, 2014). Maturity models typically include a sequence of levels that form an anticipated or logical path from an initial state to maturity

[16] Capability Maturity Model for Software

(Becker et al., 2009; Gottschalk, 2009). An organization's current maturity level represents its capabilities about a specific class of objects and application domain (de Bruin and Rosemann, 2005). Maturity assessment usually involves variation over five stages of development (Jugdev and Thomas, 2002), and assessment procedures which help organisations understand their current position and which determine their future direction (*Table 3*).

Level	**Description**
Initial	Processes are not usually documented
Repeatable	Basic management practices have been established
Defined	The management and technical processes necessary to achieve the organisational purpose will be documented, standardized and integrated to some extent with other business processes.
Managed	There will be evidence of quantitative objectives for quality and process performance, and these will be used as criteria in managing processes.
Optimized	The organization will focus on optimization of its quantitatively managed processes to consider changing business needs and external factors.

Table 3 – Maturity levels description

Measurement is based on subjective assessments of what people are doing operationally, with each being scored or allocated a level of maturity, usually from a graded step model (Young et al, 2014). Despite all their similarities, maturity models differ from each other with respect to their assessment methodology, such as: the number of aspects and dimensions covered and the evaluation process, how they aggregate results and levels of maturity. These differences are based on different studies regarding *best practices* in project management (Killen and Hunt, 2008) and has resulted in recurring discussions about what is or should be a theoretical construction project management maturity (Pasian et al., 2012).

Thus, choosing a maturity model approach is a management decision and the organisational context must be considered to ensure the adequacy of the model chosen (Wendler, 2012). Each organization should decide their optimal maturity level depending on their business needs and prioritise process improvement effort accordingly (OGC, 2010a). Following, a brief description of the three of the most popular maturity models.

CMMI©[17]

Despite the diversity of models and except for some differences, they converge on a conceptual framework, comprising well-established processes through which an organization develops itself in a systemic and planned way to achieve a desired future state.

Nowadays, CMMI© is one of the most widely cited and used. CMMI© can be used for process improvement and maturity/capability determination (Yucalar and Erdogan, 2009). Studies performed highlighted that the CMMI© usage reduced costs, improved productivity and result in less quality assurance issues providing a significant return on investment (Gibson et al., 2006; Goldenson and Gibson, 2003).

The CMMI© emerged in 1987 as the Capability Maturity Model a project at the Software Engineering Institute (SEI), which is a research centre at Carnegie-Mellon University (Paulk, 1993). This centre was established and funded by the United States Department of Defence.

The CMM for Software was first published in 1991 (Chrissis, 2011) and is based on a checklist of critical success factors in software development projects during the late 70s and early 80s. CMM has achieved considerable adoption and undergone several revisions and iterations. Its success led to the development of CMMs for a variety of subjects beyond software. The proliferation of new models was confusing, so the government financed a two-year project that involved more than 200 industries and academic experts to create a single, extensible framework that integrated systems engineering, software engineering and product development. The result was CMMI©.

This framework defines sets of *best practices* grouped into process areas that product development organisations implement to improve the predictability of their project costs

[17] Capability Maturity Model Integration

and schedules (Beynon, 2007). Considerable research has been done to determine the best software and systems engineering development, acquisition, and sustainment practices. Many of these practices are part of the CMMI© framework (Chrissis, 2011).

The five-step CMMI© process is used to establish an organization's current maturity level. A CMMI© model provides a structured view of process improvement across an organization helping with the integration of the traditionally separate organization areas, such as: setting process improvement goals and priorities; providing guidance for quality processes and delivering a criterion to evaluate current practices.

CMMI© claimed several benefits from this model, such as: the substantial reduction on systems integration with greater probability of success; causing integration of, and interaction among the various engineering functions; employing systems engineering principles in software development; increasing and improve software engineering content in programs and leverage previous process improvement investments; increasing focus and consistency in the requirements development and management; systems design and development; systems integration, risk management and measurement and analysis.

Bodies of knowledge captured in CMMI© models include: Systems engineering (SE); software engineering (SW); integrated product and process development (IPPD); and, supplier sourcing (SS).

There are two types of representations in the CMMI© models: staged and continuous. A representation allows an organization to pursue different improvement paths. The organization and presentation of the data are different in each representation. However, the content is the same. Both representations provide the same essential content but organised in different ways (*Table 4*).

Continuous Representation	**Staged Representation**
Maximum flexibility for order of process improvement	Predefined and proven path with case study and ROI data
Focuses on improvement within process areas	Focuses on organisational improvement

Improvement of process areas can occur at different rates	Overall results summarized in a maturity level
Source selection investigation can target risky areas at any level	Maturity levels are common discriminators

Table 4– Continuous and staged representation (adapted from CMMI©, 2010)

Each representation has its advantages and limitations for suitable applicability (Chrissis, 2011). The staged representation is suitable for an organization that does not emphasize one process over another, but needs an overall guidance for improvement, or an organization in need of producing an indication or proof of its general level of maturity. The latter situation may be required as a precondition to enter a bidding process in some country or organization.

The continuous representation provides flexibility for selecting the processes considered important for achieving the business goals of the organization, as the organization best sees fit for the situation (Yoo et al., 2004).

The continuous representation allows the measurement of improvement at the process level. This finer level of assessment enables better monitoring of process improvement by upper management. The two representations are not independent. They are based on the same 22 process areas, and there is a transformation or mapping from the continuous representation to the staged representation, known as equivalent staging. If a company achieves certain capability levels in certain process areas, then it is automatically assumed to obtain certain maturity levels. CMMI© defines five maturity levels (*Table 5*). A maturity level is a well-defined evolutionary plateau of process improvement. Each level is a layer in the foundation for continuous process improvement using a proven sequence of improvements, beginning with basic management practices and progressing through a predefined and proven path of successive levels.

Level	**Description**
Initial	Process unpredictable, poor controlled and reactive
Managed	Process characterized for projects and is often reactive

Defined	Process characterised for the organization and is proactive
Quantitatively	Process measured and controlled
Optimizing	Focus on continuous improvement

Table 5- Maturity models (adapted from CMMI©, 2010)

Each maturity level provides a necessary foundation for effective implementation of processes at the next level. Higher level processes have less chance of success without the discipline provided by lower levels. The effect of innovation can be obscured in a noisy process. Higher maturity level processes may be performed by organisations at lower maturity levels, with the risk of not being consistently applied in a crisis. Both representations provide ways of implementing process improvement to achieve business goals.

OPM3©[18]

Following the CMM development, the concept of maturity has expanded in organisations reaching the project management area, which aroused the interest of PMI members (Project Management Institute) to develop a standard for the maturity model on projects (Zhang et al., 2012).

PMI released the first edition of the OPM3© standard in 2003 (PMI, 2003). OPM3© is meant to enable organisations to bridge the gap between organisational strategy and successful projects (Schlichter, 2001).

OPM3© focuses on the comparison of organisational activities to *best practices*, defined by PMI as the optimal method of meeting a specific stated objective (Crawford, 2006). The OPM3©´s intent is (Fahrenkrog et al., 2004):

[18] Organizational Project Management Maturity Model

- To guide the development of capabilities necessary to execute organisational strategy through successful projects, distinguished from capabilities associated only with the management of individual projects; and

- To be able to be used by organisations of all sizes and types, in virtually any industry or culture.

OPM3© assesses *best practices* in Project, Programme and Portfolio management by analysing:

- Capabilities – Presence of specific organisational activities that have been identified as part of a best practice.
- Outcomes – The beneficial results that organisations obtain from performance of those activities.
- Key Performance Indicators (KPIs) – Measures that are used to determine the existence and strength of a capability.

Organisations can then be classified into four stages of development in each process area at the Project, Programme and Portfolio level (*Figure 1*):

- Standardize: Structured processes are adopted.
- Measure: Data is used to evaluate process performance.
- Control: Control plan developed for measures.
- Continuously Improve: Processes are optimized.

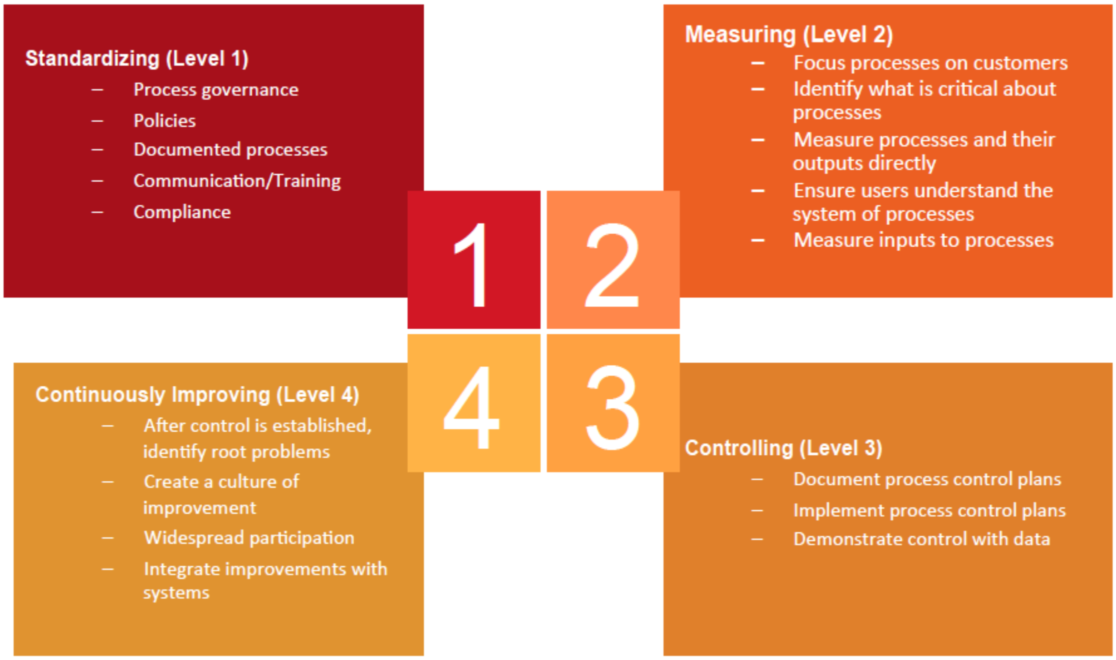

Figure 1- OPM3© Levels (source: OPM Experts LLC, 2015)[19]

OPM3© is a conceptual structure composed of standardized elements, evaluation, control, and improved governance, which provides visible benefits, being developed in a systematic way to achieve the objective of the project working the points of greatest relevance. The purpose of OPM3© is not to prescribe what kind of improvements users should make or how they should make them. Rather, by providing a broad-based set of organisational project management best practices, this standard allows an organization to use it as a basis for study and self-examination, and consequently to make its own informed decision regarding potential initiatives for changes (PMI, 2013e).

OPM3© provides a method to evaluate and improve systematically the organization of a single project to a portfolio of projects (Zhang et al., 2012). There are three basic elements to implement the OPM3© (PMI, 2003):

[19] http://www.opmexperts.com/opm3/

- Knowledge: The description of the contents of the management and organisational maturity model projects;
- Evaluation: The methods, processes and procedures that serve as the basis for organizing self-diagnose of the maturity of the project. This review is carried out through a questionnaire with 151 questions that allows verify the strengths and weaknesses of the project against the "*best practices*";
- Improvement: Considering a continuous improvement process that helps managers to modify the organization of the current stage for a more mature stage.

The PMBOK[20] Guide describes a process model for the execution of single projects with five process groups including thirty-nine processes, divided into core and facilitating processes PMI (2003). Organisational project management, as defined in OPM3©, requires an understanding of not only project management and its processes but also portfolio and programme management. The development of this standard was inspired by the increasing interest in a maturity model that shows a step-by-step method of improving and maintaining an organization's ability to translate organisational strategy into the successful and consistent delivery of projects.

The OPM3© program aims to support organisations to improve the capabilities that strengthen the enterprise-wide processes used in the domains of Portfolio, Programme, and Project management within the organization in alignment with the strategic objectives (Grant and Pennypacker, 2006).

The concept of organisational project management is based on the idea that there is a correlation between an organization capability in project, programme and portfolio management, and its effectiveness in implementing strategy. The degree to which an organization practices this type of project management is referred to as its organisational project management maturity (PMI, 2003).

[20]Project Management Body of Knowledge

OPM3© does not measure the maturity of the organization by assigning an achieved level, like most maturity models, but as a percentage of best practices achieved. A good understanding of OPM3© contents should be developed before carrying out an assessment. A framework cycle constitutes following steps for measuring maturity:

- Acquire knowledge – this component of OPM3© cycle requires preparation for assessment of project management maturity;
- Perform assessment – involves gathering all the data required for measurement of maturity assessment;
- Manage improvements – the results from perform assessment stage are compared against best practices standard of project, programme and portfolio management.

Because project management practices may vary from organization to organization, a set of best practices have been defined by PMI (2013e) for the comparison and improvement. According to the PMI (2003), the model brings the following benefits to the organization:

- Helps organisations who wish to increase their maturity to plan improvements;
- Helps the organization assess its maturity compared with best practices to be used in project management;
- Enables greater consistency with the PMBOK;
- Provides the application of the model in any kind of independent of their size, industry or segmentation;
- Provides discussions of programme management and portfolio;
- Helps organisations implement projects correctly aligned strategically in a dynamic and global economy;
- Improved schedule and budget predictability;
- Integration of separate organisational functions:
- Improved quality and customer satisfaction;

- Provide guidance for quality process and provide point of reference for appraisal (benchmarking[21]).

The OPM3© model consists of three dimensions or ways to visualize an organization's maturity level:

- The first dimension involves the stages of improvement processes that enable organisations to visualize best practices. Standardization, measurement, control and continuous improvement;
- The second dimension is the relationship between best practices and its management domain capabilities in project, programme and portfolio;
- The third dimension involves the stages of process improvement. Initiating, planning, executing, controlling and closing

Ghoddousi et al., 2011 presented some reasons to explain why an organization chooses the OPM3© to assess their maturity in project management, namely:

- Continuous approach with a percentage score. Most of other models used a process divided into five levels;
- Supported on PMI standards
- Applied in all business sectors;
- Results based on the industry feedback and has been modified repeatedly;
- Great emphasis to the determination of weaknesses and continual improvement.

OPM3© is by far the most sophisticated and the most resource intensive of the maturity models in the discipline of project management (Hillson, 2003b; Cooke-Davies, 2004; Backlund et al., 2014). Some inconsistencies are noted:

- Lack a well-researched and theoretical understanding of what is needed for successful project management outcomes;

[21] Benchmarking is comparing one's business processes and performance metrics to industry bests and *best practices* from other companies

- Founded on the assumption that there is an ideal path of development towards maturity that most organisations should pursue regardless of discipline area, project scope, competitive marketplace context or chosen strategy;
- The lack of reference processes for the areas of programme and portfolio, which became the *Best Practices*[22] repetitive causing difficulty in their interpretation;
- The self-assessment questionnaire that is too bureaucratic and repetitive and the absence of a rating scale of measurable maturity as used in other models, which make it difficult to understand, internal communication, targets and commitments for the improvement of organisational maturity through the OPM3©.

In 2008, the model was updated with the publication of the second edition (PMI, 2008), and the number of questions was reduced to 125. The main change from the first to the second edition was that the latter assessed the organisational facilitators criteria as well as its suitability with the standard from PMI for portfolio management (PMI, 2006) launched in 2006. The third edition (PMI 2013e) was released in 2013.

The most important change of this third edition was the compatibility with the structure of PMI standards, such as, PMBOK Guide (5th edition) (PMI 2013a), The Standard of Program Management (3th edition) (PMI 2013c) and The Standard for Portfolio Management (PMI 2013d).

In 2015, PMI stopped selling the OPM3© Capability Statements and suddenly entered the maturity assessment consulting business directly, competing with OPM3© users and promoting an alternative proprietary model used only by their own consultants.[23]

[22] *Best Practices* refer to the methods, currently recognized within a given industry or discipline, to achieve a stated goal or objective (PMI, 2008).
[23] http://www.opmexperts.com/pmi

P3M3©[24]

P3M3© is a product of the OGC that is an office of Her Majesty's Treasury within the UK government and is responsible for improving *value for money*[25] by driving up standards and capability in public sector procurement. It achieves this through policy and process guidance, helping organisations to improve their efficiency and deliver successfully. The purpose of P3M3© is to provide a frame of reference that can be used to baseline an organization's capabilities in project, programme and portfolio management (AXELOS, 2016) (*Figure 2*).

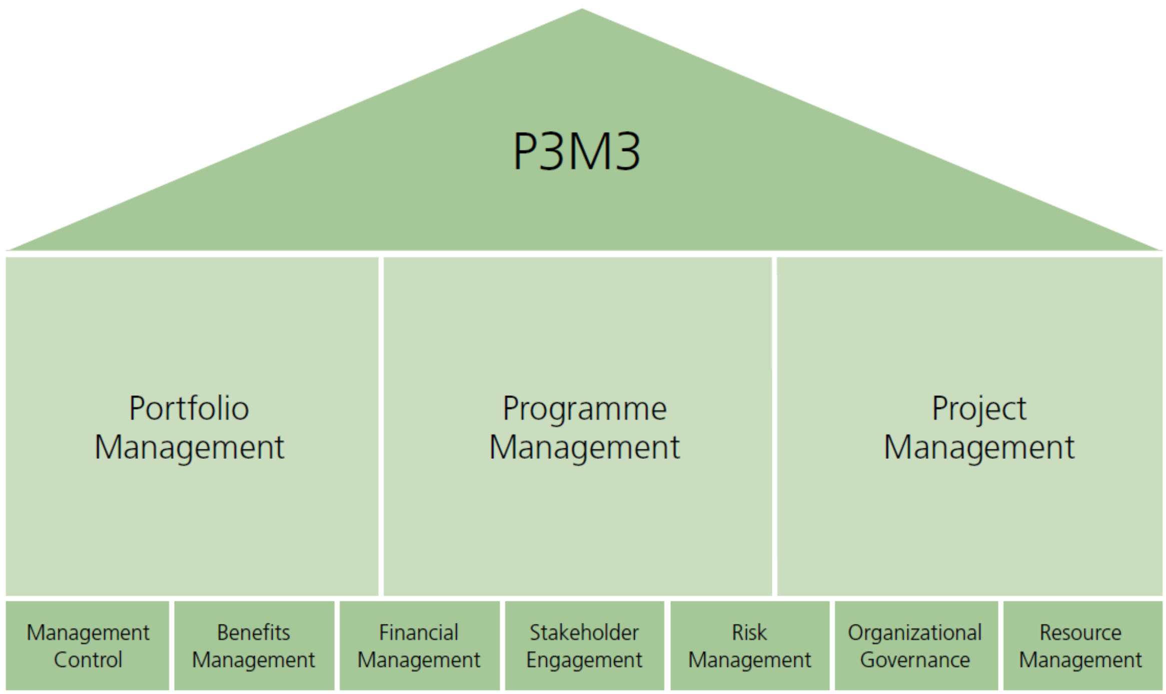

Figure 2- P3M3© structure (adapted from AXELOS, 2016)

AXELOS (2016) describes P3M3© as a key standard amongst maturity models, providing a framework with which organisations can assess their current performance and put in place improvement plans. The P3M3© is an enhanced version of the Project

[24] Portfolio, Programme and Project Management Maturity Model
[25] Used in reference to something that is well worth the money spent on it (English Oxford Living Dictionairy).

Management Maturity Model, itself based on the process maturity framework that evolved into the SEI Capability Maturity Model© (CMM).

Although connected, there are no interdependencies between these models, which allows for independent assessment in any of the specific disciplines. P3M3© is designed to enable organisations to understand their current level of maturity and highlight areas that would give them the most value and performance improvement in the short and long terms. The P3M3© contains three models that enable independent assessment.

P3M3© uses a five-level maturity framework and focuses on seven process perspectives, which exist in all three models and can be assessed at all five maturity levels. For each of the process areas there are several attributes defined at each level of maturity. These attributes are the basis on which the organization should assess its current maturity and make plans to improve. The description of the five maturity levels is on the *Table 6*.

Level	**Description**
Level 1	Awareness of process; Processes are not usually documented. Actual practice is determined by events or individual preferences, and is highly subjective and variable.
Level 2	Repeatable process; the organization will be able to demonstrate that basic management practices have been established.
Level 3	Defined process; The management and technical processes necessary to achieve the organisational purpose will be documented, standardized and integrated to some extent with other business processes
Level 4	Managed process; mature behaviour and processes are quantitatively managed. There will be evidence of quantitative objectives for quality and process performance, and these will be used as criteria in managing processes.
Level 5	Optimized process. The organization will focus on optimization of its quantitatively managed processes to consider changing business needs and external factors. It will anticipate future capacity demands and capability requirements to meet delivery challenges

Table 6- P3M3© maturity levels (OGC, 2010a)

There are seven Process Perspectives within P3M3© (*Table 7*), defining the key characteristics of a mature organization, which exist in all three models and can be assessed at five maturity levels are the following (OGC, 2010a).

Perspective	**Description**
Management Control	Management control is characterized by clear evidence of leadership and direction, scope, stages, tranches and review processes during the course of the initiative.
Benefits Management	Benefits should be assessed and approved by the organisational areas that will deliver them. Benefit dependencies and other requirements are clearly defined and understanding gained on how the outputs of the initiative will meet those requirements.
Financial Management	There should be evidence of the appropriate involvement of the organization's financial functions, with approvals being embedded in the broader organisational hierarchy.
Stakeholder Engagement	Stakeholder engagement includes communications planning, the effective identification and use of different communications channels, and techniques to enable objectives to be achieved.
Risk Management	Risk management maintains a balance of focus on threats and opportunities, with appropriate management actions to minimize or eliminate the likelihood of any identified threat occurring, or to minimize its impact if it does occur, and maximize opportunities.
Organisational Governance	Organisational governance also looks at how a range of other organisational controls are deployed and standards achieved, including legislative and regulatory frameworks.
Resource Management	These include human resources, buildings, equipment, supplies, information, tools and supporting teams.

Table 7 – P3M3© Process Perspectives (OGC, 2010a)

Embedded within the Process Perspectives are several Attributes. Specific Attributes relate only to a specific Process Perspective. Generic Attributes are common to all Process Perspectives at a given Maturity Level, and include planning, information management, and training and development. There are no interdependencies between the models, so an organization may be better at programme management than it is at project management (*Table 8*).

Model	Description
Portfolio Management	Portfolio Management is a coordinated collection of strategic processes and decisions, which enable the most effective balance of organisational change and business as usual/operations
Programme Management	A temporary, flexible organization created to coordinate, direct and oversee the implementation of a set of related projects and activities to deliver outcomes and benefits related to the organization's strategic objectives. During a programme lifecycle, projects are initiated, executed, and closed. Programmes provide an umbrella under which these projects can be coordinated. The programme integrates the projects so that it can deliver an outcome greater than the sum of its parts.
Project Management	A unique set of coordinated activities, with definite starting and finishing points, undertaken by an individual or team to meet specific objectives within defined time, cost and performance parameters as specified in the business case.

Table 8 – P3M3© Models (OGC, 2010b)

It is important for organisations to understand the optimal level of performance in their quest to maximize *value for money* from investment, and to have a realistic view of what they can achieve. Not all organisations will be able to reach the highest level and, for many, the middle levels may be adequate to meet their business needs and aspirations. Each organization needs to decide their optimal maturity level depending on their business needs and prioritise process improvement effort accordingly (OGC, 2010a). "P3M3© is not simply about isolated, here-and- now assessments – it also acts as a roadmap for ongoing improvement and progression towards realistic and achievable goals that are suitable for your business needs and aspirations" (OGC, 2010a, p. 5).

When using P3M3©, an organization may choose to review only one specific perspective (e.g. risk management). It is unlikely that an organization will have strengths in all areas or that the defined perspectives are applicable to all situations. So, depending from the sector of industry or business target, the organization may choose what perspectives are appropriate to be assessed. The P3M3© claims some of the organisational benefits, such as (Sowden, Hinley and Clarke, 2013):

- The strengths and weaknesses are judged against an objective standard, not just against other organisations;
- Helps organisations to decide what level of performance capability they need to achieve to meet their business needs;
- Focuses on the organization's maturity rather than specific initiatives;
- Recognizes achievements from investment;
- Justifies investment in portfolio, programme and project management infrastructure;
- Provides a roadmap for continual progression and improvement;
- Increased productivity, cost predictability, higher-quality outcomes, improved customer satisfaction and enhanced employee morale.

Although there has been no systematic study to determine the actual benefits, organisations using P3M3© are supposedly able to achieve (Goldenson and Gibson, 2003):

- A higher rate of return on investment and greater production efficiency;
- Lower production costs and better-quality outcomes;
- Improved customer satisfaction and enhanced employee morale.

Some critics are also pointed out:

- One of the most weeknesses of the P3M3© model is that it is based on the OGC project management maturity model and therefore emphasises concerns related to project management success, i.e. delivery on-time on-budget on-quality (Morris and Pinto, 2007).
- Young et al. (2014) argue that another deficiency of the P3M3© model is that it uses a single number to represent maturity at the project, programme and portfolio level, with this number being the lowest score in either generic attributes or the process perspectives across each sub-model.
- The *generic attributes* evaluated in all three P3M3© domains are claimed as essential to achieving improvement in project management maturity. It is doubtful however whether these generic attributes are appropriate for

programme and portfolio management domains, which are typically more complex than standalone project management (Artto et al., 2009; Young et al., 2014).

The P3M3© maturity model gives an opportunity for organisations to use self-assessment to obtain an up-to-date evaluation of the maturity of their project. This self-assessment was crucial for providing the data for the strategic analysis needed to endorse the organization's choice of drivers for investment, as well as the identification and structure of benefits beyond. Since P3M3© usage has grown greatly and for many organisations it is now the default maturity assessment model. In many sectors, management models have an increasing importance and become the foundation for assessing organisational capability and identifying opportunities for improvements. Under the P3M3© model, maturity is assessed by evaluating each process perspective to determine whether practice is on what level (*Table 9*).

Maturity	**Project Management**	**Programm Management**	**Portfolio Management**
Level 1 Awareness of process	Does the organization recognize projects and run them differently from its ongoing business?	Does the organization recognize programmes and run them differently from projects?	Does the organization's Executive Board recognize programmes and projects, and maintains an informal list of its investments in programmes and projects?
Level 2 Repeatable process	Does the organization ensure that each project is run with its own processes and procedures to a minimum specified standard?	Does the organization ensure that each programme is run with its own processes and procedures to a minimum specified standard?	Does the organization ensure that each programme and/ or project in its portfolio is run with its own processes and procedures to a minimum specified standard?
Level 3 Defined process	Does the organization have its own centrally controlled project processes and can individual projects flex within these	Does the organization have its own centrally controlled programme processes and can individual programmes flex within these	Does the organization have its own centrally controlled programme and project processes and can individual programmes and projects flex within these processes to suit particular programmes and/or

	processes to suit the particular project?	processes to suit the particular programme?	projects? Does the organization have its own portfolio management process?
Level 4 Managed process	Does the organization obtain and retain specific measurements on its project management performance and run a quality management organization to better predict future performance?	Does the organization obtain and retain specific measurements on its programme management performance and run a quality management organization to better predict future performance?	Does the organization obtain and retain specific management metrics on its whole portfolio of programmes and projects as a means of predicting future performance? Does the organization assess its capacity to manage programmes and projects and prioritize them accordingly?
Level 5 Optimized process	Does the organization undertake continuous process improvement with proactive problem and technology management for projects to improve its ability to depict performance over time and optimize processes?	Does the organization undertake continuous process improvement with proactive problem and technology management for programmes in order to improve its ability to depict performance over time and optimize processes?	Does the organization undertake continuous process improvement with proactive problem and technology management for the portfolio to improve its ability to depict performance over time and optimize processes?

Table 9 - Maturity levels practices (Sowden et al.,2010)

P3M3© was one of the earliest maturity models on the market. The first version come out on 2005 and was designed on the premise that organisations increase effectiveness in each of the three domains (project, programme and portfolio) incrementally. The version 2 released in 2008 was designed as three separated models, so the organisations could assess one model independently of the other two. The version 2 also introduced de concept of process perspectives that identified the seven core areas that covered de main management activities in the three models.

The version 3 (AXELOS, 2016) builds on the knowledge gained from a significant number of assessments of a wide range of organisations. This new version included the concept called *threads. Threads* are a way of grouping attributes and are applied to all 7 perspectives, providing a more structured way to review and diagnose the areas that are enabling or inhibiting performance and replace the generic attributes of version 2 (*Figure 3*).

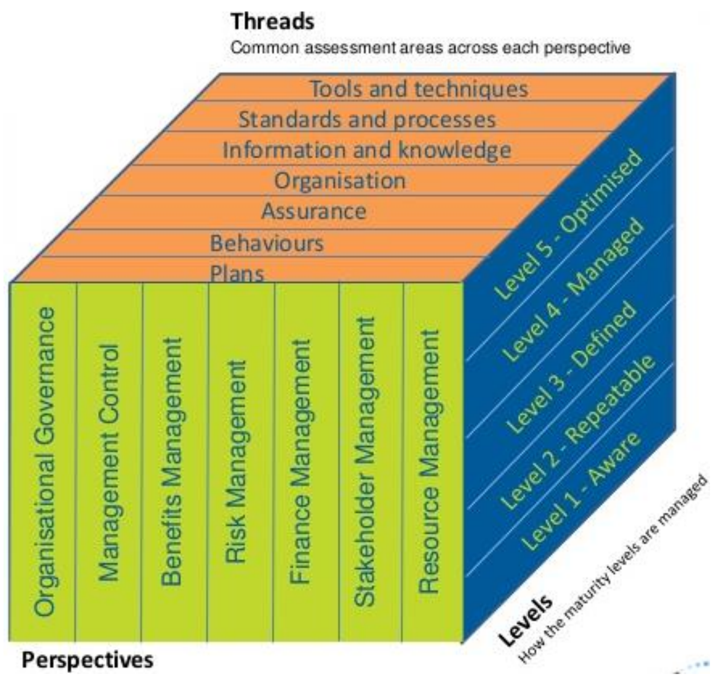

Figure 3 - Threads concept (AXELOS, 2016)

The main changes are the following:

- New self-assessment toolkit;
- An introduction guide as a more sophisticated reference for users;
- Greater diagnostic analysis includes focus on areas such as behaviours, tools and techniques and knowledge management. Greater recognition of techniques;
- Reference to commercial management asset in the models

- Greater alignment with the main bodies of knowledge (e.g. PMI, IPMA, APM, ISO[26] 21500);
- Portfolio model improved to reflect the evolving best practice in this discipline;
- Closer integration of the three domains;
- Better coverage of procurement, contract and asset management

Management maturity models tend to focus on process maturity and compliance. P3M3© is unique in that it looks at the whole system and not just at the processes. It analyses the balance between the process, the competencies of the people who operate it, the tools that are deployed to support it, and the management information used to manage delivery and improvements. The *Table 10* shows the main aspects related to three models described above.

Maturity Model	**CMMI©**	**P3M3©**	**OPM3©**
Constructor	SEI	OGC/AXELOS	PMI
Version/Date	V.1.3 /2010	V.3 /2016	V.3 /2013
Theoretical background	-	MSP[27]	PMBOK
Continuity between editions	Yes	Yes	Yes
Sector	Software/engineering	All	All
Domains	Project	PPP[28]	PPP
Scope	22 process areas	32 process areas	*Best practices*
Representation	Staged/ Continuous	Staged	Continuous
Levels	5	5	4
Self-Assessed	Yes	Yes	Yes
Links to strategy	Yes	Yes	Yes
Continuous improvement	Yes	Yes	Yes
Interpretation	Medium	Medium	Yes
Ease of execution	Yes	Yes	Yes

Table 10 - Main aspects of Maturity Models

[26] International Organization for Standardization
[27] Managing Successful Programmes (AXELOS, 2011)
[28] Project, Programme & Portfolio

2.4 Project Success

2.4.1 Overview

What is success? Success is a highly subjective term and is defined by English Oxford Living Dictionaries[29] as "the accomplishment of an aim or purpose".

The concept of project success remains vague and ambiguous, to the point that the literature on project management does not reach a broader consensus on its definition and measurement. So, project success is not easily defined or determined. Some believe that a project is successful when it meets budget, schedule and quality constraints even though it may not have met factors such as customer needs or achieved a quality of the final product (Dvir et al., 1998).

These criteria were and still widely accepted but is criticised for being insufficient to fully define project success (Dvir et al., 1998; Milis et al., 2003; Ika, 2009). The notion of success is one of the most controversial topics in the field of project management (Pinto and Slevin, 1988; Yu, 2005). However, there is no agreement upon a single universal definition of success that fits all projects (McLeod et al., 2012).

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. To reduce the subjectivity relating to project success, common criteria should be defined in the initiating phase of the project (PMI, 2013a). Researchers have been made different distinctions:

- Between project success and project management success. Where project management success is also described as a narrow view of success. The success of the project is measured against the general objectives of the project, while the success of the project management is generally measured according to the

[29] https://en.oxforddictionaries.com/definition/success

criteria of cost, time and quality (De Wit, 1988; Munns and Bjeirmi, 1996; Cooke-Davies, 2002; Westerveld, 2003).

- Between project management success and product success. Where product success measures the benefits of a project's final product (Baccarini, 1999).
- Between micro and macro success. The micro perspective refers to the success perceived by the contractor or performing organization and the developer, during the implementation phase. The macro perspective refers to the success appreciated by other stakeholders and users over the entire project life cycle (Lim and Mohamed, 1999).

Bushuyev and Wagner (2014) argue that the processes, methods and tools are important elements to building a solid and structured organization, but the success of projects requires other factors to deliver projects efficiently.

2.4.2 Project Success background

"The right project will succeed almost without the success of project management, but successful project management could enhance its success" (Munns and Bjeirmi, 1996, p.86).

The success of the project is a relevant factor in project management, it is one of the most frequently debated topics among academics, and there is no consensus on the criteria by which it can be judged (Baccarini 1999; Crawford, 2006; Freeman and Beale 1992; Ika, 2009; Pinto and Slevin 1988; Shenhar, Levy and Dvir 1997).

Finding a consensus about the criteria for project success does not seem to be an easy task (Yu, Flett and Bowers, 2005). However, the professional bodies of knowledge, like PMBOK Guide (PMI, 2013a) or Individual Competence Baseline (IPMA 2015), emphasized that key project stakeholder's satisfaction should be included on the overall project success criteria of the projects.

The success or failure of a project can be perceived differently by different stakeholders of the project (Cleland and Ireland, 2006; Toor and Ogunlana, 2010).

Stakeholders have distinct interests in different projects and therefore the perception of success vary differently across the various stakeholders (Bryde and Brown, 2005). There can be ambiguity in determining and measuring the success or failure of a project (Baccarini, 1999; Fowler and Walsh, 1999; Hyväri, 2006, Ika, 2009; Jugdev and Müller, 2005; Thomas and Fernandez, 2008).

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 (Andersen and Jessen, 2003; Davis, 2014; Lim and Mohamed, 1999; Lyytinen and Hirschheim, 1987). It is not surprising that different participants in a project think differently while they evaluate the project performance (Cox et al., 2003).

Different perceptions, criteria and success factors are required at different stages of the project lifecycle (Shenhar et al., 2001; McLeod et al., 2012). The participation of different stakeholders' groups in the design and development process can be essential for a project's success (Miller and Oliver, 2015; Walsham, 1993). To ensure that a project is successfully completed, the project plans need to be updated regularly and objectives clearly defined early in the project (Clarke, 1999).

Pinto and Slevin (1988) in a research involving more than 650 project managers, they concluded that the success of the project is something much more complex. The satisfaction of different stakeholders with the outcome has much to do with the perceived success or failure of the projects.

Another survey performed during 2002 using 236 project managers highlighted that *iron triangle* criteria were still the most commonly cited measures of project success (White and Fortune, 2002).

According to PwC (2012) study, 97% of the surveyed companies believe that project management is critical to business performance and organisational success, and 94% agreed that project management enables business growth.

One of the key findings of KPMG 2013 survey is that the organisations that consistently adopt good project management practices achieved dramatically higher success rates compare with those who did not. The practices that are particularly important to increase this project success rates, includes (KPMG, 2013):

- The consistent application of an appropriate methodology throughout the project lifecycle;
- The effective project risk management;
- The use of a Project Management Office;
- The use of programme and/or portfolio-management techniques, in addition to project management;
- Projects supported in a high-quality business case, and tracking the associated benefits.

Amongst the several project success criteria that are mentioned in the literature, *iron triangle* seems to be the basis of the most of project success approaches (Agarwal and Rathod, 2006; Fortune and White, 2006) because fulfilling the criteria for the completion of a project on time, within budget and according to performance specifications are easy to assess (Jugdev and Müller, 2005).

These classic criteria remain as the most widely used measure of project success and its main value is in offering a simple, direct measure of performance of the project, but it neglects whether the deliverables fulfilled the objectives of the project (Bannerman, 2008). In addition, many studies have expanded project success criteria into other aspects, such as organisational objectives, stakeholder’s satisfaction, customer’s benefit, or future potential to organization.

Project success criteria have evolved from simple quantifiable iron triangle criteria, which primarily are related to project efficiency (Bryde, 2005), to measures that have a longer-term perspective directly relating to effectiveness and organisational impact (Belout, 1998; Jugdev et al., 2001; Shenhar et al., 1997). Baccarini (1999) agrees with the existence of success-related factors for projects, which can be divided into two groups:

1. Project Success Criteria (PSC): This refers to a group of principles or standards used to determine project success;
2. Critical Success Factors (CSFs): This refers specifically to the conditions and circumstances that contribute to project results.

Horine (2005) believes that although the projects are all different, there exists always a shared core of common principles that are repeatable in any successful project:

- Be aligned with organisational objectives;
- Have the top-management support;
- Have an effective and competent leadership;
- Address all key stakeholders'shared common vision;
- Agreeing on the purpose, goals and scope;
- Manage and validate stakeholders' expectations;
- Make a proper planning;
- Having clearly defined and agreed upon scope, approach, and deliverables;
- Communicate effectively with each stakeholder;
- Clearly definition of the team member's roles and responsibilities;
- Perform work estimates accurate and complete;
- Develop and agree upon a realistic schedule;
- Project team strongly focused on project, results and customer;
- Measure project progress correctly from the baseline;
- Pursue consistently project issues and subsequent action items;
- Develop an environment of collaboration and teamwork;
- Manage closely expectations and changes concerning the scope, quality, schedule, and cost;
- Whenever necessary involve competent resources;
- Identify proactively risk and determine mitigation strategies to reduce project exposure;
- Anticipate and overcome obstacles to ensure project meets objectives.

According to Bannerman (2008), research on the concept of project success was developed around three different strands:

3. The identification of factors that contributed to project success (Baker et al., 1988; Cooke-Davies, 2002; Pinto and Covin, 1989; Pinto and Slevin, 1988; Schultz, Slevin, and Pinto, 1987; Slevin and Pinto, 1986);
4. The identification of other relevant variables which can influence the results of a project, such as: size (Yourdon, 1999); type (Pinto and Covin, 1989; Shenhar et al., 2002); life cycle phases (Pinto and Mantel, 1990); or, complexity (Shenhar, Renier and Wideman, 1996).
5. The definition of the criteria by which a project is considered to be a success or a failure (Collins and Bacccarini, 2004; Chan et al., 2002).

Given the strategic importance of the projects, it is becoming increasingly important to investigate to what extent the results obtained contribute to the achievement of the organisations' strategies (Jugdev and Müller, 2005).

The formula for project management success has not yet been discovered, and there probably will not be a single best solution (Rolstadås, 2014).

Serrador and Turner (2015) found a significant correlation between project efficiency and overall project success, arguing that efficiency should not be the final measure of success but neither can it be ignored. The last decades experienced a gradual understanding that project success requires broader definition than project management success (Jugdev and Müller, 2005).

The success and failure in projects represents two sides of the same coin as the link between the use of project management and project success.

Following we presented some definitions of the Project Success concept (*Table 11*).

Project Success concept	**Authors**
Project management literature often identifies two components of project success: 1. Project Success Factors - The elements of a project that increase the likelihood of success; The independent variables that make success more likely. 2. Project Success Criteria - The measures used to judge the success or failure of a project; Dependent variables that measure success.	Morris and Hough (1987); Wateridge (1998); Turner (1999)
"In the long run, what really matters is whether the parties associated with, and affected by a project are satisfied. Good schedule and cost performance means very little in the face of a poor performing end product".	Baker, Murphy and Fisher (1988, p.685)
Developed a framework of project success characteristics. Their success model and measurement scale was developed by overlaying the three implementation dimensions from organisational change: 3. Technical validity - Whether or not the project works as it is intended to work. 4. Organisational validity - Whether or not this project is the correct for the clients 5. Organisational effectiveness – Whether or not the project contributing to an improvement of the organisational effectiveness in the client´s organization	Pinto and Slevin (1988)
In interviews with experienced project managers, the authors identified three distinct aspects of project performance as benchmarks against which a project's success or failure can be assessed: - The process of implementing the project; - The perceived value of the project; - Customer satisfaction with the project delivered.	Pinto and Mantel (1990)
Referred to project success as: … meeting or exceeding stakeholder needs and expectation … by balancing competing demands among: - Scope, time, costs, quality. - Stakeholders with different needs and expectations. - Identified requirements (needs) and unidentified requirements (expectations).	PMI (1996, p.1-3)
Defined the four primary success categories of project success: 1. Efficiency: meeting schedule, cost and scope; 2. Impact on the customer: meeting the requirements, customer satisfaction and benefits for the customer; 3. Business success: sales, profits, cash flow, service quality and market share; 4. Preparing for the future: new technology, new market, new products, new basic skills and new organizational capabilities.	Shenhar, Levy and Dvir (1997)
Used four dimensions for measuring project success have found that customer satisfaction is by far the most important criteria.	Lipovetsky et al. (1997)

"Managing people effectively influences any results of a project"	Belout (1998, p. 23)
The "triple constraint" (cost, time and scope) as a criterion of project performance is the traditional way of defining project success.	Atkinson (1999)
Identified two distinct components of project success: 1. Project management success - Focuses on the successful achievement of cost, time and project quality objectives. 2. Product success - Deals with the effects of the final product of the project.	Baccarini (1999)
The concept of project success has been developed from a simple combination of cost, time and quality to a multi-dimensional criterion, including factors that involve not only the project, but also the business and the organization.	Lim and Mohamed (1999); Shenhar et al. (2001)
Project success is measured by its efficiency in the short term and its effectiveness in achieving the expected results in the medium and the long term.	Jugdev et al. (2001); Müller and Jugdev (2012)
Traditional way of measuring project success is the through the so-called *iron triangle* of time, budget and required quality	Westerveld (2003)
Reported the evolution of the concept from the simple iron triangle requirements of cost, schedule and quality through benefits to the organization and to stakeholders. The four relevant dimensions of success are: project efficiency, impact on the customer, business success, and future potential.	Pinto (2004)
Identified four stages of project success evolution: 1. The time, cost and quality constraints evaluation method; 2. The need for stakeholder satisfaction; 3. The emergence of an organization's specific strategic view; 4. A more focused, strategically-oriented view, in response to increasing globalisation and to the fast growth of IS/IT investments.	Jugdev and Müller (2005)
They point out that success must be analyzed from two different points of view: 1. The level at which technical project performance objectives were achieved (e.g. time, cost and quality requirements). 2. The project contribution to the organizational strategic objectives.	Cleland and Ireland (2006)
"Cost, time, functionality and quality remain the important criteria for assessing performance of software projects in the mind of professionals"	Agarwal and Rathod (2006, p. 360)
Recognized the project success dimension in terms of short-term and long-term goals according to timeframe of expected results: - Short-term goals of project efficiency - meeting time, cost and quality - Medium-term goals of customer success – meeting technical specifications, functional performance and solving customer´s problems.	Hyvari (2006)

- Long-term goals business success – interpreted as commercial success and gaining increased market share. - A very long-term goal of preparing for the future – developing new tools, techniques, products and markets, etc.	
Suggested two groups: 1. Those criteria that can be measured objectively, such as meeting budget, schedule and specification targets. 2. Those criteria that are measured more subjectively, such as the overall satisfaction of the customer and other key stakeholders.	Jha and Iyer (2007)
Project success suggests that success measures must reflect the strategic intent of the company and its business objectives as well as reflect the interests of various stakeholders.	Shenhar and Dvir (2007)
Project success can be understood in so far as it satisfies customer needs, aligns the project output with the organisation's strategy and gives a return on investment.	Thomas and Mullaly (2008)
The main concern for project managers in 1960 up to the 1980s was to delivery project outputs on time, cost and scope.	Ika (2009)
Suggested that, what appears to be a failure in one project might be a success in another one. What is seems to be important is the recognition that all people involved need to be satisfied with the outcome of a project	Meredith and Mantel (2009)
Defined project success as three distinct sets of attributes: 1. Enterprise perspective which is focused on commercial and financial metrics. 2. Client view which considered the project's scope, quality and client satisfaction. 3. Team viewpoint which focused its attention on how deliverables were created and attained. With these different sets of attributes, a stakeholder could differ from another on their perception of a specific project's success.	Rad and Anantatmula (2010)
The ability of the project's output to deliver the expected return on investment is the key to declaring the project success from the business perspective.	Camilleri (2011); Artto and Wikström (2005)
For project success, perceived satisfaction should be also measured, instead of using time, cost and performance as measures. Completing a project according to such criteria does not necessarily mean success.	Turner and Zolin (2012)
Identified that project success is not only achieved by improving project management practices but there are many other factors which include the project manager competency, the project team skills, organisational culture and support of senior management towards project management activities.	Pretorius et al. (2012)
Offer a taxonomy of project success and hence divide project success into project management success and project investment success.	Zwikael and Smyrk (2012)
Project success consists of criteria or standards which assess project results or outcomes.	Creasy and Anantatmula (2013)

Project success is measured from a different perspective, which may be that of project efficiency, team and customer influence, business success or preparing for the future.	Mir and Pinnington (2014)
Success could be measured against any one of following different sets of objectives: 1. Project objectives – what the project organization is expected to deliver at the close of the project in terms of scope, quality, cost and time. 2. Business objectives – what the project owner expects to obtain from using the project results. 3. Social and environmental objectives – what benefits the local society expect from the project both during project execution and during the use of the project results.	Rolstadås (2014)
The project management is mainly measurable in terms of schedule, budget and requirements/quality, furthermore, include benefit to the organization, end user satisfaction, benefit to stakeholders, benefit to project personnel, strategic objectives of the organization, and business success.	Ika (2015); Papke-Shields et al. (2010)

Table 11 – Project Success concept

2.4.3 Critical Success Factors and Project Success Criteria

"CSFs are those few things that must go well to ensure success for a manager or an organization and, therefore, they represent those managerial or enterprise areas that must be given special and continual attention to bring about high performance" (Boynton and Zmud, 1984, p.17).

CSFs are an important theme of research in the project management literature (Ika et al., 2012; Nauman et al., 2010; Söderlund, 2011) and bring together vital issues for an organization's today's operational activities and for its future success. Successful IS/IT implementations has been one of the main concerns of academics and practitioners.

Why are some projects more successful than other? This question was deeply researched for decades and one of the investigation lines leads to the emergence of CSFs (Holland and Light, 1999). The CSFs are the set of factors that are required to deliver the success criteria (Wateridge, 1995), and can thus be described as the circumstances, facts, or influences which contribute to the result or the achievement of success criteria (Lim and Mohamed, 1999).

What are the influences of CSFs on project success? The answer to this question has resulted in the extensive research around the project CSFs. Research on CSFs can be traced back to some decades ago, where Daniel (1961) first discussed the CSFs in management literature. “Usually three to six factors determine success; these key jobs must be done exceedingly well for a company to be successful” (Daniel, 1961, p.50). In a broad approach, he focused on industry-related CSFs which are relevant for any company in a specific industry. Anthony et al. (1972) went a step further by emphasizing the need to tailor CSFs to both a company’s strategic objectives and its managers. Management planning and control systems are responsible for reporting those CSFs that are perceived by the managers as important for a particular industry.

Combining the perspective of both Daniel (1961) and Anthony et al. (1972), Rockart (1979) first developed a CSFs approach that concentrates on information needs for management control and seeks to identify data which can be used to monitor and improve existing areas of business. Rockart (1979) defined CSFs as the limited number of key areas of activity in which results are absolutely necessary for the achievement of the objectives. Bullen and Rochart (1981) extend the CSFs definition and present those as a management information system planning tool. Today, Rockart’s (1979) CSF approach is particularly relevant within the limits of project management and IS/IT implementation and therefore often used by managers and executives. Bullen and Rochart (1981) distinguished CSFs into five major sources:

- The industry – Characteristics of an industry determines the success factors of the companies within the industry.
- Competitive strategy and company’s position – Company’s history and competitive strategy determine its position in an industry.
- Environmental factors – These are macroeconomic factors over which an organization has little or no influence.
- Temporal factors – Areas which suddenly appeared an unexpected happening.
- Managerial position – Various functional managerial positions have generic sets of CSFs.

According to Ward and Griffith (1996) CSFs enable management to use their judgment in two ways:

1. By assessing the relative importance of systems opportunities in terms of how well they support the achievement of business objectives;
2. By identifying the information required to manage and plan the information needs of business executives.

Rowlinson (1999) developed the concept and states that CSFs are fundamental issues that must be maintained for team working to take place in an efficient and effective manner. This concept has been applied to project environments (Cooke-Davies, 2002) and analysis of the literature found that most studies have focused on deriving CSFs that are applicable to a specific industry, such as construction or IS/IT (Lyer and Jha, 2005). This suggests a need for further study to identify generic CSFs for projects. Researchers have used this method to improve the performance of the management process (e.g. Chan et al., 2001; Jefferies et al., 2002; Yu et al., 2006). Some authors agree that a wide range of variables can affect the success of a project (Dvir et al., 1998). However, these authors emphasise that success factors are dependent on the type of project, thus challenging the idea of a universal set of valid factors for all projects. In parallel, others criticized the CSFs as offering an over-simplified solution that ignores the contextual circumstances that influence the projects, making extremely difficult to apply on day-to-day companies' operation (e.g. Berg, 2001; Wagner et al., 2006; Yusof et al., 2008).

The CSFs research deals with the identification and assessment of factors that might explain why an organisation, or a project was successfully (Krcmar et al., 2004). An outcome which is common to most studies of project CSFs is a list of factors. Another criticism is that this CSFs studies are often exclusively focused on the identification of this factors (Nah et al., 2001) and often there is a lack of research analysing how these factors can be handled in different contexts (Remus and Wiener, 2010).

From a project management perspective, CSFs are "characteristics, conditions, or variables that can have a significant impact on the success of the project when properly sustained, maintained, or managed" (Milosevic and Patanakul, 2005, p. 183). It is difficult for project managers to evaluate which key factors impact on performance (Belassi and Tukel, 1996). In response to this difficulty, these authors proposed the development of frameworks that group CSFs.

To identify the relevant CSF several research methods can be used (Esteves, 2004), namely, action research (Jenkins et al., 1999), case studies (Holland and Light, 1999; Sumner, 1999), Delphi technique (McCarthy and Atthirawong, 2003; Brancheau et al., 1996), group interviews (Khandewal and Miller, 1992), literature review (Esteves and Pastor, 1999; Umble et al., 2003), multivariate analysis (Dvir et al., 1996), scenario analysis (Barat, 1992), structured interviews (Rockart and Van Bullen, 1986), and most used method, the questionnaire (Shah and Siddiqui, 2006).

The *iron triangle* criteria have been criticized for their exclusive focus on the project management process, to the detriment of including the vision and goals of the different stakeholders (Baccarini, 1999; Bannerman, 2008).

Numerous research studies have been performed around project management to identify critical success factors that influence the success and/or failure of projects (e.g. Pinto and Slevin, 1987; Pinto and Mantel, 1990; Belassi and Tukel, 1996; Tukel and Rom, 2001; Westerveld, 2003: Diallo and Thuillier, 2004, 2005, Fortune and White, 2006). These studies show that these factors are interrelated and sometimes overlapping each other's.

Pinto and Prescott (1988) argued that "most of the studies in the critical success factor research stream have been theoretical and have assumed a static view of the importance of various factors over the life of a project." (p. 5). Khang and Moe (2008) group the CSFs factors studies on three generic ways:

- Skills and competencies - technical, interpersonal, and administrative competencies of the project manager and the team members.
- Objectives - understanding of the project goals, objectives, mission and the commitments to the project success by all the project team.

- Relationships - an environment with adequate support from key stakeholders, adequate resources, and creates favourable conditions with support from top management.

Fortune and White (2006) reviewed 63 publications that focus on CSFs and found a limited agreement among authors and listed the three most cited factors:

- The importance of the support from senior management;
- The importance of having clear and realistic objectives;
- The importance of producing an efficient plan and kept up to date.

In public sector, several studies were performed concerning CSFs, namely:

- Extensive literature reviews of CSFs in government IS/IT projects identified, top management commitment, linkage to business, technical alignment, knowledge-able personnel, and user involvement as key factors (Gil-García and Pardo, 2005; Ho and Pardo, 2004).
- The need to involve users in a sustainable way as highlighted as a key issue (Carter and Belanger, 2005; Chan and Pan, 2008).
- Focusing on the differences between public and private organisations (Rosacker and Olson, 2008).
- Focusing on CSFs of Healthcare information systems implementation projects and results point out in the same way (Øvretveit et al., 2007).

Success is far more complex to achieve than the factors just addressed by these criteria. In fact, there are some degree of agreement with the definition provided by Baker et al. (1988), which states that project success is a matter of perception and that a project will be most likely to be perceived as an "overall success".

Projects differ in size, uniqueness and complexity, so the criteria for measuring success vary from project to project, making it unlikely that there is a universal set of criteria for project success. (Müller and Turner, 2007; Westerveld, 2003). Individuals and stakeholders often interpret project success in different ways (Cleland and Ireland, 2006;

Lim and Mohamed, 1999). Bredillet (2007) assume that projects are reasonably homogeneousbut that there is a growing understanding that projects are different, that success can be judged in different ways, and that different projects require different competence profiles. In addition, performance views also vary across industries (Chan and Chan, 2004). Projects vary, depending on the subject, and criteria must be developed to evaluate a project's outcome that is specific for each project.

Recently, it has been realised that success cannot be effectively evaluated simply by the iron triangle criterion alone and many researchers have tried to improve the situation by adding new dimensions. The PSC may therefore refer to a group of principles or standards used to determine or judge project success (Baccarini and Collins, 2004; Ika, 2009). Murphy et al. (1974) used a sample of project managers' data on the factors that contributed to the success of the project, deduced ten factors that were considered strongly related to perceived success. Dvir et al. (1998) suggest that PSC are not universal for all projects.

While the achievement of objectives is useful for evaluating the outcome of a project, this is not enough to evaluate a project's success. Defining project success criteria upfront is helpful to establish agreement on how and when a project will be evaluated, which helps create a common vision about the outcome, which is in itself a significant driver of project management success. Otherwise team members and the project leader will find that they are heading in different directions and the result of the project will not be successfully determined, owing to differences in perception, emphasis and objectives (Baccarini, 1999; Christenson and Walker, 2004). Jugdev and Müller (2005) supported this view and recommended defining a project's success criteria at the start as good project management practice. Over time, various attempts have been made to either add more dimensions to the basic criteria, or to reduce them to less dimensions (Atkinson, 1999; Globerson and Zwikael, 2002). Although not strongly supported by empirical research, many papers exist which address the issue of PSC. These papers tend to highlight that there is a lack of consensous concerning the criteria by which success is judged, (Freeman and Beale, 1992; Shenhar, Levy and Dvir, 1997; Baccarini, 1999; Pinto and Slevin, 1988; Prabhakar, 2008).

In the academic literature, we found examples of projects that have successfully completed the criteria of the *iron triangle*, but resulted in disappointing business experiences (Shenhar et al., 2005). On the other hand, initiatives that did not meet the constraints of cost and time later proved to be successful (e.g. Sydney Opera House[30]). Researchers also agree that there are differences in project management success among different industry types (Cooke-Davies and Arzymanow, 2003; Ibbs and Kwak, 2000; Zwikael and Globerson, 2006).

Pinto and Slevin (1988) suggested that the importance of each dimension changes along time. Internal factors, such as budget, time schedule and technical performance are important at the beginning of a project but in more advanced phases the external factors, such as customer satisfaction, tend to become more relevant. Baker et al. (1988) suggested that overruns in budget and time cease to be important after the project is terminated, while customer satisfaction, and its relation to the project organization, continues to be important in the termination phase, and beyond. Pinto and Covin (1989) claimed that not only does the relative importance of success dimensions vary with the project's progress, but the CSFs are different for each phase of the project. The research into PSCs can be grouped into three major classes (Hussein, 2013):

1. The project success criteria research - A body of research that focuses on defining what constitutes project success, and a clear rational for deciding whether the project was a success or failure. Including categories that deal with stakeholders, timeline, project size or type (Baccarini, 1999; Lim and Mohamed, 1999; Lipovetsky et al, 1997; Shenhar et al, 2001). Also, examining how the perception of success has changed over the years (Collins and Baccarini, 2004; De Wit, 1988; Ika, 2009; Jugdev and Müller, 2005; Wateridge, 1995).

[30] Budgeted initially to $7 million ended up costing more than $100 million. Originally scheduled for 4 years took 14 years to be completed. A recent study reveals that Opera House adds $775 million to the Australian economy every year in direct ticket sales, retail and food spending and by boost to tourism to Australia.

2. The rational of success criteria - This body of research considers the significance of the criteria as a tool for shaping and managing a project. Creating a common reference point for how projects will be evaluated, and an important factor to align the project team, establishing commitment to the project objectives (Christenson and Walker, 2004; Dvir and Lechler, 2004; Jugdev and Müller, 2005).
3. Identifying risk factors associated with success criteria - The literature review has shown that there are several risk factors that contribute to poor management and complications during identification, management and evaluation of project success criteria.

This body of research considers the potential threats and challenges influencing the initial definition of criteria, as well as the implementation and evaluation phases, namely:

- The narrowness of the criteria (Belassi and Tukel, 1996; Ingason and Jónasson, 2009; Yang et al, 2010; Williams and Samset, 2010; Winter et al, 2006);
- Criteria ambiguity (Crawford and Pollack, 2004; Duimering et al, 2006);
- Diversity (Westerveld, 2003; Hussein, 2012);
- Incompleteness (Atkinson et al, 2006; Young, 2006)
- Changes (Kutsch and Hall, 2010)
- Unrealistic targets (Chapman et al, 2006; Smithson and Hirschheim, 1998).
- Poor alignment of the performing to success criteria (Couillard, 1995; Thomas and Fernández, 2008)
- Lack of organisational commitment to project success criteria (Cooke-Davies, 2002; Hartman, 2000; Munns and Bjeirmi,1996; Thomas and Fernández, 2008, Young, 2001).

The understanding of project success is evolving, and it is useful to see how the field of research on project success developed over the last decades. According to Jugdev and Müller (2005), the evolution is as follow:

- Project implementation (1960s-1980s): Because they are easy to use, the metrics time, cost, and requirements are a recurring feature to measure project success.
- CSF Lists (1980s-1990s): The emphasis in project management was on developing CSF lists.
- CSF Frameworks (1990s-2000s): Arising of integrated frameworks on project success. Development of the concept that success was dependent from stakeholders and success involved the interactions between the internal and external organisations.
- Strategic Project Management (21st century): Highlighted the following four conditions (Wateridge, 1998; Müller, 2003; Turner, 2004, p. 350):
  - Success criteria should be agreed with the stakeholders before the start of the project;
  - A collaborative working relationship should be maintained between the project owner and project manager;
  - The project manager should be empowered with flexibility to deal with unforeseen circumstances, and the owner giving guidance as to how they think the project should be best achieved;
  - The owner should take an interest in the performance of the project.

Ika (2009) (*Table 12*) show a very similar understanding.

Research	**1960s-1980s**	**1980s-2000s**	**21st century**
PSC	Time, cost and quality	Time, cost and quality Client satisfaction Benefits to organization End-users satisfaction Benefits to stakeholders Benefits to project team	Time, cost, quality Strategic objective of client organisations and business success End-user's satisfaction Benefits to stakeholders Benefits to project team Symbolic and rhetoric evaluations of success and failure
CSFs	Initial lists	CSFs list and frameworks	More inclusive CSF frameworks and symbolic and rhetoric success factors
Focus	Project management success	Project/product success	Project/product, portfolio, and programme success and narratives of success and failure

Table 12- Project success over the time (Ika, 2009)

Summarizing PSCs are used to measure success, whilst CSFs facilitate the achievement of success (Collins and Baccarini, 2004; Turner, 2008).

2.5 IS/IT challenges

2.5.1 Overview

The idea that something was wrong with the investments in IS/IT is not new. Nevertheless, it gained more visibility when Solow (1987), Nobel Prize in Economics, said ironically "we see computers everywhere except in the productivity statistics" (p.36). This sentence highlights the inability to demonstrate that investments in IS/IT result in organisations productivity improvements and was been firmly supported with empirical evidence from the 1970s to the early 1990s. This apparent contradiction becomes known as the *productivity paradox*[31]. Solow was followed by others, Strassmann (1990) reports some evidence of disappointments in several studies and concludes that there is no direct relation between computers expenditures, organisational profits and productivity. Brynjolfsson (1993) introduces the *mismanagement of information and technology* as one explanation for the paradox. In line with his argument, other researchers argue that most organisations focus primarily on the implementation of technology rather than on the realization of the stakeholder's expectations and the previously identified benefits. The notion that the IS/IT function serves different roles in different organisations and that such roles may evolve over time has been extensively discussed in past research. IS/IT has become an extremely important tool for the sustainability and business growth of organisations.

Recently, the focus of the IS/IT literature has shifted from the importance of IS/IT and its potential to change a whole range of strategic and industry structure variables (Porter, 1985; Clemons and Kimbrough, 1986) to the relationship between IS/IT and specific components of firm strategy, such as, business environment (Maier, Rainer and

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[31] The information technology (IT) productivity paradox is the perceived discrepancy between IT investment and IT performance, between input and output (Macdonald et al., 2000).

Snyder, 1997), competitive advantage (Mata, Fuerst and Barney, 1995), organisational performance (Powell and Dent-Micallef, 1997; Bharadwaj, 2000), and knowledge accumulation (Grant, 1996). Hitt and Brynjolfsson (1996) emphasize that productivity is not the same thing as profitability. Their research indicates that IS/IT increases value to consumers and organisational productivity but does not increase organisational profitability. Lately, IT-driven productivity has been identified as an essential driver of the very strong economy (Reingold and Stepanek, 2000). Devaraj and Kohli (2002) provide some possible explanations for the productivity paradox, such as:

- Time lag - Many IS/IT investments pay off only after a long time. It takes at least 5- 6 years before CRM benefits are large (Reichheld and Scheffer, 2000).
- Inconsistent evidence - Several large IS/IT failures (e.g. ERP), received lots of publicity. On the other hand, there are many unpublicized success stories.
- Difficulties in isolating the IS/IT effect - Improvements in results at organisational levels may be the result of several factors, some of which are external. It is difficult to isolate the specific effect of IS/IT from the others.

Turban et al. (2008) states that understanding the paradox requires an understanding of the concept of productivity.

In the *industrial era*, the economy was based on tangible assets and organisations could determine and document their business strategy using financial tools. In the current *information era*, businesses began to create and develop intangible assets, such as: customer relationships, skills, knowledge, information technology and a corporate culture, which encourages innovation, problem solving and decision making. The current context of uncertainty, rapid business change, globalization and market liberalization has contributed to growing competitiveness, supported strongly by IS/IT investments, which are now regarded as being an essential tool for the operational and strategic survival of organisations.

Nowadays, with the enormous technological changes, the organisations face new opportunities from IS/IT implementations, hoping that these investments can help to increase productivity and business prosperity. Meanwhile, several studies performed in public and private sectors have proven that the investments done in IS/IT have not brought the expected benefits. Some authors argue that related investments in IS/IT with an increasing performance of the organisations in the last decades were far from true. The perception of the continuous unsuccessful IS/IT investments found a new way and approach for how projects are undertaken (Gomes, Romão and Caldeira, 2013b). The focus should be on the realization of the benefits, since that is the main reason for organisations to invest (Ward and Daniel, 2006).

2.5.2 IS/IT Investments background

Essentially, the purpose of investment in IS/IT is to improve the operational efficiency of an organisation, reducing costs and improving levels of profit. Thus, many traditional appraisal techniques are used to evaluate tangible benefits, which are based on direct project costs. Firms in almost every industry rely on investments in IS/IT to realise benefits after their successful implementation (Gomes and Romão 2015b). Since the 1980s, IS/IT has positioned itself as a strategic tool that through flexibility and innovative ways of conducting business that can produce superior performance (Farbey et al., 1993; Glenn, 2009; McFarland, 1984; Porter, 2001). As a result, the relationship between investments in IS/IT and improving organisational performance has been the subject of many studies (Melville et al., 2004). The issue remains controversial, as evidenced by articles in major business magazines (Carr, 2003; Farrell, 2003). Carr (2003) argues that emergent technologies may offer opportunities to those who can exploit them effectively in the early stages of their development.

Organisations are being put under increasing pressure to justify the large amount of financial resources spent on IS/IT assets (Madeira, Gomes and Romão, 2017). As competition increases because of globalization and other market factors, it is even more important that an organization performs at its best capabilities (Ashurst and Doherty, 2003). The decision-making process over IS/IT investments is not as objective and transparent as it is claimed to be, creating significant failures on achievement of the objectives and their related benefits (Berghout et al., 2005). Organisations seek benefits and value only in monetary terms, which have resulted in a lot of wasted energy, time and money. It is very common that organisations place their focus on the technical aspects such as *does it work?* rather than the social aspects such as *is this adopted successfully?* or from a business perspective *is this delivering value?* (Gomes and Romão, 2017).

The difficulties due to the implementation of IS/IT solutions and assessment of their performance have been acknowledged by several scholars (Lueg and Lu, 2012, 2013; Martinsons et al., 1999). Therefore, finding means to overcome these issues and to improve the performance and return from investments in IS/IT has been a research focus of the last decades. Grounded by theory of competitive strategy, several authors argued that IS/IT can contribute to more profits if it cannot be replicated easily or it can make product differentiation (Brooke, 1992; Mithas et al., 2012). Although many studies have focused on the consequences of IS/IT investments, fewer studies have examined factors that impact the IS/IT capabilities (Devaraj and Kohli, 2003; Brynjolfsson, 1993).

According to IDC[32] (2016) "Worldwide IT spending is forecast to reach nearly $2.4 trillion in 2017, up 3.5% over 2016". Worldwide surveys highlighted the significant global increasing of IS/IT expenditure and referred the large financial resources spent by organisations for the next years (e.g. Gartner, 2016[33]) (*Figure 4*).

[32] Worldwide Semiannual IT Spending Guide: Industry and Company Size, International Data Corporation (IDC). http://www.idc.com/getdoc.jsp?containerId=IDC_P33207

[33] Gartner Worldwide IT Spending Forecast. http://www.gartner.com/technology/research/it-spending-forecast/

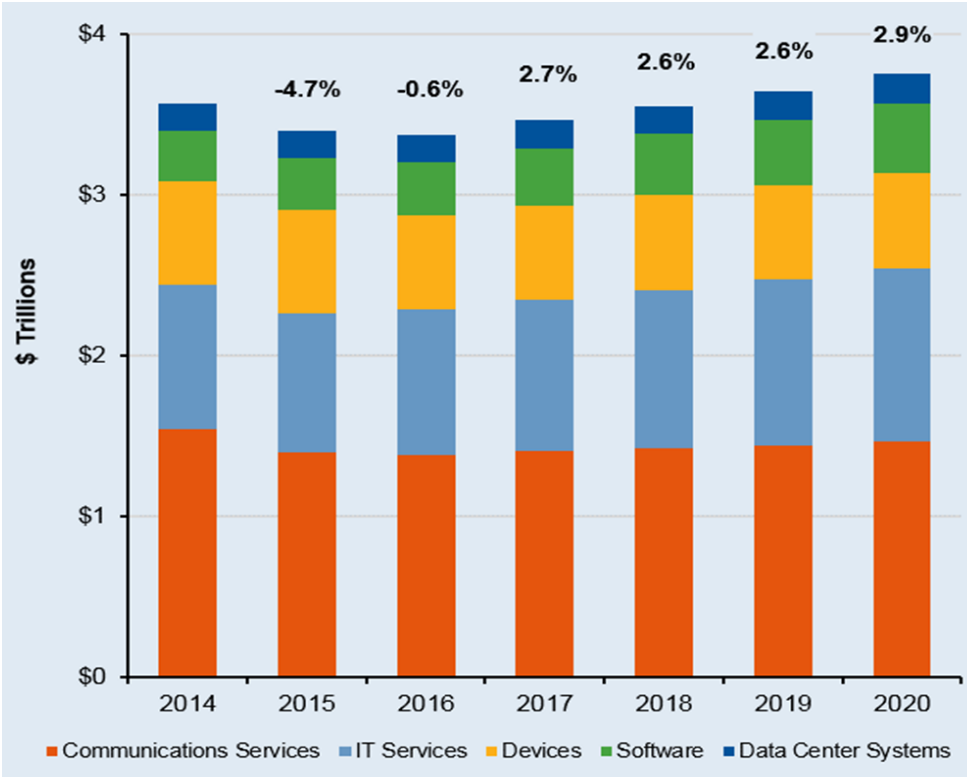

Figure 4 – Worldwide IT spending is forecast (source: Gartner, 2016)

Many IS/IT investments appear to go ahead without the use of formal investment appraisal techniques, which results in difficulties on understanding both the impact and implications of the IS/IT implementation due to a lack of organisational processes to evaluate the desired outcomes (Remenyi et al., 2007).

These surveys continue to show high failures rate in IS/IT projects (Standish Group, 2015) despite *best practices* and the definition of the procedures and methodologies applied, we continue to see flaws in the implementation of IS/IT based projects (Gheorghiu, 2006). Independently of success or failure, many projects fail to deliver the desired benefits (Standing et al., 2006) and therefore organisations lose large amounts of money (Dhillon, 2005).

Glaser (2005) about the failures of IS/IT projects, highlight the lack of support and insufficient leadership, inability to manage the complexity, lack of initiative, inability to anticipate situations and failure to demonstrate progress. In recent times, IS/IT managers have found it increasingly difficult to justify rising IS/IT expenditures (Counihan, Finnegan and Sammon, 2002).

Moreover, the evaluation of these IS/IT investments requires multi-dimensional measures and is a complex tangle of financial, organisational, social, procedural and technical threads, many of which are currently either avoided or dealt with ineffectively (Cronk and Fitzgerald, 2002). Several authors proposed models or frameworks for realizing business value from IS/IT investments, namely:

- Mooney et al., (1995) – Develop a process oriented framework for assessing the business value of information technology and the subsequent effects on firm performance.
- Soh and Markus (1995) – Process theory to address when, how and why a firm´s investments in IS/IT results in improved organisations performance (*Figure 5*).

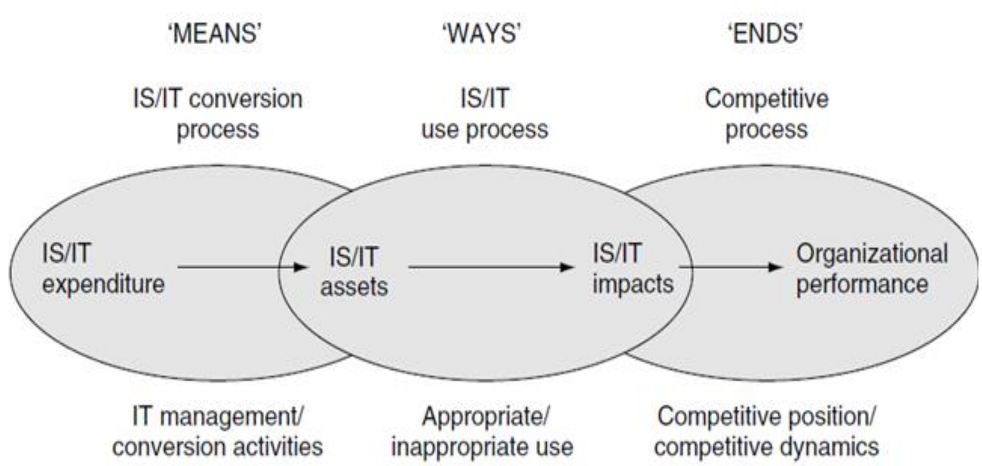

Figure 5 - How IS/IT creates business value (adapted from Soh and Markus, 1995)

This model identifies three distinct processes that must be successfully undertaken: The conversion of the IS/IT into assets that can be used by the firm, the effective use of those firm assets, which captures the need to undertake a business change to achieve effective use and finally, the effective use must be transformed into helpful improvements in organisational performance.

- Lentz et al., (2002) – An organisational capability theory that proposed more cohesive value management capability the more likely the firm´s IT-intensive business initiatives will lead to improved business performance.

- Smith and Mckeen (2003) – A framework to explore how firms are attempting to determine and develop effective IS/IT value propositions. Suggest that IS/IT is being used as aggregator for organisational transformation and strategy and therefore IS/IT must be viewed together the information and the people of the business.

- Jeffrey and Leliveld (2004) – A framework that proposed the use of IS/IT portfolio management for maximising IS/IT business value. The most important benefit is the business and strategy alignment.
- Kohli and Deveraj (2004) – A framework to conceive and implement an IS/IT investments payoff to ensure creation of appropriate assets required to achieve the payoffs and to measure outcomes.

- Peppard and Ward (2004) – An organisational capability theory that proposed a perspective on management of IS/IT that specifically considers how organisations can continuously derive and leverage value through IS/IT.

- Marshall et al., (2005) analysed the process model developed by and Soh and Markus (1995) and proposed revisions to make the model more comprehensive. The authors added a key process in the beginning of the lifecycle which they called "IT Alignment Process", arguing that "IT expenditure" alone cannot give rise to business benefits, and that expenditures need to be linked back to business strategy and business requirements (Figure 6).

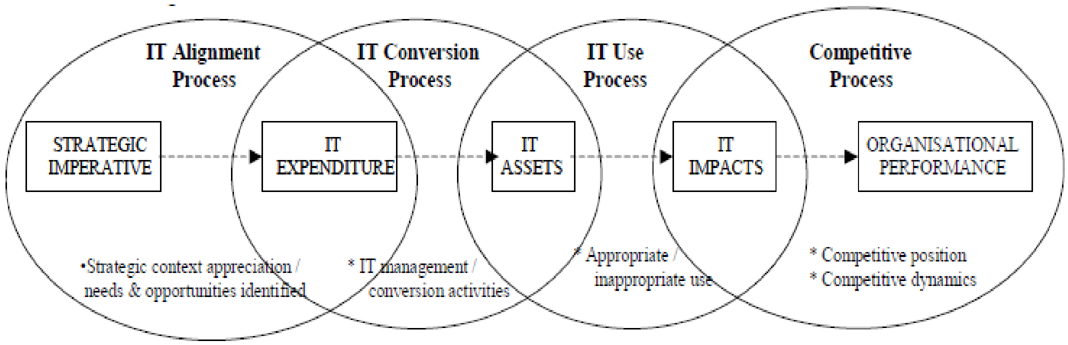

Figure 6- Modified Model for the Realisation of Business Value (Marshall et al., 2005)

- Ashurst et al. (2008) developed a benefits realization competence framework that conceptualizes the lifecycle of IT projects as comprising the following key phases:

  - Benefits planning - where the planned outcomes of an IT project are identified, and the means of means by which they will be achieved are stipulated;
  - Benefits delivery, where the actual design and execution of what they called *the program of organisational change necessary to realize all the benefits specified in the benefits realization plan* takes place.
  - Benefits review - where the assessment of the success of an IS/IT project takes place, and where the identification of the ways and means by which further benefits might be realised takes place.
  - Benefits exploitation - where what they called *the adoption of the portfolio of practices required to realize the potential benefits from information, applications and IS/IT services, over their operational life* take place.

- Ward and Daniel (2012) incorporating their earlier research of 2006[34] developed a process-driven model consisting of five major iterative steps (*Figure 7)*:

[34] Ward, J., & Daniel, E. (2006). Benefits Management, Delivering Value from IS and IT Investments. John Wiley and Sons: Chichester, UK: John Wiley and Sons.

1. Identify and structure the benefits, which results in developing a business case identifying the objectives for the investment and all potential benefits that could be obtained;
2. Plan the benefits realization containing a full benefits plan and a business case for the investment;
3. Execute the benefits plan, which includes the actual conversion and implementation of business process changes and information system implementation;
4. Review and evaluate the results, which takes place after the implementation is completed, as a post implementation review step, to assess performance and adjust accordingly; and
5. Establish the potential for further benefits.

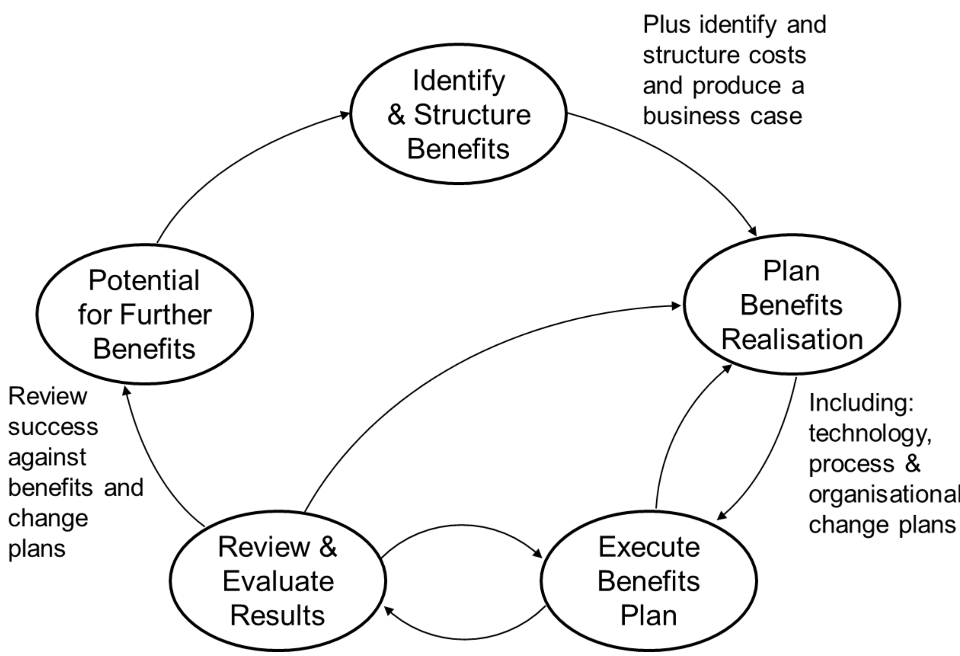

Figure 7 – Process Model of Benefits Management (adopted Ward and Daniel, 2012)

Project failure is estimated yearly in the hundreds of billions of dollars (McManus and Wood-Harper, 2007) where failure is not limited to any specific industry (Flyvbjerg, Bruzelius, and Rothengatter, 2003; Nichols, Sharma, and Spires, 2011). The general perception of the continuous failures of IS/IT investments has forced organisations to seek new ways and approaches to achieving successful projects. The major reason for failures in implementing IS/IT includes (Lorenzi and Riley, 2000; Kaplan and Shaw, 2002):

- Ineffective outgoing communication;
- Underestimation of complexity;
- Scope creep;
- Systems and technology;
- Organisational and leadership issues.

The focus should be on obtaining benefits since this is the main justification for the investment (Ward and Daniel, 2006). Peppard et al. (2007) claims five principles for realizing benefits through IS/IT:

1. Just having the technology does not give any benefit or create value;
2. IS/IT enables people to do things differently;
3. Benefits result from changes and innovations in ways of working and only the relevant stakeholders can make these changes;
4. All IS/IT projects have outcomes, but not all outcomes are benefits.
5. Benefits must be actively pursued to be obtained.

In these five principles, it is suggested that the value of IS / IT implementation lies in the interaction between IS / IT and the organization, not its inherent value. Against this backdrop, efforts have been made to understand the value that IS/IT brings and how to increase that value.

The challenges faced by organisations to increase value from their IS/IT investments, the low-level of organisational competencies in exploiting IS/IT was revealed and an underlying cause of the difficulty in dealing with these challenges. Several studies indicated that there is a need for complementary investments in organization and internal training for the companies' IS/IT investments to achieve their full impact (e.g. Van Ark, 2005; Brynjolfsson and Hitt, 2003).

The business problems that the organisations address today require enterprise-wide solutions that call for an integrated approach and effective management of organisational resources to achieve the business objectives. Organisations still exhibit *silver bullet thinking* when it comes to IS/IT (Thorp, 2001). They act as if, once an investment in an IS/IT solution is made, the benefits associated with it will automatically happen. However, simply identifying and estimating benefits will not necessarily make them happen (Thorp, 2001).

The evolution of IS/IT and its application within organisations has led to viewing IS/IT as a strategic tool, which assume an increasingly prevalent role in the carrying out organisational activities. 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 (Melville, Kraemer and Gurbaxani, 2004; Devaraj and Kholi, 2003). Although many researchers have focused on the consequences of IS/IT investments (Devaraj and Kohli, 2003), there have been fewer studies examining factors that impact the IS/IT capability. The general perception of the continuous failures of IS/IT investments has forced organisations to seek new ways and approaches to achieving successful projects.

There has been a trend for rising expenditure in IS/IT over the last decades, which corresponds to the plethora of IS/IT products now available in the market. Well-managed IS/IT investments, which have been carefully selected and which are focused on meeting business needs, can have a positive impact on an organization’s performance. Essentially, the purpose of investment in IS/IT is to improve the operational efficiency of an organization, to reduce costs and improve levels of profit. Firms in almost every industry rely on investments in IS/IT to realize benefits after their successful implementation. However, many IS/IT projects fail to deliver the desired benefits (Peppard et al., 2007). Although organisations continue to make substantial investments in IS/IT, the successful realization of value, namely, in the form of benefits from such investments, has consistently been reported as a major organisational challenge. To respond to the constraints of the new business environment, successful organisations have basically developed three important strategies (Gomes and Romão, 2013):

- Training employees in the use of IS/IT, to provide organisations with the knowledge and ability to respond to the pressures to change;
- Participating in collaborative platforms which involve all relevant stakeholders in the business process;
- Finding ways of obtaining superior performance by using frameworks that assist management processes.

Any organisational strategy should address both external and internal domains (Henderson and Venkatraman, 1993). The external domain is characterized by the business environment in which the organisations competes and is concerned with decisions such as product/service offering and the distinctive strategy attributes that differentiate the organization from the others. By opposition, the internal domain is concerned with choices of the administrative structure and the specific rationale of critical business processes.

From the alignment perspective, the IS/IT strategy incorporates a fit between the business and IS/IT strategic domains by acknowledging that IS/IT capabilities can both shape or support the business strategy. Additionally, the functional alignment is concerned with the integration of the internal business and IS/IT domains.

It has been argued that the lack of alignment between IS/IT and business is the reason why unrealistic benefits are identified, or not identified at all, and also why the operationalisation of measures is incorrectly specified, activities and resources are improperly planned, and required organisational changes are not carried out (Henderson and Venkatraman, 1993).

From the perspective of IS/IT, the problems of non-alignment with the business strategy typically result in reactive postures against IS/IT investments being seen as a cost centre and not as a strategic *business partner*. From the point of view of business, the non-alignment of IS/IT result in a decreasing income arising from investments in technology and a reduction of competitive capabilities for the organization (Tallon, Kraemer and Gurbaxani, 2000).

With the shift from traditional industrial economy to this new business environment with great predominance of intangible assets such as knowledge or innovation, organisations must manage increasing levels of complexity, mobility and uncertainty (Voelpel et al., 2005). The management of knowledge has generated considerable interest in business and management circles due to its capability to deliver to organisations, strategic results relating to profitability, competitiveness and capacity enhancement (Chua, 2009; Jeon, Kim and Koh 2011).

For many companies, the competitive advantage is a continuous process of performance improvement, looking for *best practices* and enhancing new capabilities, including the search for new products or services and for more efficiently processes and procedures developing the dynamic capabilities (Teece, Pisano and Shuen, 1997), to quickly respond to the external challenges and effectively continuous changes, adapting to new industry trends.

Traditional appraisal techniques are often unable to capture many of the qualitative benefits that are brought about by IS/IT investments (Farbey, Land and Targett, 1993; Irani and Love, 1999; Lin et al, 2005; Maskell, 1991; Murphy and Simon, 2002; Ward, Taylor and Bond, 1996). These techniques also ignore the impact that the system may have in human and organisational terms. Strassmann (1997) suggested that the IS/IT investments produce negligible benefits. Otherwise, some studies report a positive relationship between the performance of organisations and IS/IT expenditure (e.g. Lee and Barua, 1999; Sircar et al, 2000).

Apparently, several reasons can cause the confusion over IS/IT benefits, namely, the mismeasurement of outputs and inputs, the difficulty of establishing the overall value of IS/IT, the choice of inappropriate methods of evaluation, lags in learning and adjustments, mismanagement by developers and users of IS/IT, and lack of effective IS/IT evaluation and benefits realization management practices amongst others (Hitt and Brynjolfsson, 1996; Lin et al., 2005; Rai, Patnayakuni and Patnayakuni, 1997) .

To achieve that the benefits from IS/IT investments materialise, the following two questions need to be answered: "*What benefits are we seeking?*" and "*How will achieve them?*" Most value from IS/IT investments come from the business changes that enable an organization to carry out some of the following actions (Gomes, Romão and Caldeira, 2013c; Ward and Daniel, 2006):

- The adoption of new or redefined processes;
- The new roles and responsibilities;
- The operation of new teams, groups or divisions;
- The new governance arrangements;
- The use of new measures and metrics;
- The use of new appraisal and reward schemes;
- The new practices for managing and sharing information.

The achievement of benefits obviously depends on the effective implementation of technology, however evidence from project successes and failures suggests that it is an organisations' inability to accommodate and exploit the capabilities of technology that usually causes a poor return from many investments. While business changes may be considered as being the way that an organization intends to work *for ever more,* it is recognised that organization will also carry out other investments and changes (Ward and Daniel, 2006).

2.6 IS/IT Project Success

2.6.1 Overview

Although the increasing role and importance of IS/IT, the understanding of why, how, and when technology enables the productivity improvement is in its early stages, resulting in a delay in productivity growth (Jorgenson and Stiroh, 2000).

DeLone and McLean (1992) analysed the resulting huge range of IS/IT project success measures into an integrated view of IS/IT project success represented by the following six dimensions (*Figure 8*):

1. System Quality: measure of the information processing system itself.
2. Information Quality: measure of information system output.
3. Information Use: measure of recipient consumption of the output of an information system.
4. User Satisfaction: measure of recipient response to the use of the output of an information system.
5. Individual Impact: measure of the effect of information on the recipient.
6. Organisational Impact: measure of the effect of information on organisational performance.

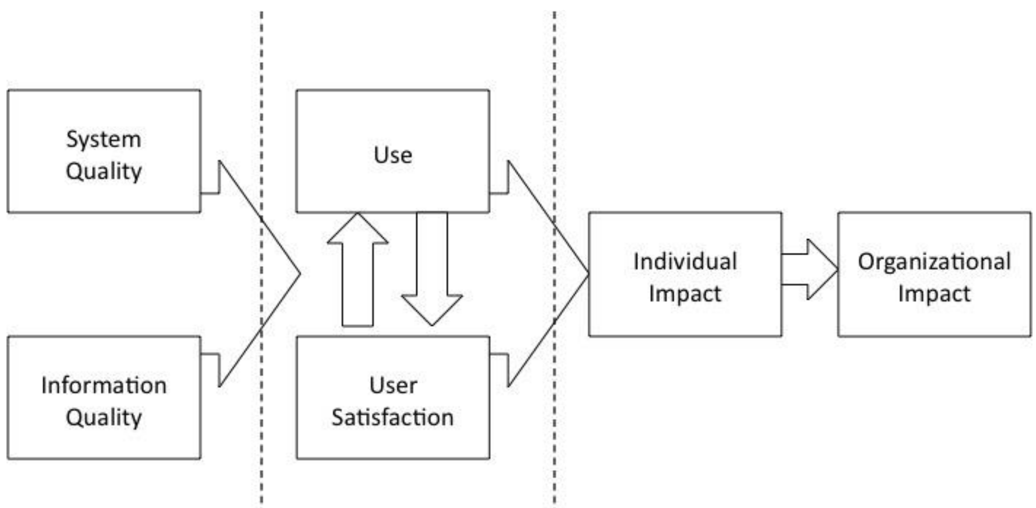

Figure 8 - Information Systems Success Model (DeLone, and McLean, 1992)

Myers (1994) suggests that success is achieved when an IS/IT is perceived to be successful by stakeholders. Murray (2001) describes nine factors for IS/IT project success:

1. Appropriate high-level commitment for the project;
2. Appropriate project funding;
3. A well-defined set of project requirements and specifications;

4. Careful development of a comprehensive project plan that incorporates sufficient time and flexibility to anticipate and deal with unforeseen difficulties as they arise;
5. An appropriate commitment of time and attention by those outside the IT department;
6. Accurate reporting of project status and potential difficulties as they arise;
7. A critical assessment of the risks inherent in the project;
8. The development of appropriate contingency plans that can be employed if the project encounters problems;
9. An objective assessment of the organization's ability and willingness to maintain the course of the project

The IS/IT is becoming so central to modern organisations that implementation of large projects is synonymous of huge changes within organisations (Kuruppuarachchi et al, 2002). This means that an organization's IS/IT projects are part of deep changes involving business systems, organisational structure, and people. In these cases, customer acceptance rather than technical, time, or budget requirements, more often determines project success.

2.6.2 IS/IT Project Success in Healthcare

Hospitals are complex organisations and this complexity magnifies the opportunity for inevitable human errors (Weick, 2001). A poorly integrated system can increase the frequency of medical errors, decrease operational efficiency, and reduce the quality of healthcare services (Themistocleous, Mantzana and Morabito, 2009).

The IS/IT implementations are part of the continuous quality improvement of healthcare and there are three key success factors in a robust IS/IT implementation (Brandrud et al., 2011):

- Reliable information;
- Engagement of all stakeholders in all phases of the work improvement;
- A proper infrastructure involving multidisciplinary teams.

Success in the strategic use of IS/IT project success in healthcare relies on the integration of all systems, such as patient records, clinical decision support, transaction processing, digital imaging, and information reporting (Jensen, 2013; Kim and Mitchelman, 1990). When diverse information systems are interoperable on a standardized platform, all stakeholders can streamline the implementation process, and improve the system quality (Gross and Ginzberg, 1984).

IS/IT project success also refers to user satisfaction, system use, perceived usefulness and system quality (Sabherwal, Jeyaraj and Chowla, 2006).

A comprehensive literature review on large-scale IS/IT projects executed in ten different countries identified eighteen frequently cited critical success factors (CSFs) for inter-enterprise systems implementations (Negi, Law and Wat, 2008). Five of them are the same as identified by the above-mentioned healthcare IS/IT implementations. These CSFs are top management support, information systems adjustments, business process adjustments, organisational resistance, and the capability of key team members. Top management support has been argued to be the most critical factor for IS/IT project success (Iacovou and Katsu, 2008; Liu et al., 2010). Extant research largely focuses on the consequences of management support for IS/ IT projects (Dong et al., 2009; Liang et al., 2007; Sharma and Yetton, 2003).

Must has been written in last decades regarding the development of IS/IT initiatives in healthcare sector (Lorenzi and Riley, 1995, 2000; Lorenzi et al., 1997; Leonard and Winkelman, 2002; Stiell et al., 2003). The publications emphasized two main aspects: The slowness of adoption of these initiatives and the resistance to change (Leonard, 2000; Treister, 1998). There are also reported innovative approaches concerning the improvement of the IS/IT in healthcare adoption (Dixon, 1999; Dixon and Dixon, 1994).

Lorenzi and Riley (1995) claimed that the IS/IT interventions are perceived as an interference in the traditional physician role. The resistance is higher when the IS/IT interventions does not generate additional value for physicians' practices (Leonard and

Winkelman, 2002). Treister (1998) highlighted a set of reasons why physicians failed on IS/IT acceptance, namely:

- On an adequate base support;
- Absence of user friendly interfaces;
- Difficulties on the information collection process;
- In adequate training plan;
- Lack of leadership in IS/IT that was respected by physicians, organization control default over the clinical practices.

The research developed by these authors focused mainly on the identification of the elements with the hope those will effective ensure the IS/IT implementations. Some examples are the following:

- Identifying information insufficiencies and difficulties that are healthcare exclusively;
- Identifying areas where the IS/IT implementations can make most difference;
- Building systems that support shared objectives;
- Designing and developing scalable tools, provider-patient interfaces and Internet applications;
- Investing in existing resources.

Since success can be judged in many dimensions, such as; effectiveness, efficiency, organisational attitudes and commitment, employee satisfaction, and patient satisfaction, existing CSF lists could be problematic, making the situation very complex and offer a more simplified solution than what is needed in practice (Berg, 2001). Leonard (2004) identifies a set of CSFs for new technological adoption, such as:

- Resistance to change or industry experience in using technology
- Training before and during the transition
- Buy-in or contribution from stakeholder groups

- Level of effective reporting on outcome measures during and after implementation
- Level of effectiveness in dealing with the implementation

According to the research done by Robinson (2007), appropriate leadership, good communication, detailed roadmap of implementation, setting measurable goals and specific attention to the preparation of human resources in terms of motivation and training were considered as the most important factors affecting the success of the implementation of these systems. Reyes-Alcázar et al. (2012) noted the CSFs that need to be considered for the Health sector are the following:

- A patient-centred approach: needs and expectations of end-users (Mead and Bower, 2010);
- Leadership: the importance on improving the quality of healthcare (West, 2004);
- Team work: a multidisciplinary process focussed on a healthcare team that shares common goals (Mickan, 2005);
- Autonomy and responsibility: the need for more autonomy amongst health professionals (Harrison and Dowswell, 2002);
- An integrated view of healthcare; the quality of patient care as perceived by end-users is a key element (Torres-Olivera, 2003);
- Professional skills: promoting skills encourages professional development (Reyes-Alcázar et al., 2012);
- Results focussed: the measurement and evaluation of clinical performance, hospital management and end-user satisfaction (Patton, 2008);
- Internal and external audits: the concept of continuous quality improvement (Chovil, 2010; Hyrkäs and Lehti, 2003; Le Brasseur, Whissell, and Ojha, 2002).

CSFs have been criticized as offering over-simplified solutions that are difficult to realize in practice, since many contextual circumstances also influence the outcome (e.g. Berg, 2001; Wagner et al., 2006).

2.7 Healthcare Sector

2.7.1 Overview

While promoting population health has been the classic goal of public health practice and policy (Dawson and Verweij, 2007), in recent decades, new objectives in terms of autonomy and equality have been introduced (Munthe, 2008).

Improving the health of the population is the defining goal of health systems; health system performance should therefore be viewed primarily from the perspective of how health systems manage to improve the overall average level of population health and reduce inequalities in health (WHO, 2007).

Healthcare systems play a clear role in the European Union and are key to achieving stronger growth and creating highly qualified jobs in a dynamic knowledge-based economy. This vision was set out by the Lisbon European Council in 2000 (European Council, 2000). Nowadays the healthcare systems face major challenges, namely:

- In a rising demand for health and social services due to an ageing population (Appleby, 2013; CHWS[35], 2006; Braun et al., 2003; Rechel et al., 2009; Townsend, 2016; WHO, 2015);
- In the increasing expectations of citizens who want the best care available (EC, 2004c);
- In the expectations for increasing citizen participation in healthcare regulation (Adams et al., 2015);
- In the increasing mobility of patients and health professionals (Buchan et al., 2014; EC, 2004a);

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- In the need to reduce the so-called *disease burden*[36] (IHME[37], 2016; Murray et al., 2013; WHO, 2015);
- In matching investment in technology with investment in the complex organisational changes needed to exploit its potential (Cresswell et al., 2013; Lorenzi and Riley, 2000; Lluch, 2011);
- In the need to limit occupational accidents and diseases (Hämäläinen et al., 2006; ILO[38], 2015);
- In the management of huge amounts of digital health information that need to be available securely and accessibly (Baker and Masys, 1999; Fernando and Dawson, 2009; van de Haak et al., 2003);
- In the need to provide the best possible healthcare (Sturmberg and Lanham, 2014)

The demographic changes in the last decades are leading to a marked aging of the population in general (Koch, 2006) requiring more care, suffering from more health issues, lifestyles creating chronic diseases, ever increasing limits for the medical science' ability to treat patients, and shrinking budgets (Saha, 2011).

Life expectancy at birth continues to increase remarkably in EU countries, reflecting reductions in mortality rates at all ages. Average life expectancy at birth for the years 2005-2007 across the 27 countries of the European Union reached 74.3 years for men and 80.8 years for women (OECD, 2010). The proportion of people over 65 is expected to almost double by 2050[39]. Furthermore, chronic diseases are on the increase, as are their management costs.

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[36] The impact of a health problem as measured by financial cost, mortality, morbidity, or other indicators. It is often quantified in terms of quality-adjusted life years (QALYs) or disability-adjusted life years (DALYs), both of which quantify the number of years lost due to disease (YLDs).
[37] Institute for Health Metrics and Evaluation
[38] International Labour Office
[39] Eurostat news release 48/2005, 8 April 2005

All these factors are starting to place additional strain on European healthcare systems. Almost a decade since the global financial and economic crisis starts. The total health spending fell in 11 out of the 34 OECD countries (*Table 13*). Expenditure on prevention and public health decrease and in several countries, patients are now expected to assume a share of health costs (OECD, 2013).

“Healthcare systems are organised and financed in different ways across the EU Member States, but most Europeans would agree that universal access to quality healthcare, at an affordable cost to both individuals and society at large, is a basic need. Moreover, this is one of the common values and principles in EU health systems” (Eurostat, 2013).

“An analysis of the financing of healthcare suggests that compulsory contributory health insurance schemes and compulsory medical saving accounts were a fairly common means for funding healthcare within the EU Member States” (Eurostat, 2013).

By 2050, average public spending for health and long-term care in countries of the OECD may rise to 10-13% of GDP[40] (OECD, 2006). The emerging situation will not be sustainable unless action is taken at all levels to change the way healthcare is delivered (EC, 2006). While average per capita health spending in OECD countries has increased slowly since 2010, spending in Portugal has severely contracted between 2010 and 2013 in real terms (OECD, 2015a). Portugal spent the equivalent of $2482 (USD) per person on health in 2013, compared with an OECD average of $3453 (USD).

[40] Gross Domestic Product

	Million EUR	EUR per inhabitant	PPS per inhabitant	% of GDP
Belgium	40 907	3 658	3 263	10.4
Bulgaria	3 298	454	1 034	7.9
Czech Republic	10 895	1 036	1 593	6.9
Denmark	:	:	:	:
Germany	308 526	3 826	3 739	10.9
Estonia	1 136	862	1 222	6.0
Ireland	:	:	:	:
Greece	15 777	1 439	1 710	8.8
Spain	92 700	1 988	2 110	9.0
France	231 060	3 515	3 262	10.9
Croatia	3 171	745	1 177	7.3
Italy	:	:	:	:
Cyprus	1 244	1 443	1 529	6.9
Latvia	:	:	:	:
Lithuania	2 147	726	1 253	6.1
Luxembourg	:	:	:	:
Hungary	7 408	749	1 369	7.4
Malta	:	:	:	:
Netherlands	71 453	4 252	3 731	11.0
Austria	32 729	3 860	3 521	10.1
Poland	25 262	664	1 264	6.4
Portugal	15 477	1 480	1 844	9.1
Romania	7 431	372	767	5.2
Slovenia	:	:	:	:
Slovakia	:	:	:	:
Finland	19 319	3 552	2 854	9.5
Sweden	48 375	5 039	3 540	11.1
United Kingdom	202 721	3 161	2 736	9.9
Iceland (¹)	1 013	3 130	2 789	8.8
Liechtenstein	287	7 762	:	:
Norway	35 130	6 916	4 134	8.9
Switzerland	57 651	7 127	4 573	11.2

(¹) Definition differs.
(:) Not available
Source: Eurostat (online data code: hlth_sha11_hf)

Table 13 - Current healthcare expenditure, 2013 (Eurostat, 2013)

These concerns have led to the implementation of integrated health systems (e-health), with the aim of improving the delivery of healthcare services and of satisfying the demands of the various players.

The definition of e-health is not consensual within the scientific community. Eysenbach (2001) collected 51 definitions available in the area's scientific literature. These multiple definitions have a common link between health and technologies. The concept of e-health adds in itself the potential to maximize: the efficiency of healtcare, the quality of services provided, the dissemination of the production of scientific evidence, the empowerment of citizens, a closer relationship between professionals, among other benefits. E-health also incorporates a set of provider's diverse tools, solutions, products or services, including administrative operations, clinical information systems, consumer-oriented portals, telemedicine and tele-health. In compliance with European guidelines, countries are being pressed to provide answers to several demands of the sector regarding the accessibility, quality and sustainability, namely, in the health services, medical care, social protection, economic policy and social security (EC, 2004b) (*Table 14*).

Objective	**Health services and medical care**	**Social protection**	**Economic policy**
Accessibility	Equitable access to appropriate care. Information about treatment and care options. Patient-centred care. Inequalities in health.	Access based on universality. Reduce inequities. Information about options. Address the consequences of the ageing of the health workforce.	Economic role and scope of health systems.
Quality	Meeting specific needs of the patient and priorities. Ensuring patient safety and consistent standards. Informed consent to interventions. Planning, distribution and monitoring of provision to meet quality standards. Developing the evidence base for improving the quality of care. Assessment of population health needs. Training professionals about quality.	Allocating resources in relation to needs. Promoting adaptability of health systems through good governance. Involving the relevant stakeholders in the management of resources.	Economic implications of different interventions and strategies.
Sustainability	Improvement the resources available whilst not leaving any individual without appropriate care. Ensuring evidence based and cost-effective interventions. Assessment of new medical technologies and techniques. Overall priority setting around health needs. Investing in preventative interventions to maximise health improvement from available resources.	Financial structures and incentives of systems. Allocation of appropriate levels of resources financing based on collective solidarity. Cost-effectiveness of medical interventions. Impact of demographic change on financing of health systems. Training of health professionals to raise productivity.	Overall trends in expenditure and implications for sustainability of public finances. Efficiency of Health systems.

Table 14 – European health system objectives (European Commission, 2004b)

The benefits of these implementations are expected to promote the improvement of the following aspects (EC, 2006):

- Citizens' access to health systems;
- Reduce the risk of errors due to lack of information;
- Reduce the time required for the provision of clinical reports;
- Reduce costs by avoiding replication of effort and resources.

The challenges expected by the authorities to implement these systems are (EC, 2006):

- Interoperability;
- Timeliness, integrity, availability and confidentiality of information;
- Alignment of software with principles of architecture and content structures;
- Establishment of rules that allow the user informed consent for access to their data by professionals;
- Ensure the difficulties of change process.

Today, healthcare organisations are amazingly focus on IS/IT investment, with the goal of achieving the minimum level of benefits that these projects can provide. The study of the success or failure of these initiatives has become vitally important for the performance of these organisations (Rahimi and Vimarlund, 2007). Healthcare organisations must improve their business practices and internal procedures to answer the increase demanding of health professionals and the public in general for better information.

The interest about the potential that IS/IT offers for improving healthcare services has resulted in large investments. The expectation of realizing the potential of technology assets to improve the quality, safety reducing costs and creating new service innovations often leads to the introduction of the huge solutions, with a limited evidence-base in support of the systems' overall effectiveness and safety (Shekelle et al., 2006).

Several reports have systemically shown that most software projects, including healthcare sector, are delivered late and over budget (e.g. Standish Group, 2015), namely, software applications strangle organisations rather than quickly improve internal processes. (Stead el al., 2005).

Hospitals adopt a patient-centred care approach and invest massively in IS/IT solutions, in the hope that these investments will improve medical care and patient demands. The concept of patient-centred care can be defined as the creation of more value for patients through the removal of all non-value-added steps or actions.

An important precondition of optimal patient-centred care is that patient information is completely and accurately recorded and accessible (Ammenwerth, et al., 2001). The most important issue in this field is the use of high-quality information.

A model of information system success provided by DeLone and McLean (2003) showed that information quality and system quality affect organisational services. System quality in patient-centred care measures important characteristics such as timeliness, reliability, completeness, accuracy and relevance (Haslina and Sharifah, 2005; William and Ephraim, 2003).

From the point of view of public service, the focus of healthcare system is the patient; therefore, any intervention should be based on their needs and expectations (Reyes-Alcázar et al., 2012). It becomes more and more important that IS/IT investments support, not only satisfied short-term objectives, but also long-term benefits, to provide organisational sustainability and a proper service for organisations, professionals and end-users.

2.7.2 IS/IT in Healthcare sector

IS/IT are now spread worldwide, adopted and used in many sectors, including the health sector. According to the (WHO, 2005), the use of IS/IT in health is not merely about technology but is a means to reach a series of desired outcomes across the entire health system. The aim of IS/IT for Health is to improve significantly the quality, access and efficacy of healthcare for all citizens (EC, 2006). The move toward computer information systems began from the 1970s that ultimate goal of these systems is access to Electronic Health Record (EHR) (Shortliffe and Baenett, 2014). EHR implementation results in the improved quality of care, cost effectiveness, customer-orientation and timely access to complete and precise information (Gagnon, 2014). Despite the potential benefits of EHR, its implementation is a difficult and complex task whose success and productivity depends on many factors (Yusof et al., 2008; Terry et al., 2008).

Since the 1990´s, the health sector has sought to improve its effectiveness and efficiency by adopting IS/IT to increase the levels of services quality, namely, patient safety, organisational efficiency and patient satisfaction (Bates and Gawande, 2000; Pan et al., 2005; Raghupathi and Tan, 1999). The use of these systems provides an important support for specialised services, and increases the efficiency, quality, safety and also reduces medical errors (Low and Chen, 2012).

According to several studies, there is a growing use of information and communication technologies by citizens and their families regarding the search for health information (Andreassen, 2007; Fox, 2011). IS/IT in healthcare represents the integrated effort to collect, process, report and use health information and knowledge to influence policy-making, program action and research and further states that they are essential to the effective functioning of health systems worldwide (WHO, 2006). The broader meaning of this system refers to any system that captures, stores, manages or transmits information related to the health of individuals or the activities of organisations that work within the health sector. Despite remarkable technical progress, failures have still been reported when integrating technically sound systems into processes of care (Lorenzi and Riley, 2003).

We live in times where healthcare providers generate significant amounts of personal data about patients and the major obstacle to the management of this increasing volume of information is the difficulty, or inability, of sharing information across systems and between organisations (Grimson et al., 2000). Medical information needed for clinical decision making has increased significantly, however the accessibility of health data is still poor, resulting in inappropriate decisions and sometimes in medical errors (Tierney, 2001).

The greatest evolution in the role of information in the health system, namely on the doctor-patient relationship, is related to the enormous flow of medical or health information that is present on the Internet (Katz and Rice, 2002; Netlleton, 2011, Murray et al., 2003). In this new reality patients play a more active role in their own healthcare (Collste, 2002, p. 123). The informatics tools have been developed to increase the accessibility and management of medical information (Bleich, Beckley and Horowitz, 1985), with the aim of supporting medical decision, of increasing the coordination between different healthcare providers, and of promoting the use of guidelines, thereby improving the global quality of care (Pringle, 1988; Shiffmann et al., 1999).

However, in addition to providing new capabilities, new technologies also impact the technical, social, organisational, economic, cultural, and political dimensions of work in new and different ways (Anderson and Aydin, 1994). Observations of new technology implementations have shown that a change in technology alters roles, strategies, and paths to failure (Sarter, Woods and Billings, 1997). Kohn, Corrigan and Donaldson (2000) highlighted that in the recognition of these new trends, the Institute of Medicine of the USA recommends the examination of the new technologies for avoiding threats to safety and redesigning them to prevent undesirable accidents.

IS/IT processes have the potential to significantly reduce the rate of these medical errors by providing relevant information in real time to all who need it (Bates et al., 2001; Chaudhry et al., 2006; McDonald et al., 1984). An important challenge for the future is to seek for a real clinical integration of systems. Clinical integration between providers and hospitals has historically been a goal which is continually sought, but rarely achieved. It will become crucial that the design of future applications be integrated easier into existing systems, through open communication interface (Geissbuhler et al., 2001). There is a growing consensus that organisational factors are far more critical for the successful implementation of IS/IT, than technical considerations (Gomes and Romão, 2016a; 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).

We have been witnessing an increased boom in IS/IT healthcare investments and this phenomenon has expanded dramatically over last 10 years. The total investments for each large hospital are huge, yet the overall benefits and costs of hospital information systems have rarely been assessed (Byrne al., 2010; Friedman and Wyatt. 1997). When systems are evaluated, about 75% are considered to have failed (Heeks, 2002; Willcocks and Lester, 1993) and there is no evidence that they improve the productivity of health professionals (Gibbs, 1997, Smith el al., 2009). Along with the computerisation of healthcare sector (Brailer and Terasawa, 2003; Dick, Steen, and Detmer, 1997; Yasnoff, 2004; Barrett, Holmes, and McAulay, 2003) systems failures has also been reported (Southon, Sauer, and Dampney, 1999; Goddard, 2000; Poon et al., 2004) showing the enormous spending of money and loss of confidence in IS/IT from the side of users and managers.

The use of IS/IT is recognised as being a major factor for the promotion of clinical practices and supportive care (Anderson, 1997; Kumar and Preetha, 2012, McDonald et al., 1998) and it is usually widespread in any modern hospital as a key instrument in healthcare delivery and in public healthcare (Drury, 2005; Lymberis and Dittmar, 2007). The globally accepted assumption is that IS/IT can, and does have a positive effect on healthcare, although the evidence supporting its practical use is low (Wootton, 2009). In fact, many decisions on the implementation of the IS/IT in healthcare are made with little or no information about the impact and consequences of its use (Kazanjian and Green, 2002). Information systems are used extensively in healthcare organisations to support various conventional data processing tasks. Range from simple systems, such as transaction processing systems, to complex systems, such as clinical decision support systems (*Table 15*).

Health Information systems	**Descriptions**	**References**
Patient centred information systems	Manage comprehensive patient care information such as medical records and appointment scheduling…	Brennan et al (2000); Cliff (2012) ; Krist and Woolf (2011) ; Smith (2000); Snyder et al (2011).
Administrative	Record the main business processes and routine transactions of organisations such	Smith (2000); Glandon and Buck (1993);

information systems	as patient admission, discharge and transfer, bill processing, reporting and other management purposes.	Jiang et al. (2000); Peabody et al (2004)
Clinical information systems	Perform specific tasks including collection of specific data for patient care, research, management, planning and maintenance of national data repositories	Ammenwerth and de Keizer (2005); Smith, (2000); Gardner and Shabot (2001)
Specific information systems (Radiology, Laboratory, Pharmacy…)	Support the acquisition, analysis of specific function of the different departments. Ensure the administrative tasks, validations, electronic transmission and computer storage.	Paré and Sicotte (2001); Van Bemmel and Musen (1997)
Telemedicine	Telemedicine provides and supports healthcare services and education across distances via electronic communications and IT	Smith, (2000); Parrino (2003); Gawande and Bates (2002).
Clinical decision support systems	Designed specifically to aid clinical decision making	Hunt et al (1998). Kaushal et al (2003); Randolph et al (1999).
Hospital information systems	Integrated hospital information processing systems. Support healthcare activities at the operational, tactical and strategic levels	Ammenwerth and de Keizer (2005); Van der Meijden et al. (2003); Smith (2000).

Table 15- Classification of health information systems (adopted from Yusof, 2008)

The challenges facing healthcare organisations require more comprehensive and integrated solutions and efficient resource management to eliminate inefficiencies and to achieve promised benefits. Many factors can lead to failures in IS/IT projects in healthcare, such as (Andrew, 2000):

- Incomplete or unclear scope;
- Poor planning;
- Failure to identify and involve stakeholders;
- Lack of communication and risk management problems.

IS/IT in healthcare should deliver relevant medical information about patients and support decisions based on the latest scientific research (Yasnoff, 2004). For decades' patients, have been sharing relevant personal data with their doctors, to facilitate a correct diagnosis. Accumulated medical records represents a significant source of information, which includes personal identification, medical history, records of treatments and medication, together with an analysis of psychological profiles and subjective assessments of patients' personality or mental state, amongst others (Mercuri, 2004). This information can be shared, to improve efficiency in the health 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, or insurances companies, which raise some issues about the protection of this strictly personal information.

The investments in IS/IT has the potential to dramatically change the way individuals or society see the healthcare sector, and also provide tremendous opportunities for supporting professionals, and for improving effectiveness and efficiency in this sector, namely, by accessing a large amount of information regarding patients, support for the clinical decisions and direct access to vast resource and knowledge data bases (Ammenwerth et al., 2006; Gomes and Romão, 2016c; Kohn et al., 2000). But are not always investments in IS/IT that result in efficiency and effectiveness gains. So, it also becomes essential to evaluate the factors that limit performance and to identify opportunities for enhancing their use. IS/IT provides an important impact on administrative operations, namely, in a decrease of paperwork and the workload of the professionals, and it also increases efficiency and expands access to affordable care (Caldeira et al., 2012).

The effective integration of IS/IT practices for health professional applications tends to be influenced by several factors, which are related to individuals, professional groups, organisational and contextual characteristics, as well as to the nature of their own intervention (Aarts et al., 2004; Grol et al., 2007; Reyes-Alcázar et al., 2012; Mead, 2000; West et al., 2004; Mickan, 2005).

One of the most critical factors that are recognised by the academic literature is resistance to change by healthcare professionals, particularly amongst doctors (West et al., 2004; Lapointe and Rivard, 2006; Mickan, 2005; Phansalker et al., 2008). The complexity of systems, organisational diversity and the amount of investment needed, and also the difficulties on the 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 to act on a number of critical factors in order to reduce the chance of failure (Harrison and Dowswell, 2002; Olson and Zhao, 2007; Torres-Olivera, 2003).

Project Management methodologies are crucial for the success of IS/IT investments in healthcare, mainly in the areas that experience complex system integration, such as IS/IT projects. Today, healthcare organisations are increasing focusing on the need for investment in IS/IT, with the goal of achieving the maximum level of benefits that these projects can attain. 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 and Vimarlund, 2007).

Health processes rely heavily on both information and knowledge. In this context, management information plays a crucial role. Numerous studies have shown the positive effects of using IS/IT in healthcare (Lenz and Reichert, 2007). The growing use of IS/IT in healthcare has been recognised as being one of the major factors for the improvement of clinical practice, and for care in general (Anderson, 1997; McDonald et al., 1998). The support of these systems provides an important asset for specialised services, which increases the quality and safety of patient care by minimising the likelihood of medical errors (Low and Chen, 2012; McDonald et al., 1984). Supported on IS/IT, the complex process of medical decision making could be significantly improved in several ways (Lenz and Reichert, 2007), such as:

- Contributing to improve data quality, such as timeliness (Van Walraven et al., 2002) or completeness (Hogan and Wagner, 1997);
- Contributing to better monitor the current state of a patient (Bates et al., 2001);
- Detecting mismatches between existing guidelines and the actual patient treatment process (e.g. Gross et al., 2001; Shiffman et al., 2004).
- Generating reminders to ensure that planned actions are not forgotten (McDonald, 1976);

- Helping to calculate drug dosage from previously entered data (Ambrisko and Nemeth, 2004; Muller, 2003);
- Calculating disease probabilities (Hejlesen, et al., 2005).

Achieving a successful change will definitely be easier if all stakeholders are engaged and motivated around the same goal. The sooner that we achieve this commitment, the smoother the change will be for a good result (Bradley, 2006).

2.7.3 IS/IT Failures in Healthcare

There is a widespread feeling that a significant proportion of initiatives in IS/IT healthcare have failed (Heeks and Davies, 1999). Studies have identified high failure rates in IS/IT projects in various sectors, particularly in hospitals (Kaplan and Harris-Salamone, 2009; Wears and Berg, 2005).

The investments on IS/IT for healthcare are financially relevant and still growing worldwide. While the potential and benefits from the use of technological innovation in health are large, the risks are also substantial. Therefore, it seems wise that the organisations should give more attention to adopting formal project evaluations and benefits management methodologies to ensure that the expected benefits from investments are eventually realised (Dibb, 2001; Schultz, 2006; Ward, Taylor and Bond, 1996).

Heeks (2008) states that 35% of IS/IT projects are total failures and 50% partial failures, with only 15% being considered successful. A study by Gheorghiu (2006) found that 70% to 80% of all information technology and information systems fail. Similarly, Kaplan and Harris-Salamone (2009) confirmed a value greater than 30% for the failure rates of major health information technology projects.

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). In various aspects, these implementations are different from other projects, in other industries. The key main differences were related to the environment, the diversity of systems and the devices that need to work, together with the challenge of integration and interoperability which is required to meet the expectations of different stakeholder groups regarding that which constitutes project success (Abouzhara, 2011).

Why do IS/IT systems implementations fail in health organisations? Healthcare projects are a complex undertaking, which depends largely on the quality of existing information (Bose, 2003).

Organisations need to have three types of skills to produce successful projects (Lorenzi and Riley, 2003):

1. Technical skills, which include a broad range of skills, such as the technical knowledge, experience, and abilities.
2. Project management skills, which include the knowledge, techniques, and skills necessary to manage successfully the IS/IT projects.
3. People and organisational skills, which include the wide range of skills necessary to effectively interface with all of the IS/IT stakeholders.

Project failures in healthcare are in part due to several reasons, namely (Lewis et al., 2011):

- Lack of senior management commitment being incomplete or missing altogether (Dorsey, 2000; Bukachi and Pakenham-Walsh, 2007);
- Difficulties in the engagement of health professionals, and a lack of focus on end-users (Elder and Clarke, 2007);
- Incorrect specification requirements (Lucas, 2008; Gauld, 2007);
- An absent or inadequate process of change (Yeo, 2002);
- Poor knowledge of the complexity of health systems (Al-Ahmad et al., 2009);
- Missing investments in human resources (Elder and Clarke, 2007; Bukachi and Pakenham-Walsh, 2007).

Proper training is a major determinant for success in 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).

Cooke-Davies and Arzymanow (2003) identify organisational culture as exerting a positive influence on the development of superior project management practices. These profound changes implicate important ethical challenges.

Reyes-Alcázar et al., (2012) point out that critical success factors are specific elements of the organization of the internal and external environment, which is necessary to ensure goal attainment and the success of a project.

2.7.4 Health information system security

Today's digital technology plays a significant role, permitting the storage and rapid retrieval of patient records and other important information.

When IS/IT is successfully developed, and implemented, there is wide consensus that it offers tremendous opportunities to help healthcare professionals in their daily operations and with the efficiency and effectiveness of care (NCVHS[41], 2001; WHO, 2002). A reliable patient information system is crucial for the quality of care and is one of the key factors of a patient-centred approach. The computer-based patient information system has the potential to store and retrieved large amounts of information and it is a reality that its use improves the effectiveness and efficiency of patient care (Gomes and Romão, 2016a).

Healthcare organisations require interdisciplinary cooperation and coordination. It needs to be highlighted that insufficient communication and missing information are among the major issues that have contributed to unintentional injury caused by medical mismanagement (Lenz and Reichert, 2007).

Securing private patient information remains one of the more pressing problems in modern health care provision (Fernando and Dawson, 2008). *Privacy* concerns control over access to oneself and associated information, including health information, while *security* refers to all measures that protect information privacy (Cheong, 1996). Privacy security implementations are those preserving the data confidentiality, data integrity and the data

[41] National Committee on Vital and Health Statistics.

availability of patient information on a health information system. As more practices adopt health information system, robust privacy and security implementations have become increasingly relevant in-patient care settings (Fernando, 2004).

Patients expect their sensitive personal information to be handled appropriately, to ensure accuracy and confidentiality (Hall, 2014). Privacy and security are big concerns for a hospital's network infrastructure. Implementing security systems to prevent data breaches and leaks, keep patient health information secure, and managing the secure transmission of electronic medical record data are all major issues in the industry. Management must continue addressing ethical and legal issues regarding control of information.

Health care organisations need to safeguard patient information with secure storage of all compliance-related documentation. This includes ensuring the ability to control access, add, or modify records from patient information.

2.7.5 Portuguese National Health System Overview

The Portuguese population enjoys good health and increasing life expectancy. All residents in Portugal have access to health care provided by the National Health Service (SNS), financed mainly through taxation.

Financial resources directed towards health care have reached a high-level relative to the country's wealth. Approximately 10% of GDP is devoted to health expenditure, which puts Portugal among the countries with the highest level of health spending within the EU27 and the OECD (Barros et al., 2011).

About 34%t of healthcare costs are financed by private entities and citizens. The NHS is funded mostly by general taxation (co-payments represent less than 1%), while subsystems and supplemental insurance operate on individual and employer contributions.

Approximately 17 % of the population is covered under a subsystem and 21% under a voluntary insurance plan. The healthcare sector represents about 10% of the gross domestic product (GDP) and almost 6% of the public budget and recorded constant growth over the last decade (Deloitte, 2011). Main characteristics of the NHS are the following:

- Regulated, planned and managed at the central level although the delivery of health care services has been structured at the regional level;
- Guaranteeing universal coverage mostly free of charge at the point of service;
- Mainly public financing of healthcare – out of general taxation
- Mixed service provision – public and private; various public and private 'sub-systems' complement the national system

At the end of the first decade of the 21st century, health in Portugal faced several challenges:

- A major increase in health expenditure and difficulties with cost control;
- Technology and innovation in medical practice, with its impact on the growth of expenditures;
- The increasing role of IS/IT in health promotion and healthcare delivery, to make them effective tools to bring the population in remote locations closer to healthcare services;
- An ageing population, with the associated pressures on continued and long-term care, among others;
- Difficulty in reducing mortality due to traffic accidents and lifestyle related diseases.

Portugal citizens have enjoyed substantial improvements in their health status over the last 25 years. Life expectancy is approaching the European Union[42] average, and rates of perinatal and infant mortality have gone from being the worst through the 1980s and 1990s to among the best in 2003 (WHO, 2009). "Portugal has a well-developed quality infrastructure, with the health data system and use of clinical guidelines standing out as areas of excellence" (OECD, 2015b, p.20). In line with its European partners' expectations, Portugal has shown a growing concern amongst its citizens, health professionals, hospital

[42] The EU 15 group comprises the countries that were EU Member States before 2004: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

managers, policy makers, and others, for obtaining more and better information about health in general.

This concern led to several developments and technological investments as a means of improving the delivery of health services and for meeting the requirements of the various stakeholders, whilst complying with the strategic guidelines of the Government's National Health Plan 2012-2016 and also with European Union commitments (Andreassen et al., 2007; DGS[43], 2013). This model advocates a patient-centred approach, and also an integrated disease management, which both contribute to achieving more and better health for all in a sustainable way (Andreassen et al., 2007). However, many uncertainties and challenges still exist, as well as constraints, which range from a lack of funding, through to the diversity of subsystems, low information system interoperability and other restrictions that may well prevent the successful implementation of this integrated data platform.

After the revolution of 1974, a process of health services restructuring began, which culminated in the establishment of the SNS[44] in 1979. According to the Portuguese Constitution[45] approved in 1976 (article 64), health policies should promote equality of access to healthcare for the citizens, ensuring everyone access to adequate medical care, irrespective of socio-economic condition or geographic location and tending to be free. The main values of the SNS are the following (CGF[46], 2014):

- Universality – no one is excluded from healthcare.
- Access to quality care – everyone has equal acess to quality care.
- Equity – everyone has equal access to care, according to their needs, regardless of gender, religion, ethnic origin, age, social status or ability to pay for such care

[43] Direção Geral de Saúde
[44] Serviço Nacional de Saúde, Lei n.º 56/79, Diário da República n.º 214/1979, Série I de 1979-09-15. Available at: https://dre.pt/web/guest/legislacao-consolidada/-/lc/75079849/view?q=Servi%C3%A7o+Nacional+de+Sa%C3%BAde, 19/07/2017.
[45] Constituição da República Portuguesa, Decreto de aprovação da Constituição, Diário da República n.º 86/1976, Série I de 1976-04-10. Available at: https://dre.pt/web/guest/legislacao-consolidada/-/lc/34520775/view?q=constitui%C3%A7%C3%A3o+portuguesa, 19/07/2017.
[46] Calouste Gulbenkian Foundation

- Solidarity – the financial arrangements of the health system guarantees everyone access to health care

The SNS is organised nationally under the supervision of the Ministry of Health that is responsible for planning and regulation of the health system, providing overall leadership for the SNS and issuing the National Health Plan and the National Strategy for Quality in Health.

The SNS has five Regional Health Authorities (ARS[47]) that are responsible for the implementation of national health objectives and have financial responsibility for primary care (*Figure 9*).

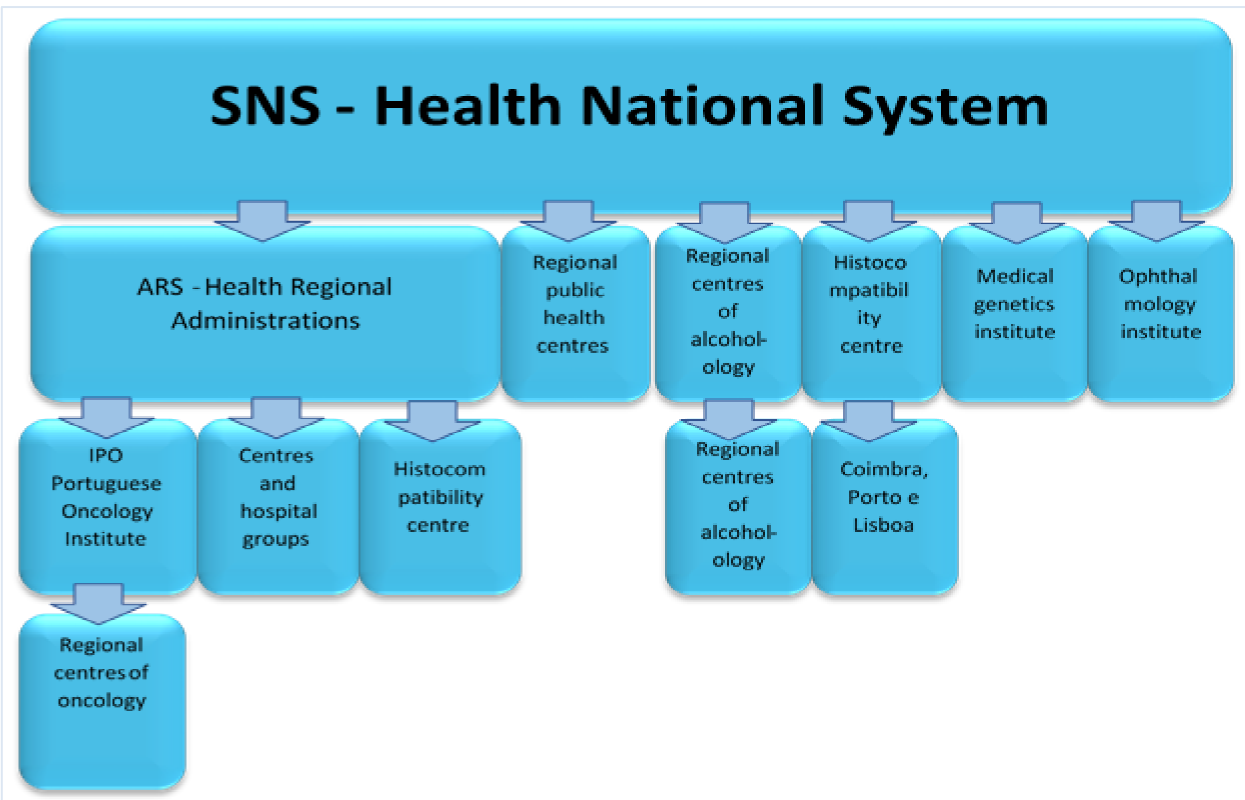

Figure 9 – SNS (source: blog SNS. Saude? Nós Sabemos …[48])

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[47] Áreas Regionais de Saúde
[48] http://saudenossabemosap12e.blogspot.pt/2010/02/estrutura-do-servico-nacional-de-saude.html

The SNS is complemented by private healthcare provision. Alongside the SNS, there are both special health insurance schemes (health subsystems) and voluntary private health insurance.

Decentralization is formally a keyword of the SNS. In fact, the Portuguese Constitution, the Basic Law on Health[49] approved in 1990 and the Statute of the SNS[50] approved in 1993 provide the political and normative support to the decentralization of the health service.

In practice, however, responsibility for planning and resource allocation in the Portuguese healthcare system has remained highly centralized, even after the current five ARS were established in 1993. The Basic Law on Health comprised the decentralization of the system's operation and management at the regional level, integration of health centres and hospitals in health units and the contracting out of health services funded by national taxation. The other European countries have regarded decentralization as an effective means to improve service delivery, to better allocate resources according to need, to involve the community in health decision-making and to reduce inequities in health (Saltman et al., 2007).

The key main findings of the 2011 survey about the consumer perceptions of Portugal's healthcare system performance (Deloitte, 2011) are the following:

- Users believe that the Portuguese healthcare system is wasteful, complex, and performs poorly – A half of users believe that 50% or more of healthcare spending is wasted, mostly attributed to redundant paperwork (67%).

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[49] Lei de Bases da Saúde, Lei n.º 48/90, Diário da República n.º 195/1990, Série I de 1990-08-24. Available at: https://dre.pt/web/guest/legislacao-consolidada/-/lc/57483775/201707171752/57494523/diploma/indice?q=48%2F90, 19/07/2017.

[50] Estatuto do Serviço Nacional de Saúde, Decreto-Lei n.º 11/93, Diário da República n.º 12/1993, Série I-A de 1993-01-15. Available at: https://dre.pt/web/guest/legislacao-consolidada/-/lc/34544275/view?q=estatuto+do+servi%C3%A7o+nacional+de+sa%C3%BAde, 19/07/2017.

- Satisfaction overall is low - 13% of users are satisfied with the performance of the healthcare system, mainly with modern technology (41%) and innovation (40%); 22% are not at all satisfied, mostly are dissatisfied with wait times (70%).
- Almost 8 in 10 Portuguese users are cautious about spending on healthcare. 3 in 10 are concerned about future healthcare costs.
- Users are concerned about their ability to meet future healthcare costs; 43% say they spent more on healthcare products and services than in the prior year.
- Overall, users feel there is substantial room for improvement in SNS; 41% agree it is possible to improve quality and reduce costs simultaneously in the current healthcare system.
- Most users believe that the system should increase access to primary healthcare services; 77% say they are in favour of expanding the number of providers by training more primary care practitioners and more specialist medical practitioners (75%).

Portugal has implemented a comprehensive set of structural reforms and introduced an extensive range of quality initiatives aimed at providing fiscal sustainability, improving efficiency and achieving better quality across the healthcare system (Biscaia and Heleno, 2017; Monteiro et al., 2017; OECD, 2015b; Pisco 2011) such as:

- The 2007 Primary Healthcare Reform led to the establishment of the innovative Family Health Unit, aimed at encouraging more multidisciplinary team working and at achieving greater co-ordination between providers.
- Rationalisation of the hospital sector started in the early 1990s and is an ongoing process characterised by the concentration of services into fewer, larger hospital centres and hospitals groups complemented with the expansion of the Local Health Units.
- The expansion of the National Continuous Care Network, a joint initiative of the Ministry of Health and the Ministry of Labour and Social Solidarity, which aims to provide care to citizens in situations of dependency and/or rehabilitation, mostly used by the elderly population.

- The new drug policy, a set of measures aimed, among other things, at reducing prices and encouraging the use of generics to reduce drug costs.

Portugal has made sustained progress in containing spending whilst maintaining efforts to continuously improve care quality (OECD, 2015b).

To go forward and meet both targets of increasing *value for money* and improving quality in care, it will be important to maintain the efforts on the improvement health performance. Structural reform concerning *where* and *how* care is delivered is also needed, with an emphasis on shifting care out of hospitals into less-expensive units. Portugal focus in near future will be on clinical processes and pathways, as well as to use more effectively the Portuguese healthcare workforce (OECD, 2015b).

The OECD document (OECD, 2015b) reported remaining challenges remain to improve the quality of care in Portugal, namely:

- Although the reorganization of the hospital system is an ongoing process, the SNS still relies on the hospital sector. To relieve pressure on hospital sector, the SNS need expand their capacity at community level.
- The SNS needs to evolve towards a more comprehensive delivery approach of health involving more partnership between health and social care providers.
- An appropriate balance between traditional *Primary Healthcare Units* and *Family Health Units* needs to be taken at system-level.
- To meet reforms targets, the use of quality-based payment could be extended.
- Ensuring that the ongoing reforms are monitored and evaluated

SNS, aligned with the other European countries, is going through major changes, with some major disruptive trends affecting the way of think health, challenging the very ways of organising and delivering health services that have been built up over these years of great expansion. These trends are:

- The growth in long-term conditions and non-communicable diseases[51]
- Citizens better educated, more demanding and less deferential towards health professionals and less likely to simply follow their advice or prescription without question.
- The start of personalised medicine, with genetic testing and biological diagnoses, changing the way patients with a range of different conditions are treated.
- Information and communications technology bringing us new imaging and diagnostic techniques and the ability to monitor and treat patients remotely and at earlier stages in the development of their conditions.
- Increasing globalisation and global interdependence in health and healthcare. Examples has already shown how new diseases can spread rapidly around the world.

A suggested list of design principles for a high quality and sustainable health and health care system in the 21st Century could be the following (CGF, 2014):

- Broad base - Designed on a shared vision that addresses the different determinants of health;
- Values-oriented - ensuring that the entire population is provided equitably;
- Inclusive - involving all sectors of society in a new social model for health;
- Responsible - Clear definition of responsibilities, authority and reports to the public;
- Open and transparent - Allowing citizens access to health information and costs of service;
- Person-centered - A sensitive, safe, integrated and personalized care, with patients fully involved in decision making process;

[51] A non-communicable disease (NCD) is a disease that is not infectious and cannot be transferred to others. Some of these are diseases that progress slowly or cause chronic symptoms while others progress very rapidly. The World Health Organization estimates that NCDs are the leading cause of death worldwide, accounting for 60 percent of deaths in all humans (e.g. Diabetes, Hypertension, Osteoporosis, Alzheimer's…)

- Local and accessible - Whenever possible with locally accessible services;
- Team-based - Cooperation and sharing of knowledge among health professionals, citizens and other partners;
- Evidence-based - Evidence available and used throughout the system;
- Continuous improvement - Focused continuous quality improvement and learning;
- Capable and efficient - making the most of available resources and avoiding waste.

2.7.6 SPMS - Serviços Partilhados do Ministério da Saúde, EPE

The centralization of the public purchases has been increasingly a strategic trend, particularly in the health sector (Aperta et al., 2015). The centralization of the procurement is driven be the cost savings and process efficiency (Karjalainen, 2009; Cousins et al, 2008). The SPMS was established in 2010 as a central purchasing entity for the Portuguese Health Minister. The SPMS is a public business organization that ensures the provision of shared services in the level of procurement and logistics, financial management, specialized human resources and IS/IT systems for the entities that integrate the National Health Service. SPMS assignments[52] are the following:

- The provision of health-specific shared services in procurement and logistics, financial services, human resources and information and communication systems and technologies to the establishments and services of the National Health Service (NHS), regardless of their legal entities, as well as to the organs and services of the Ministry of Health and any other entities, when carrying out specific activities in the health area.
- In the context of shared purchasing and logistics services, the mission is to centralize, optimize and rationalize the acquisition of goods and services and to provide logistics services, with responsibilities for procurement strategy, pre-

[52] https://www.sns.gov.pt/entidades-de-saude/servicos-partilhados-do-ministerio-da-saude/

contractual procedures, public procurement, internal logistics, payments and performance monitoring.

- In shared financial services, its mission is to cooperate, share knowledge and information, and develop service activities in the areas of financial and accounting management, with responsibilities for budget planning and preparation, budget control, contract management, analytical accounting, general accounting, payments and collections and treasury.
- In the scope of shared human resources services, the mission is to provide a shared service of high efficiency human resources and levels of automation, with responsibilities for information gathering and diagnosis, salary processing and management indicators.
- In the context of shared services of information and communication systems and technologies, its mission is to cooperate, share knowledge and information and develop activities in the areas of information and communication systems and technologies, ensuring the infrastructure of information systems of the Ministry of Health and promoting the definition and use of standards, methodologies and requirements that guarantee the interoperability and interconnection of health information systems among each other and with information systems that are transversal to public administration.

SPMS was also equipped with new mechanisms which aims to facilitate the procurement procedures on health and enable a more effective functioning in the context of all public procurement, particularly in the context of aggregation of information (Mimoso, 2014). Thus, the whole procurement process must be based on a single integrated information system[53]. Centralized purchases in health are a relatively recent process in Portugal. In some situations, the centralization of purchases can offer competitive and efficiency advantages through the capacity of negotiation and the reduction of the resources used.

[53] https://community.vortal.biz/PRODSTS/Users/Login/Index?SkinName=SPMS

Several disadvantages were also reported, namely, possibility of oligopoly by suppliers, generated by imperfect competition; decreased suppliers' ability to respond in the medium or long term may lead to a decrease in competition and a possible increase in prices; and, difficulties in controlling the purchasing process, which may compromise its effectiveness (Aperta et al., 2015).

2.7.7 National Strategy for the Health Information Ecosystem 2020[54]

The adoption of a strategy for Health Information Systems within the 2016-2020 timeframe, is aligned with the strategic initiatives promoted by Government's National Health Plan, the Health guidelines designed by the WHO and European Union. The National Strategy for the Health Information Ecosystem 2020 – ENESIS 2020 (eSIS) add a set of technologies, people and processes involved in the life cycle of information related to all dimensions of citizen health and other related areas, including the organisations where healthcare is provided. eSIS is an approach that goes beyond the NHS and extends to the health system, in line with the general understanding arising from the *Basic Law on Health* approved in 1990 and reinforced through the *despacho No. 3156/2017* which establishes a clear intention to introduce principles of governance and management of the National Strategy for the Health Information Ecosystem.

The SPSM is responsible for the coordination and supervision of eSIS under guidance of the respective ministry, guaranteeing the promotion of the eSIS and ensuring its operational implementation under the NHS. The result is a shared vision for the area of the Systems and Information Technology for Health that, when integrated in the Sectorial Plan of the Ministry of Health, and founded on participatory management and governance, allows the strategies and initiatives of the various actors of the ecosystem to be steered, and to progress in a collaborative or separate manner towards common goals.

[54] Despacho n.º 3156/2017, Diário da República n.º 74/2017, Série II de 2017-04-13, Ministry of Health. Available at: https://dre.pt/home/-/dre/106881538/details/4/maximized?serie=II&dreId=106872363, 19/07/2017.

Chapter 3. Philosophical Perspective and Research Approach

3.1 Overview

"The goal of research in social sciences is to produce a reliable body of knowledge that enables us to understand and explain the social world. The identification of a philosophical perspective is important. It exposes the researcher's assumptions about the nature of the phenomena under investigation (ontology) and his/ her point of view of the ways in which is possible to acquire knowledge (epistemology)" (Caldeira, 2000, p. 73).

Business and management research provides conclusions that enhance knowledge and understanding but also address contemporary business issues and practical managerial problems (Saunders et al., 2009). Business and management research is defined as the methodical and objective procedure of getting the necessary information to facilitate the decision-making procedure regarding various organisational issues (Zikmund, 2010).

It is not easy to conduct a research today, heightened by the incoherent classification of research philosophies such as epistemology, ontology, axiology and by debates about quantitative versus qualitative research (Mkansi and Acheampong, 2012). Several studies have used different descriptions, categorisations and classifications of research paradigms and philosophies in relation to research methods with overlapping emphasis and meanings (Saunders et al., 2009; Ritchie and Lewis, 2003; Guba, 1990; Guba and Lincoln, 1989).

There has been widespread debate in recent years within many of the social sciences regarding the relative merits of quantitative and qualitative strategies for research. The positions taken by individual researchers vary considerably, from those who see the two strategies as entirely separate and based on alternative views of the world, to those who are happy to mix these strategies within their research projects.

Bryman (1988) argued for a *best of both worlds* approach and suggested that qualitative and quantitative approaches should be combined. Hughes (1997), nevertheless, warns that such solutions underestimate the politics of legitimacy that are associated with choice of methods.

Historically, research in information systems, particularly in the US, is mostly supported in a positivist philosophy (Mingers, 2004), as demonstrated by several studies (e. g. Orlikowski and Baroudi, 1991; Chen and Hirschheim, 2004).

Each research paradigm provides a set of specific attributes to achieve different scientific research objectives. If on one hand the positivist paradigm points to replicability and generalization, the interpretative paradigm increases understanding through the in-depth analysis of the phenomenon studied (Orlikowski and Baroudi, 1991).

Chen and Hirschheim (2004) argue that the methodologies or alternative paradigms such as interpretivism and qualitative methods should be encouraged because they provide different dimensions to the research that the positivist paradigm and its quantitative methods would not be able to accomplish.

What distinguishes information systems from other fields is its concern for the use of artefacts in human-machine systems. This domain of interest locates the discipline of IS/IT "at the intersection of knowledge of the properties of physical objects (machines) and knowledge of human behaviour" Gregor (2006; p. 4). Therefore, according to the same author, to understand IS/IT, theory is required that links the natural world, the social world and the artificial world of human constructions.

In the IS/IT discipline, political and professional contexts have changed significantly (Chen and Hirschheim, 2004) and the alternative paradigms such as interpretivist have become more widely accepted even in the mainstream journals such as MIS Quarterly, traditionally positivist-oriented (Trauth and Jessup, 2000; Walsham, 1995a).

Research diversity and methodological pluralism has received substantial attention during the last decades (Galliers, 1991; Klein et al., 1991; Walsham, 1995b; Mingers, 2001) being advocated for any serious IS/IT research agenda (Klein et al., 1991). In contrast to the dominant quantitative methods, qualitative research methods have also become more popular in the IS/IT field (Lee, 1989; Walsham, 1995b; Silverman, 1998).

3.2 Research paradigm

"Research paradigms inherently reflect our beliefs about the world we live in and want to live in" (Lather, 1986, p. 259).

According to Kuhn (1970) paradigm refers to a research culture with a set of beliefs, values, and assumptions that a community of researchers has in common regarding the nature and conduct of research.

Research paradigms can be interpreted as worldviews or as a set of beliefs that underpin an individual understanding of the world and their place and relationship within in (Guba and Lincoln, 1994). As such, a paradigm represents a consensus across the relevant scientific community about the theoretical and methodological rules to be followed, the instruments to be used, and the problems to be investigated, and the standards by which research is to be judged (Marshall and Rossman, 2006).

Paradigms can be revealed by the researcher's responses to the following three questions (Guba and Lincoln, 1994, p.108):

- "What is the form and nature of reality, and therefore what can be known about it?" (Ontological question);
- "What is the nature of the relationship between the researcher, and what can be known?" (Epistemological question);
- "How can the researcher go about finding whatever he believes can be known?" (Methodological question).

Guba and Lincoln (1994) have made a very useful contribution to articulating and differentiating competing paradigms of inquiry.

According to these authors there are four main paradigms of inquiry: (1) positivism, (2) post-positivism, (3) critical theory, and (4) constructivism (*Table 16*).

Paradigms	Characteristics
Positivism	Ontology: **Realism.** There is a *real*, objective reality that is knowable. Epistemology: **Objectivist.** The researcher is assumed to be independent from the investigation object. Methodology: **Experimental.** Questions and hypotheses are stated and subjected to empirical test to verify them.
Post-positivism	Ontology: **Critical realism**. There is a *real*, objective reality, but humans cannot know it for sure. Epistemology: **Modified Objectivist.** The goal is objectivity, but pure objectivity is impossible. Results are *probably* true. Methodology: **Modified Experimental**. Includes both qualitative and quantitative methods.
Critical theory	Ontology: **Historical Realism.** Reality can be understood, but only as constructed historically and connected to power. Epistemology: **Transactional and subjectivist**. Knowledge is mediated reflectively through the perspective of the researcher. Methodology: **Dialogic and dialectical.** Focused on investigator/participant dialogue, uncovering subjugated knowledge and linking it to social critique
Constructivism	Ontology: **Relativist**. All truth is *constructed* by humans and situated within a historical moment and social context. Epistemology: **Transactional and subjectivist.** Researcher and participants are linked, constructing knowledge together. Methodology: **Hermeneutical and dialectical**: Generally qualitative, research through dialogue.

Table 16 – Paradigms of inquiry (adapted from Guba and Lincoln, 1994)

According to the literature, the research process has three major dimensions: ontology, epistemology and methodology integrated in a comprehensive system of thought and interrelated practices that define the nature of the investigation along these three dimensions (Blanche et al., 2006).

Ontological questions in social science research are related to the nature of reality. There are two broads and contrasting positions: objectivism holding that there is an independent reality and constructionism assuming that reality is the product of social processes (Neuman, 2006).

Positivist researchers do not regard themselves as important variables in their research and believe they remain detached from what they research. The philosophical basis is that the world exists and is knowable and researchers can use quantitative methodology to discover it (Cohen, Manion and Morrison, 2007). Research findings are usually represented quantitatively in numbers which speak for themselves (Bassey, 1995; Cohen, Manion and Morrison, 2007; Mutch, 2005).

On the other hand, interpretive researchers cannot accept the idea of there being a reality which exists irrespective of people (Tuli, 2010). They see reality as a human construct (Mutch, 2005). Interpretive researchers use qualitative research methodologies to investigate, interpret and describe social realities (Bassey, 1995; Cohen, Manion and Morrison, 2007). The research findings in qualitative methodology are usually reported descriptively using words (Mutch, 2005).

There are two broad epistemological positions: positivism and interpretivism /constructivism. Positivists see social science as an organised method for combining deductive logic with precise empirical observations of individual behaviour to discover and confirm a set of probabilistic causal laws that can be used to predict general patterns of human activity (Neuman, 2006). The nature of social reality for positivists is that empirical facts exist apart from the researcher's ideas or thoughts; they are governed by laws of cause and effect; patterns of social reality are stable and knowledge of them is additive (Crotty, 1998; Neuman, 2006; Marczyk, DeMatteo and Festinger, 2005).

On the other hand, the interpretivist/constructivist researchers see the world as constructed, interpreted, and experienced by people in their interactions with each other and with the wider social systems (Maxwell, 2006; Bogdan and Biklen, 1992; Guba and Lincoln, 1985; Merriam, 1988). According to this paradigm the nature of inquiry is interpretive, and the purpose of inquiry is to understand a specific phenomenon, not to generalize the findings to a population (Farzanfar, 2005). Researchers within the interpretivist paradigm are naturalistic since they study real-world situations as they unfold naturally.

Methodology is a research strategy that translates ontological and epistemological principles into guidelines that show how research is to be conducted (Sarantakos, 2005). Methodology also describes the principles, procedures, and practices that govern research (Kazdin, 2003).

The positivist research paradigm underpins quantitative methodology owing to its deductive nature. The realist/objectivist ontology and empiricist epistemology contained in the positivist paradigm requires a research methodology that is objective or detached since the emphasis is on measuring variables and testing hypotheses that are linked to general causal explanations (Sarantakos, 2005; Marczyk, DeMatteo and Festinger, 2005). On the other hand, qualitative methodology is underpinned by interpretivist epistemology and constructivist ontology. This assumes that meaning is embedded in the participants' experiences and that this meaning is mediated through the researcher's own perceptions (Merriman, 1998).

Ontology and epistemology influence the structure and processes of social research and provide explanations around philosophy of science (Machamer, 2002; Nelson, 1990). The ontology refers to the study of the nature of what exists in the world, that is, the nature of being. Ontological assumptions focus on issues around being human within the world and whether a person sees social reality or aspects of the social world as external, independent, given and objectively real or instead as socially constructed, subjectively experienced (Wellington et. al, 2005). Iivari et al., (1998) explain that ontology deals with the structure and properties of "what is assumed to exist" (p.172). According to Orlikowski and Baroudi (1991), "Ontological beliefs must do with the essence of phenomena under investigation, that is, whether the empirical world is assumed to be objective and hence independent of humans, or subjective and hence having existence only through the action of humans in creating and recreating it" (p.7).

Epistemology is the study of the nature of knowledge, its defining features, its substantive conditions and its limits. An epistemological issue concerns the question of what is considered as acceptable knowledge in a discipline (Bryman and Bell, 2003). Orlikowski and Baroudi (1991) improve this discussion by claiming that “Epistemological assumptions concern the criteria by which valid knowledge about a phenomenon may be constructed and evaluated” (p. 8). Morgan and Smircich (1980, p. 193) observe that different assumptions related to ontology pose relevant problems of epistemology. In other words, the “different world view they reflect imply different grounds for knowledge about the social world”. “Methodology as a research strategy translates ontological and epistemological principals into guidelines that show how research has to be conducted” (Cook and Fonow, 1990, p. 72). According to Silverman (2006) methodology is a general approach that establishes the ways in which any phenomenon can be studied. In the information systems field many different research methods and approaches are accepted as appropriate (Myers, 1997). Methods refer to specific research techniques, that include quantitative methods as statistical correlations, surveys and experiments or qualitative methods that embrace techniques such as observation and interviewing (Silverman, 2006).

There are many ways of conducting social science research: experiments, surveys, history, analysis of archival information and case studies (Yin, 2003).

Bryman and Bell (2003) summarized the differences between those two types of research strategies (*Table 17*).

Approach	**Quantitative**	**Qualitative**
Principal orientation to the role of theory in relation to research	Deductive; theory testing	Inductive; theory generation
Epistemological orientation	Natural science model, positivism	Interpretation
Ontological orientation	Objectivism	Constructionism

Table 17 - Quantitative and qualitative research strategies (Bryman and Bell, 2003)

The deductive orientation applies to this work given that the research paradigm is the positivism epistemology following the objectivism ontological orientation. The deductive theory research, based on what is known about a particular subject and theoretical considerations in relation to that subject, deduces hypotheses that must be subjected to empirical tests (Bryman and Bell, 2003).

The goal of methodological assumption is to indicate the research methods and techniques that help the researcher gather empirical evidence (Orlikowski and Baroudi, 1991). There are several ways of conducting social science research: experiments, surveys, history, analysis of archival information, case study (Yin, 2003).

The research method can be qualitative or quantitative. There are three main differences in qualitative and quantitative research (Stake, 1995, p.37):

1. The distinction between explanation and understanding as the purpose of enquiry;
2. The distinction between personal and impersonal role for the researcher;
3. A distinction between knowledge discovered and knowledge constructed.

Traditionally, there are two research methods: survey and experiment. Survey is a kind of research that uses predefined and structured questionnaires to capture data from individuals (Palvia et al., 2003).

Qualitative methods are powerful especially when used to build new or refine existing theories (Shah and Corley, 2006). The purpose of quantitative research approach is to generalize from a sample to a population so that inferences can be made about characteristics, attitudes, or behaviours of this population (Babbie, 1990; Creswell, 2003). Quantitative researchers seek scientific explanations using this method to reach the following objectives:

- Develop the understanding of causal relations;
- Describe group tendencies;
- Determine whether the predictive generalization of a theory holds true.

Surveys are widely used by quantitative researchers, including the following types: self-administered questionnaires, structured interviews by telephone or face-to-face, structured reviews to collect information, and structured observations (Fink, 1995). Recently, researchers started to use web-based or internet survey and administering it online (Buchanan and Smith, 1999; Nesbary, 2000). According to Schmidt (1997), there are several advantages in terms of accessibility, time, and cost. Creswell (2003) recommends the following procedures for data collection:

- Identify the purpose of survey research;
- Indicate why a survey is the preferred type of data collection for the study;
- Indicate whether the study will be cross sectional or longitudinal;
- Specify the form of data collection stressing its strengths and weaknesses.

A researcher should characterize the population and the sampling procedures as follows:

- Identify the population in the study;
- Identify if the sampling design is single or multistage/clustering;
- Identify the selection process for individuals;
- Identify if the study will involve stratification of the population before selecting the sample;
- Discuss the procedures for selecting the samples from available lists; and
- Indicate the number of people in the sample and the procedures used to compute this number.

The research paradigm will result from the ontology and epistemology followed by the researcher. All these elements are interconnected. Orlikowski and Baroudi (1991) believe that all three research philosophies - positivism, realism and interpretivism – can offer an insightful perspective on the phenomena of interest in IS/IT research.

Researchers adopt a positivism philosophical perspective when believe that facts and values are distinct, and scientific knowledge consists almost exclusively of observable facts. Positivist studies follow the premise related to the "existence of a priori fixed relationships within phenomena which are typically investigated with structured instrumentation" (Orlikowski and Baroudi, 1991, p.5). Lee and Baskerville (2003) discuss the positivist need to discover universal laws that govern the studied phenomena.

The critical realist paradigm can be characterised by the critical intention to change reality and the wish to emancipate alienated individuals. Researchers following a realist perspective focus on understanding the mechanisms and structures that rule social behaviour (Caldeira, 2000).

A realist researcher thinks that social phenomena exist not only in the mind but also in the objective world. Moreover, that some plausible relationships are to be found among them (Miles and Huberman, 1994).

Orlikowski and Baroudi (1991) reflect that critical realists "aim to critique the status quo, through the exposure of what are believed to be deep-seated, structural contradictions within social systems, and thereby to transform these alienating and restrictive social conditions" (p.6).

Caldeira (2000), analysing critical realism literature, concludes that this is a unique philosophical perspective, although different research methods can be used and combined. For Mingers (2004) critical realism includes the qualitative or quantitative description of the phenomenon and, mainly, it wants to "get beneath the surface to understand and explain why things are as they are, to hypothesise the structures and mechanisms that shape observable events" (p. 100).

According to Walsham (1993), an interpretivist epistemological position is concerned with the understanding of reality and states that knowledge is subjective, being a social construction.

Orlikowski and Baroudi (1991) observe that interpretive studies "assume that people create and associate their own subjective and intersubjective meanings as they interact with the world around them. Interpretive researchers thus attempt to understand phenomena through accessing the meaning that participants assign to them" (p. 5).

For Walsham (2006), our knowledge of reality (including the domain of human action) is a social human construction. In this case, it is important to observe that interpretivist researchers are no more *detached* from their objects of study than are their informants. Miles and Huberman (1994) argue that researchers have "their own understandings, their own convictions, their own conceptual orientations; they too, are members of a particular culture at a specific historical moment" (p. 8).

3.3 Research design

3.3.1 Overview

Research design is the "logical plan for getting from here to there, where here is the initial set of research questions to be answered, and there are the conclusions" (Yin, 2003; p.20).

Research design is the science of planning procedures for conducting studies to get the most valid findings (Vogt and Johnson, 2011). Bryman (2012) has defined research design as the framework for collection and analysis of data.

According to Yin (1984) the methodological design must be suitable to: "The research problem; the extent of control the researcher has over actual behavioural events; and the time-focus of the phenomena observed, i.e. contemporary or historical." (p.13)

To be successful when performing research, it is essential to select appropriate research methods. As emphasised by Barnes (2001) any research method inevitably has both advantages and disadvantages, and there is unlikely to be one best way of approaching the task. There are several different research strategies to follow while doing a research study within applied sciences. The research design includes a range of dimensions of the research process such as (Bryman and Bell, 2003):

- Expression of interrelationships between variables;

- Generalisation of larger group of individuals than those who actually participate in the investigation;
- Understanding behaviour and the meaning of behaviour in a specific social context and a temporal appreciation of social phenomena and their interconnections.

One of the issues that influence the research methodology and design is the type of research question, and *how* and *why* questions are most appropriate to answer through a case study, while the questions of *what*, *which* and *when*, for example, are more suited to the application of quantitative methods (Yin, 2003) (*Table 18*).

Strategy	**Form of research question**	**Requires control over behavioural events?**	**Focus contemporary events?**
Experiment	how, why	yes	yes
Survey	who, what, where, how many, how much	no	yes
Archival analysis	who, what, where, how many, how much	no	yes/no
History	how, why	no	no
Case study	how, why	no	yes

Table 18 - Different research strategies (Yin, 2003)

3.3.2 The adopted research strategy

This study will follow an objective ontology according to a positivist epistemology, considering that the knowledge can be codified without being influenced by the researcher. As the scientific rigor in this kind of research paradigm is of crucial importance to truthfully explain the social reality under investigation, the study will develop a research model and a set of hypotheses from the existing literature and theories, which supporting and guidance the research. The set of hypotheses will then be empirically tested. Therefore, the researcher will be independent of the work producing true statements about the reality under study, which is assumed as an external reality that could be known. The ontological and epistemological positions of the researcher, as detailed here, influence all the research design decisions made throughout the work and also the steps taken towards the building and testing of the new theory.

This investigation is primarily quantitative and confirmatory in nature, with its roots on the research model hypotheses testing. Therefore, a more qualitative phase was performed just to define and validate a new concept definition and its components through experts' exploratory meetings and interviews (Appendix C).

The results of this exploratory study allowed us to validate a central construct of our model and served as input to the next step of the study: the validation of the research.

The hypotheses testing offers the understanding of the nature of certain relationships among the variables of interest for the study. It could also establish cause-and-effect relationships and can be done with both qualitative and quantitative data.

The purpose of the study is to test hypotheses with quantitative data. The type of investigation can be causal or correlational. A causal investigation is undertaken when it is necessary to establish a cause-and-effect relationship, that is, when the intention of the researcher is to state that variable X causes variable Y (Sekaran and Bougie, 2009). The study will be based on a cross-sectional survey since it excludes explicitly the time dimension. The cross-sectional design entails the collection of data from several cases, at a single point in time, 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 and Bell, 2003).

The study will follow 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, to truthfully explain the social reality under investigation, the study will develop a research model and a set of hypotheses from the existing literature and theories, which will support and orientate the research. A pretest process was carried out to validate the consistency of statistical variables. As previously stated, the main purpose of this empirical study is to gather evidence to confirm the project management mediation effect on the relation between organisational maturity and project success in healthcare and value testable hypotheses. In the *Table 19* we have a summary of the research design choices made in the present work.

Purpose of research	Explanation and prediction
Type of study	Mediation approach
Level of analysis	Individual level
Time dimension	Cross-sectional
Data collection	Survey

Table 19 - Summary of the research design choices

At this point we recall the research questions that were stated in Chapter 1.

1. *How Organisational Maturity affected IS/IT Project Success in Healthcare?*
2. *How Project Management affected IS/IT Project Success in Healthcare?*
3. *How Organisational Maturity affected the Project Management?*
4. *How Organisational Maturity affected IS/IT Project Success through the effect of Project Management on IS/IT Project Success?*

How, *what* and *which* questions aiming at validating an existing theory, and thus suited to be analysed with data collected through a survey (Yin, 2003).

Chapter 4. Research model, hypotheses and contructs

4.1 Introduction

A theory is "a set of interrelated constructs, definitions, and propositions that presents a systematic view of phenomena by specifying relations among variables, with the purpose of explaining natural phenomena" (Kerlinger's, 1979, p. 64).

A conceptual model can guide research by providing a visual representation of theoretical constructs and variables of interest. The design of the conceptual model results from research conducting a thorough the review of the literature.

Peer-reviewed journal articles, books/monographs, conference papers, and other relevant references were the source. As mentioned before the aim of the study is to investigate whether health institutions' maturity has an influence on the Success of IS/IT Projects and whether the application of Project Management practices mediates this relationship.

Mediation analysis is frequently of interest to social science researches as a means of testing processes and hypothetical mechanisms through which an independent variable, X, can induce a dependent variable, Y, indirectly through the mediator variable, M (Hayes and Preacher, 2014; Iacobucci et al., 2007).

The mediation analysis explains 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 (Baron and Kenny, 1986; Fairchild and Mackinnon, 2009; Fritz et al., 2012; Hayes and Preacher, 2014; Hayes, 2015; Iacobucci, 2008; MacKinnon et al., 2007; Rucker et al., 2011).

In the mediation analysis, *the total effect*, path c, is examined from the relationship between independent variable, X, and dependent variable, Y, and the mediation is examined for the same previous relationship, but with intervening variable acting as the mediator. According to the mediation perspective, an intervening variable exists between one or several antecedent variables and the consequent variable. The path c’ is called the *direct effect* and the path (a*b), *the indirect effect* (*Figure 10*).

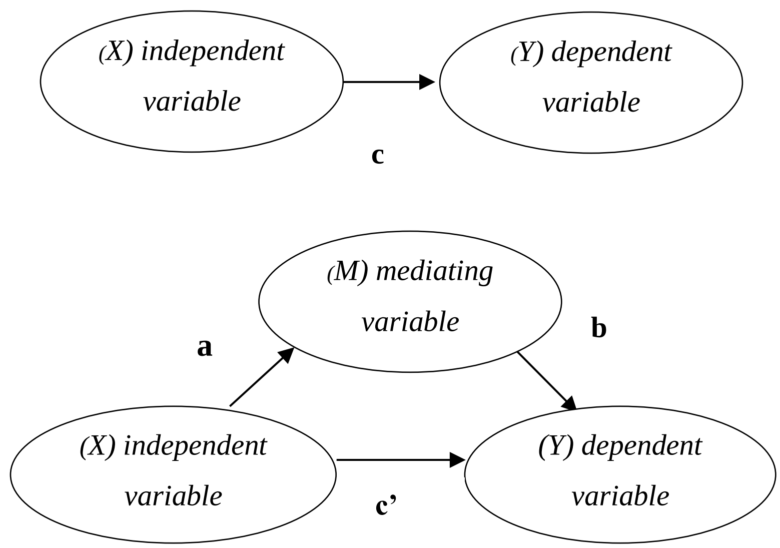

Figure 10 - Mediation Model

4.2 The conceptual model and hypothesis

Organisational Maturity and Project Management have both an effect on Project Success (e. g. Adenfelt, 2010; Isik, et al., 2009; Kerzner, 2001; Shi, 2001; Skulmoski, 2001).

Our study explores the possibility of a mediating role of Project Management in the relationship between Organisational Maturity and IS/IT Project Success. The concept of Project Management is based on the idea that there is a correlation between an organisational capability in project, programme and portfolio management, and its effectiveness in implementing strategy (Too and Weaver, 2014). The main target of Project Management is to support the execution of an organization’s competitive strategy to fulfil the predefined outcomes and achieved the Project Success (Milosevic, 2003).

Our research is supported by a more complex model since in addition to considering the *direct effect* of Organisational Maturity in the Success of an IS/IT Project it also includes an *indirect effect*.

Our main assumption is that the Project Management practices as a mediator, as it transmits the effect of the Organisational Maturity into 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 IS/IT Project Success (Gomes et., 2016a, 2016b). Accordingly, we developed the following hypothesis:

H1 - There is a direct relationship between Organisational Maturity (X) and the IS/IT Project Success (Y).

H2 - There is an indirect relationship between Organisational Maturity (X) and the IS/IT Project Success (Y), which is mediated by Project Management (M).

4.3 Constructs

4.3.1 Organisational Maturity construct

According to the P3M3© framework the Organisational Maturity was measured by seven items, known as perspectives (OGC, 2010a). Respondents were asked to indicate how their organisational unit performed relative to the several processes in different functional areas, in an incremental five steps, that means, higher levels include the procedures of low levels. For each *perspective*, the respondents evaluated the marurity level that better fit to their health unit (*Table 20*). The *Table 21* identifies the perspectives recommended by the P3M3© framework.

Level	**Description**
Level 1	The processes or projects are ad-hoc, managed without standardization and are not properly documented in the different areas of the organization

Level 2	The processes or projects are standardized with minimum specifications. The organisations present evidence of project management, namely, in the planning and management of the change, although in an inconsistent and differentiated way.
Level 3	The organization has processes and projects that are centrally defined and standardized and are followed in all projects. Have tools for project control. Defined responsibilities.
Level 4	The organization has processes or projects defined, standardized and managed using quantitative measures to evaluate the performance of projects or processes.
Level 5	Organisations have quantitative measurements for the continuous improvement of their processes or projects. Proactivity in problem management and process optimization.

Table 20 – Organisational maturity levels description

Perspective	**Description**
Management Control	Ensure that the project approach delivers the change objectives of the organization (M02).
Benefits Management	Approach to organisational change, embedded within the organisational and is assessed as part of the development of organisational strategy (M03).
Financial Management	Cost estimation techniques used at the project level are continually reviewed in terms of actual versus estimate comparisons to improve estimation throughout the organization (M04).
Stakeholders Management	Communications optimization from extensive knowledge of the project stakeholder environment (M05).
Risk Management	Embedded in the organisational culture and underpins all decision-making within projects (M06).
Organisational Governance	The core aspect of organisational control, with reporting, ownership and control responsibilities (M07).
Resources Management	Load balancing and effective use of both internal and external resources across projects (M08).

Table 21 - P3M3© perspectives

4.3.2 IS/IT Project Success construct

Similarly, IS/IT Project Success was conceptualized as a construct consisting in the following four subscales and measured by a 5-item Likert scale that checks the levels of agreement with the item statement. Were considered the following subscales:

- **Project Management Success -** Measured against *iron triangle* criteria (time, cost and requirements/quality).
- **Strategic alignment** - Linking process between the overall goals and the goals of each project that contribute to the success.
- **Organisational change -** The process in which the organization transforms its structure, strategies, operational methods, technologies, or organisational culture to affect change within the organization and the effects of these changes on the organization.
- **Stakeholders expectations -** In this subscale we include the two main stakeholder's groups, the health professionals and the organization:
  - **Health professionals –** There is widespread academic agreement on the need to maintain a certain degree of autonomy for healthcare professionals to improve not only their ability to cope with everyday challenges, but also as a fundamental aspect of their personal performance, motivation and realization (Harrison and Dowswell, 2002). So, the satisfaction of the professionals' expectations becomes a crucial issue for the project success.
  - **Organisational -** Process-focused approach to the management of organisational change enables collaboration between leaders, managers and staff in the implementation of technology and business process changes (D'Ortenzio, 2012).

Table 22 shows the academic support for the questions performed:

Mapping questions about project success and academic literature

IS/IT Project Success Items	Subscales	Atkinson, 1999	Shenhar, Dvir, Levy and Maltz, 2001	Shenhar, Dvir, Levy (1997), Pinto (2004) Shenhar and Dvir, 2007
Meet the objectives (PS30).	Strategic Alignment	Project Performance	Meeting design goals	Efficiency
Meet the expected benefits (PS31).	Strategic Alignment	Benefits to organization	Benefits to organization	Business Success, Future
Meet de technical requirements (PS32).	Project Mangement Success	Project Performance	Meeting design goals	Efficiency
Meet the schedule (PS33).	Project Mangement Success	Project Performance	Meeting design goals	Efficiency
Meet the budget (PS34).	Project Mangement Success	Project Performance	Meeting design goals	Efficiency
Meet project expectations (PS35).	Strategic Alignment	Benefits to organization	Benefits to organization	Business Success
Alignment with business strategy (PS36).	Organisational changes	Benefits to organization	Benefits to organization	Business Success, Future
Identified new opportunities for improvement (PS37).	Organisational changes	Benefits to organization	Benefits to organization	Business Success,
Changed the way you work (PS38).	Organisational changes	Benefits to end-user	Benefits to end-user	Business Success,
Changes on the internal processes (PS39).	Organisational changes	Benefits to organization	Benefits to organization	Business Success,
Changes on the professional skills (PS40).	Organisational changes	Benefits to end-user	Benefits to end-user	Impact on team/ Customer
Facilitates access to information on Health in general (PS41).	Stakeholders satisfaction	Benefits to organization	Benefits to organization	Business Success
Facilitates communication between professionals, users and managers (PS43).	Stakeholders satisfaction	Benefits to end-user	Benefits to customer/ end-user/ organization	Impact on Customer, Business Success
Facilitates information sharing between professionals (PS43).	Stakeholders satisfaction	Benefits to end-user	Benefits to end-user	Impact on team/ Customer
Make your daily tasks easier (PS44).	Stakeholders satisfaction	Benefits to organization	Benefits to end-user	Impact on team/ Customer

Facilitates the storage of the information for later use (PS45).	Stakeholders satisfaction	Benefits to organization & Customer	Benefits to organization	Business Success, Future
Enables improved patient treatment performance (PS46).	Stakeholders satisfaction	Benefits to end-user	Benefits to customer/ end-user & organization	Impact on Customer, Business Success
Facilitates the standardization of procedures and routines (PS47).	Stakeholders satisfaction	Benefits to organization	Benefits to organization	Business Success
Improves the quality of information available for use (PS48).	Stakeholders satisfaction	Benefits to end-user	Benefits to organization	Business Success
Facilitates the integration of information between the various systems and hospitals (PS49).	Stakeholders satisfaction	Benefits to end-user	Benefits to organization	Business Success, Future
Facilitates administrative procedures (PS50).	Stakeholders satisfaction	Benefits to organization	Benefits to organization	Business Success

Table 22 – Project Success items

4.3.3 Project Management construct

The Project Management (mediator variable) are conceptualized by the ten subscales that represents the knowledge areas of the PMBOK guide version 5 (PMI, 2013a). In this block of questions, we intend to analyse which practices of project management are effectively used and their applicability to projects of IS/IT. The instrument was the Likert scale of 5-points.

- **Project Integration Management** - The processes and activities to identify, define, combine, unify, and coordinate the various processes and project management activities within the Project Management Process Groups[55].

  Questions:

  Is there a business plan developed? (PM10).
  Is there an established plan to manage implementation? (PM11).

[55] "A logical grouping of project management inputs, tools and techniques, and outputs. The Project Management Process Groups include initiating processes, planning processes, executing processes, monitoring and controlling processes, and closing processes. Project Management Process Groups are not project phases" (PMI, 2013, p.554).

- **Project Scope Management -** The processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully.

  Questions:

  Are the technical requirements collected? (PM12).

  Is the scope clearly defined? (PM13).

- **Project Time Management -** The processes required to manage the timely completion of the project.

  Questions:

  Are the implementation stages identified and linked? (PM14).
  Is there an established general timetable for the phases? (PM15).

- **Project Cost Management -** The processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so that the project can be completed within the approved budget.

  Questions:

  Are the costs per phase identified? (PM16).
  Is there an established general cost plan for the phases? (PM17)

- **Project Quality Management -** The processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken.

  Questions:

  Are tools developed for quality control? (PM18).
  Is there an established quality plan for the project? (PM19).

- **Project Human Resource Management -** The processes that organize, manage, and lead the project team.

Questions:

Is the stakeholders training ensured? (PM20).
Were motivation techniques established? (PM21).

- **Project Communications Management -** The processes that are required to ensure timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring, and the ultimate disposition of project information.

Questions:

Are the internal communication procedures defined? (PM22).
Is there an established communications plan? (PM23).

- **Project Risk Management -** The processes of conducting risk management planning, identification, analysis, response planning, and controlling risk on a project.

Questions:

Are the project risks identified? (PM24).
Is there an established risks management plan? (PM25).

- **Project Procurement Management -**The processes necessary to purchase or acquire products, services, or results needed from outside the project team.

Questions:

Are procurement procedures defined? (PM26).
Is there an established procurement management plan? (PM27).

- **Project Stakeholder Management -** The processes required to identify the people, groups, or organisations that could impact or be impacted by the project.

Questions:

Are the involved stakeholders identified? (PM28).
Is there an established plan to manage stakeholders? (PM29).

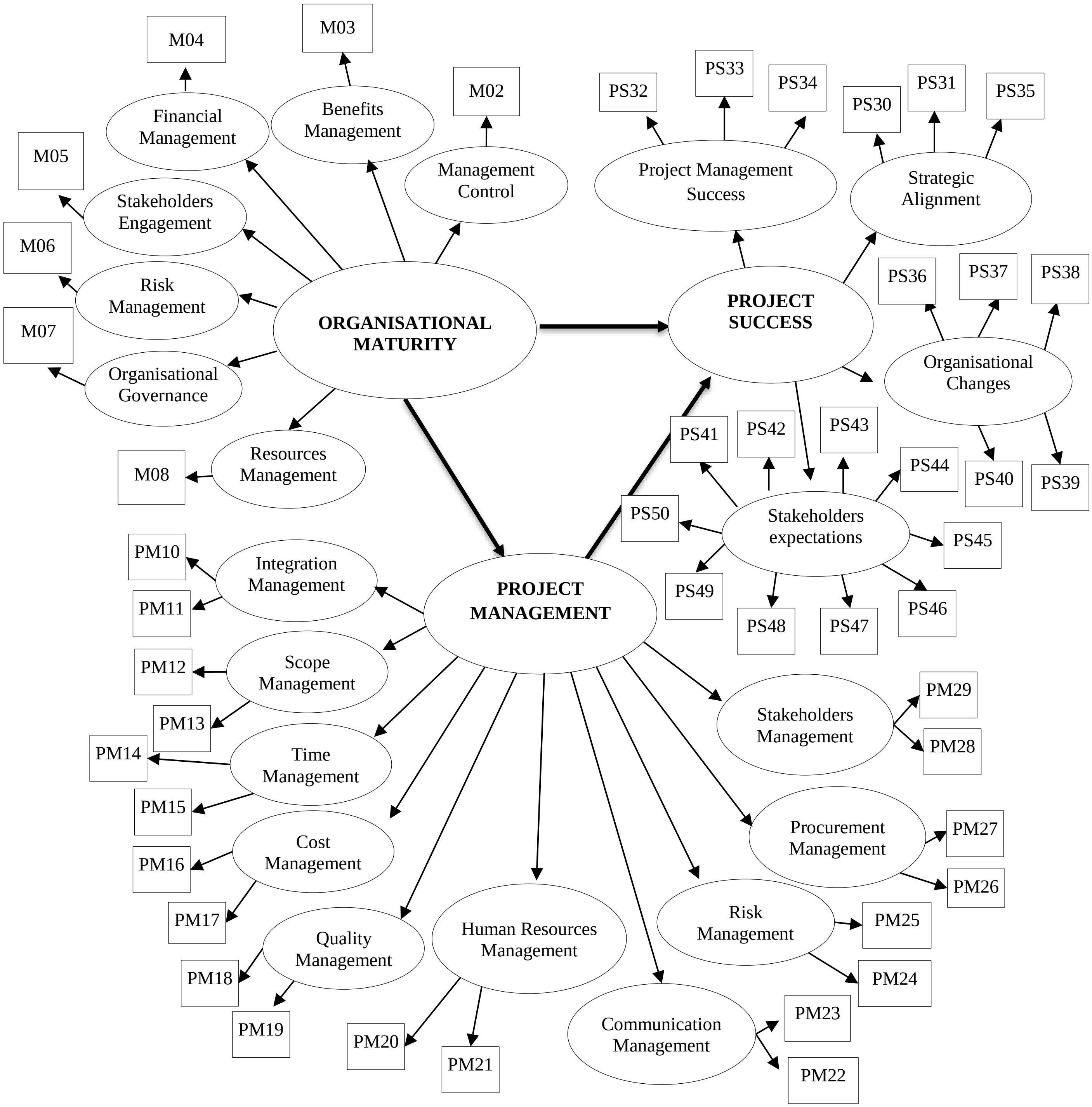

Figure 11 – The research model

Chapter 5. Research methodology and design

5.1 Overview

A survey is a research method for collecting information from a selected group of people using standardized questionnaires or interviews. The heart of a survey is its questionnaire (Krosnick and Presser, 2010).

“Questionnaires are an efficient data collection mechanism when the researcher knows exactly what is required and how to measure the variables of interest” (Sekaran, 2003, p. 236).

Surveys also require selecting populations for inclusion, pretesting instruments, determining delivery methods, ensuring validity, and analysing results.

During the past 20 years, to improve survey data quality, researchers and survey practitioners have increased their use of an evolving set of questionnaires pretesting methods, including review by experts, cognitive interviewing, behaviour coding, and the use of respondent debriefing.

Designing and implementing a survey is a systematic process of gathering information on a specific topic by asking questions of individuals and then generalizing the results to the groups represented by the respondents. The process involves five distinct steps (*Figure 12*).

Figure 12 - Process of designing and implementing a survey

5.2 Pretest

Pretesting is a very important step in a survey-based research. A frequent difficulty with questionnaire design is that respondents commonly misinterpret questions and this difficulty has been consistently recognised within the literature (Belson, 1981). Pretesting can help you identify questions that don't make sense to participants, or problems with the questionnaire that might lead to biased answers. Pretesting is a method of checking that questions work as intended and are understood by those individuals who are likely to respond to them (Hilton, 2017). It is also the case that pretesting has the capacity to reduce sampling error and increase questionnaire response rates (Drennan, 2003).

In this context, the questionnaire pretesting process must look for an answer to the following questions *(*Babonea and Voicu, 2011)*:*

- Does every survey question measure what it should measure?
- Do respondents understand all the terms?
- Are questions interpreted in the same manner by all the respondents?
- Did closed questions provide at least one answer choice that would apply to every respondent?
- Does the questionnaire create a positive impression, thus motivating people to answer?
- Are the answer choices to be selected correct?
- Does any aspect of the questionnaire suggest any biasing attempt from the researcher?

5.3 Participants

The participants were healthcare professionals from seven different hospitals, which are geographically distributed across Portugal. The professionals' profile was controlled, 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:

- Possessing a comprehensive knowledge of the organization's operational processes

- Having been involved and participated in the implementation of an information or technology system.

5.4 Instrument

The final version of questionnaire has four different sections (Gomes et al., 2016a, 2016b) (Appendix D):

1. Participant's Profile - Personal and professional data (gender, age, formal education, role in the organization, workplace, health region and project involvement).

2. Organisational Maturity - A self-assessment questionnaire from the P3M3© framework (OGC, 2010b) was applied, which comprised 7 items, whereby participants were asked to rate the level of maturity in ordinal scale, were 1 is "awareness of process" and 5 is "optimized process".

3. Project Management - This was evaluated by a 10-item, answered on a 7-point *Likert*[56] scale from 1 to 7 (1=never; 7 =always). The questions highlight the main issues of the PMBOK Guide knowledge areas (PMI, 2013).

4. Project Success - Assessed with an 18-item scale, asking participants to evaluate health professional's perceptions concerning the success of the IS/IT projects on a 7-point *Likert* scale, from 1 to 7 (1=never; 7 =always).

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

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[56] Likert scales allow interviewees to indicate to what extent they agree with a statement and are thus useful when measuring perceptions (Saunders, et al. 2009).

5.5 Pretest 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 (Appendix E) were carried out with healthcare professionals to validate the questions' content. After concluding the questionnaire design, a pretest was applied.

As are well-known, pretesting tools can be used to improve the quality of survey data (Collins, 2003). The pretest allows for the identification of problems regarding question content, namely the misinterpretation of individual terms or concepts, 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 pretest, each respondent gave their opinion about interpretability issues, completeness, size, and time spent in filling it out.

For the purposes of validity considerations, participants were encouraged to comment on the complete test measure including formatting, presentation and relevance of its intended use at the end of the questionnaire.

We applied the initial version of the questionnaire on a small sample which had a similar profile to that of the final sample.

5.6 Pretest data analysis

To close the final version of the questionnaire, special attention was given to data collected through the pretest. 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 answers 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[57] and the values of the "alpha if item deleted" were also checked (Cronbach, 1951; Streiner, 2003). Data analysis was conducted by using IBM-SPSS Statistics 22.0 (Arbuckle, 2011).

5.7 Pretest 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 Organization Maturity, and the 20-item scale of Project Management showed symmetrical and mesokurtic distributions (*Table 23*) since 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 23)*.

Original scales (on pretest)	**Range of ratio (Skewness/Standard error)**	**Range of ratio (Kurtosis//Standard error)**
Organisational Maturity (7 items)	-1.115 to .387	-1.587 to -.617
Project Management (20 items)	-1.521 to .002	-.862 to 1.237
Project Success (21 items)	-4.571 to 2.082	-1.449 to 4.669

Table 23 - Summary statistics for items distribution (Gomes et al., 2016b)

[57] Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability.

According to Chau (1999), Cronbach's alpha is the most widely used method of reliability assessment in business research. Nunally and Berstein (1994) have indicated .7 to be an acceptable reliability coefficient. The three scales were assessed, and Cronbach's alpha values are presented in *Table 24*.

Original scales	Cronbach's alpha
Organisational Maturity (7 items)	.86
Project Management (20 items)	.97
Project Success (21 items)	.94

Table 24 – Reliability assessment (Gomes et al., 2016a, 2016b)

The values demonstrating an excellent reliability of the instruments (Kline, 2000). 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. On the other hand, very high reliabilities (.95 or higher) are not necessarily desirable, as this could indicate that the items may be redundant (Streiner, 2003). Considering the global dimension of the questionnaire, and the time that respondents took in the pretest, we chose to include only one item per indicator. The internal reliability remained excellent for the reduced Project Management scale (α = .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 (α = .93) (*Table 25*).

Original scales	Cronbach's alpha	Final scales	Cronbach's alpha
Organisational Maturity (7 items)	.86	Organisational Maturity (7 items)	.86
Project Management (20 items)	.97	Project Management (10 items)	.94
Project Success (21 items)	.94	Project Success (18 items)	.93

Table 25 - Internal consistency of the scales (Gomes et., 2016a, 2016b)

5.8 General discussion

The questionnaire for validating the contents was performed the same way in the pretest, 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 shortening and revised. It was perceived that there was a degree of lack of familiarity of the respondents about certain theoretical concepts presented in the pretest.

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 involved IS/IT projects have low participation and little involvement from healthcare professionals, and thus most 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 organization, and a cross-sectional view of the topics covered.

Findings from the pretest mainly showed a lack of symmetry in the distribution of various items. Given that the pretest data was still under review, this was admitted being a greater error and, as suggested by Hair et al. (2010), 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 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 (Cook and Beckman, 2009; Dawes, 2008) (Appendix F). Thus, the analysis of the pretest results also led to adopting a 7-point *Likert* scale, instead of the 5-point scale for the Project Management and Project Success constructs.

Chapter 6. Survey

6.1 General procedure

The survey was supported under a signed agreement between ISEG and SPMS[58] of the Ministry of Health specifically for this purpose (Appendix G).

Emails were sent to the respondents together with a presentation letter (Appendix H). In each letter, the research objectives and the importance of each respondent's answer were described, and a link to the questionnaire provided.

To achieve a greater number of responses, two follow-ups to non-respondents were made (Appendix H). According to Bryman and Bell (2003) the follow-up reminders have a demonstrable effect on the response rate.

The mails used to two main sources of contacts:

1. SPMS databases:
   - Plataforma de Dados de Saúde (PDS);
   - Comissão de Acompanhamento para a Informatização Clínica (CAIC);
2. Direct emails (e.g. health administrations, informatics directories, heads of clinical service, nursing directorates, health schools and academics).

According to the pretest conclusions, the questionnaire was sent to the professionals who apparently have a more suitable profile for answer. Several explanations were included in the main body of the questionnaire to facilitate the understanding of concepts and content, improving the validity of the answers.

The questionnaire was developed with the LimeSurvey[59] software and available to answer from November 2015 to July 2016.

[58] Serviços Partilhados do Ministério da Saúde
[59] LimeSurvey (formerly PHPSurveyor) is an Open Source PHP web application to develop, publish and collect responses to online & offline surveys

6.2 Analysing the survey dataset

The questionnaire was accessed by 610 professionals but only 242 fulfil completely the questions.

Initially, we have plan the survey to be online about 6 months, but due to difficulty in obtain answers we had to extended more 2 months.

The two email databases provided by the SPMS did not bring the response number that would be expectable. The sending was accompanied by an explanatory letter, appealing to the questionnaire completion. A new refreshment was made 3 months after the first sending, but also without great success. To increase the answers number, the strategy adopted was to identify all potential target respondents across the health sector and send personalized emails. This action reverses the low response rate.

The data collected by the survey was checked for completeness and outliers. Some improvements will be needed to go ahead with study:

- **Answers to questionnaire**

  Although the respondents fulfil completely the questionnaire, the existence of the answers *I don´t know*, obliges to decide between excluding the respondent or re-using the answer by filling the answer with a value that represents the mean or the median of the item. After analysed the pros and cons was decided to simple remove the respondents.
- **Items**

  Concerns to the excessive answer *I don´t know* in several items we found that probably some items were not applicable to the practices on the Portuguese Healthcare organisations (e.g. Benefits Management).
- **Organisational Maturity construct**

  Although the P3M3© were developed to assess the maturity of the UK public organisations, namely the National Healthcare System (NHS) the applicability in Portuguese context is much different, we have not found any evidence of their use on the Portuguese health organisations and for that reason we decided to not include the Benefits Management item to explain this construct.

- **Project Management construct**

  Most of the projects refereed by the respondents are decided and set up centrally by the Health Ministry, (SPMS), so the items like *Cost Management* are not a management practice applicable to the present situation. The item was also excluded.

- **Project Success construct**

  In according with the justification given on the previous bullet, the item *costs fulfilment* was also excluded

- **Redundancy**

  Analysing the 18 items from Project Success there are some questions that could generated redundancy. To optimize this construct, we have decided to reshape it to 13 items.

- **Model simplification**

  We proceeded to model simplification, removing the subscales on the construct Project Success. Like the other two construct the items are now directly related with the variable without the need subscale. In the reality, this subscale didn´t bring any additional value to the model.

- **Database adjustments**

  Were removed from database all the items mentioned above and all the respondents that have at least one answer *I don´t know.* The final sample has 139 respondents.

  The new respondent’s database has naturally some differences from the initial one, namely in following main aspects (Appendix I):

  - More respondents from Hospital Administration (+3.9%) and IS/IT staff (+4.2%).
  - More respondents directly involved with Project Management practices (+13.2%) to the detriment of the so-called *project users* and *others*.

This new sample apparently is more focus on the Project Management practices and reveals respondents with a more recognized knowledge on the internal processes and on the technological solutions.

6.3 Descriptive statistics

The dataset features of 139 answers has the following caracteristics: 73 male respondents (52.5%) and ages between the 27-86 years (M = 47.17; SD = 10.36); About a half of the sample are Doctors (24.5%) and Nurses (25.2%); As expected the respondents have a good level of education, practically all have an academic degree (93.0%) with many holding a master's degree (35. 2%) and some a Ph. D. (8. 6%); Most the answers come from the two main urban areas, Porto (ARS Norte – 28.8%) and Lisboa (ARS Lisboa and Vale do Tejo – 28.1%); Finally, 85 professionals (61.1%) declared to have a direct involvement with projects.

The following tables show more detailed about the respondent's profile (*Table 26*) and the mean and standard deviation values from all the items understudy *(Table 27).*

Item	N=139	%
Sex		
Male	73	52.5
Female	66	47.5
Professional occupation		
Hospital Management	18	12.9
Doctors	34	24.5
Nurses	35	25.2
Systems & Technology	23	16.5
Senior Technician	9	6.5
Diagnostic & therapeutically staff	8	5.8
Administrative services	2	1.4
Other	10	7.2
Education		
Only graduation	83	59.7
Master of Science	37	26.6
Ph.D.	12	8.6
Other	7	5.0

Health regions		
ARS Norte	40	28.8
ARS Centro	25	18.0
ARS Lisboa and Vale do Tejo	39	28.1
ARS Alentejo	15	10.8
ARS Algarve	5	3.6
Madeira and Açores	4	2.9
Other	11	7.9
Project involvement		
User	44	31.7
Project team	45	32.4
Project Manager	22	15.8
Project Sponsor	18	12.9
Other	10	7.2

Table 26 – Sociodemographic statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	SD	Kurtosis	SD
MAT02	139	1	5	2.76	1.203	.585	.206	-.611	.408
MAT04	139	1	5	2.78	1.228	.555	.206	-.666	.408
MAT05	139	1	5	2.57	1.325	.591	.206	-.728	.408
MAT06	139	1	5	2.35	1.350	.872	.206	-.369	.408
MAT07	139	1	5	2.78	1.240	.527	.206	-.717	.408
MAT08	139	1	5	2.68	1.205	.623	.206	-.470	.408
GP01	139	1	7	4.82	1.729	-.384	.206	-.892	.408
GP02	139	1	7	5.17	1.644	-.557	.206	-.808	.408
GP03	139	1	7	5.43	1.513	-.676	.206	-.548	.408
GP05	139	1	7	4.99	1.613	-.430	.206	-.821	.408
GP06	139	1	7	4.70	1.680	-.368	.206	-.764	.408
GP07	139	1	7	4.40	1.666	-.191	.206	-1.095	.408
GP08	139	1	7	4.21	1.683	.073	.206	-.992	.408
GP09	139	1	7	4.92	1.597	-.399	.206	-.870	.408
GP10	139	1	7	4.65	1.744	-.367	.206	-.946	.408
SP01	139	1	7	5.38	1.276	-.792	.206	.298	.408
SP03	139	1	7	5.24	1.300	-.873	.206	.214	.408
SP04	139	1	7	4.87	1.488	-.591	.206	-.462	.408
SP06	139	1	7	5.40	1.361	-.799	.206	.192	.408
SP09	139	1	7	5.35	1.244	-.950	.206	.798	.408

SP10	139	1	7	5.05	1.321	-1.013	.206	.969	.408
SP11	139	1	7	5.70	1.214	-1.323	.206	1.796	.408
SP12	139	1	7	5.77	1.131	-1.362	.206	2.479	.408
SP13	139	1	7	5.53	1.332	-1.223	.206	1.374	.408
SP14	139	1	7	5.99	1.189	-1.588	.206	2.955	.408
SP15	139	1	7	5.62	1.326	-1.498	.206	2.379	.408
SP17	139	1	7	5.88	1.158	-1.436	.206	2.439	.408
SP18	139	1	7	5.83	1.219	-1.356	.206	1.992	.408
Valid N	139								

Table 27- Descriptive statistics

The results show that the means values were higher than 4 on the Project Management and Project Success constructs items suggesting that the perceived values were at moderate to high levels of importance and below 3 on the Organisational Maturity construct items, suggesting low awareness on the organisational internal processes. The standard deviations show values from 1.203 to 1.729 indicating some data variability.

6.4 Survey results

6.4.1 Sample size

The past two decades have seen a remarkable interest in SEM methods in management research (Westland, 2010). Advances in statistical modelling and in the ease of use of related software programs has contributed not only to an increasing number of studies using latent variable analyses but also raises questions about how to estimate the requisite sample size for testing such models (Wolf et al., 2013).

The optimal number of items that should be associated with latent variables has been an issue of much study and debate in the SEM literature (e.g., Ding et al., 1995; Tomás, 2000). Based on statistical theory, a common rule is that fewer than three items per latent variable is inadequate (Ding et al., 1995; Tomás et al., 2000).

Further, it has been found that power, accuracy, and precision of estimates increases as the number of items per latent variable also increases (e.g., Boomsma, 1982; MacCallum, Browne, and Sugawara, 1996; Nunnally, 1967). Early recommendations involved having 10 observations per estimated parameter (Bentler and Chou, 1987) or per variable (Nunnally, 1967) and sample sizes between 100 and 200 participants (Boomsma, 1982). Anderson and Gerbing (1984) found that with three or more indicators per factor, a sample size of 100 will usually be sufficient for convergence, and a sample size of 150 will usually be sufficient for a convergent and proper solution.

Researchers have criticized these sample size rules and claimed the appropriated sample size is dependent on the features of the gathered data. Recommend obtaining the largest possible sample because the adequacy of the sample size cannot be determined after the data have been analysed (Henson and Roberts, 2006). After estimating a model, always report multiple fit indices (e.g., $\chi 2$, *df, p,* CFI/TLI, RMSEA, SRMR). According to Jackson et al, (2009) report all appropriate fit indices, not just those favourable to your study.

The use of bootstrapping has steadily become a common supplement to statistical parameter estimation as well as assisting potential small sample issues (Efron, 1979). Using a bootstrapping approach, the current research assesses models varying with small to moderate sample size (50, 100, 200) and moderate to large factor loadings (.60, .75, .90) with the idea the small samples can compensate with large loadings (Guadagnoli and Velicer, 1988).

Our study has a sample with 139 respondents and presents larger factor loading (*Table 29 and 30*) and acceptable *fit indices (Table 32)* fulfilling the requirements for the application of this methodology.

6.4.2 Internal consistency

Internal consistency is typically a measure based on the correlations between different items on the same test (or the same subscale on a larger test). It measures whether several items that propose to measure the same general construct produce similar scores.

Reliability is the extent to which measurements are repeatable. When different persons perform the measurements, on different occasions, under different conditions, with supposedly alternative instruments which measure the same thing. To assess reliability, we applied the Cronbach's alpha to all constructs in our conceptual model (Flynn et al., 1990). The Cronbach's alpha values for the survey exceeded the suggested value of .70 generally considered adequate for assessing reliability in empirical research (Nunnally and Bernstein, 1994). Thus, the scale items used in this research can be considered reliable (*Table 28*).

Scales	**Cronbach's alpha**
Organisational Maturity (6 items)	.928
Project Management (9 items)	.967
Project Success (13 items)	.967

Table 28 - Reliability values

6.4.3 Construct validity

Construct validity is "the degree to which a test measures what it claims, or purports, to be measuring" (Brown, 1996, p. 231). A commonly used method (Boelen et al., 2008; Fournier-Vicente, et al., 2008) to investigate construct validity is confirmatory factor analysis (CFA).

In a CFA, convergent and discriminant validity examine the extent to which measures of a latent variable shared their variance and how they are different from others. Convergent validity means that a set of indicators represents the same underlying construct, which can be demonstrated with their unidimensionality (Henseler et al., 2009). Convergent validity is observed when the path coefficients from the latent constructs to their corresponding manifest indicators are statistically significant (Anderson and Gerbing, 1988).

Discriminant validity means that two constructs that are conceptually different from each other should exhibit sufficient difference (Henseler et al., 2009). Discriminant validity measures of constructs that theoretically should not be related to each other. *Table 29* and Table *30* show a significant relationship between items and the respective constructs (higher values) and less related to the other constructs (lower values) proving the convergent and discriminant validity of the scales.

Correlations Items/Scale	Organisational Maturity	Project Management	Project Success
MAT02	**.870*****	.510***	.338***
MAT04	**.812*****	.490***	.320***
MAT05	**.888*****	.470***	.302***
MAT06	**.844*****	.491***	.236**
MAT07	**.892*****	.506***	.297***
MAT08	**.840*****	.523***	.379***
GP01	.578***	**.893*****	.639***
GP02	.407****	**.890*****	.736***
GP03	.438***	**.873*****	.773***
GP05	.443***	**.873*****	.699***
GP06	.534***	**.907*****	.662***
GP07	.574***	**.929*****	.671***
GP08	.611***	**.870*****	.595***
GP09	.454***	**.865*****	.617***
GP10	.593***	**.913*****	.613***
SP01	.382***	.759***	**.860*****
SP03	.410***	.764***	**.887*****
SP04	.339***	.657***	**.812*****
SP06	.357***	.698***	**.847*****
SP09	.367***	.699***	**.848*****
SP10	.415***	.674***	**.791*****
SP11	.274**	.659***	**.895*****
SP12	.228**	.582***	**.875*****
SP13	.236**	.541***	**.869*****
SP14	.207**	.545***	**.848*****
SP15	.246**	.526***	**.828*****
SP17	.321***	.607***	**.877*****
SP18	.184*	.522***	**.825*****

* *p< .05* ** *p< .01* *** *p< .001*

Table 29 - Correlations Items/Scale

Correlations Item/Scale (range)	**Organisational Maturity**	**Project Management**	**Project Success**
Items of Organisational Maturity	**[.812 to .892]**	[.470 to .523]	[.236 to .379]
Items of Project Management	[.407 to .611]	**[.865 to .929]**	[.595 to .773]
Items of Project Success	[.184 to .415]	[.522 to .764]	**[.791 to .895]**

Table 30 – Range of correlations Items/scale

The convergent validity of the measurement model can be assessed by the Average Variance Extracted (AVE) and Composite Reliability (CR) (Fornell-Larcker, 1981; Hair et al., 2010).

AVE measures the level of variance captured by a construct versus the level due to measurement error, values above 0.7 are considered very good, whereas, the level of .5 is acceptable. The AVE of each construct also exceeded .50, ranging from .686 to .769 (*Table 31*) demonstrated sufficient convergent validity of the scales.

CR is a less biased estimate of reliability than Cronbach Alpha. CR measures internal consistency but unlike the Cronbach's alpha, it considers that indicators have different loadings (Henseler et al., 2009). The acceptable value of CR is .7 and above (*Table 31*).

Construct	**Composite Reliability**	**Average Variance Extracted**
Organisational Maturity	.967	.686
Project Management	.968	.769
IS/IT Project Success	.951	.695

Table 31 – Construct reliability

6.4.4 Confirmatory Factor Analysis (CFA)

According to Anderson and Gerbing (1988) the SEM analysis followed a two-stage process. First, construct validity was assessed by running a confirmatory factor analysis (CFA) for the measurement model of each construct. Second, the structural equation model was estimated for the Research Model. CFA is a powerful statistical tool for examining the nature of the relations among latent constructs (Jackson, Gillaspy and Purc-Stephenson, 2009) and explicitly tests a priori hypotheses about relations between observed variables and latent variables or factors.

CFA plays an essential role in measurement model validation in path or structural analyses (Brown, 2006; MacCallum and Austin, 2000) and is used to test the convergent validity of the measures chosen to represent each construct (Bagozzi, et al., 1991; Bollen, 1989). The CFA framework uses a maximum likelihood approach in its statistical analysis of construct validity and a decomposition of the measurement variance into its constituent components.

The objective of CFA is to test whether the data fit a hypothesized measurement model (*Figure 13*) based on theory and previous analytic research (Jöreskog, 1969).

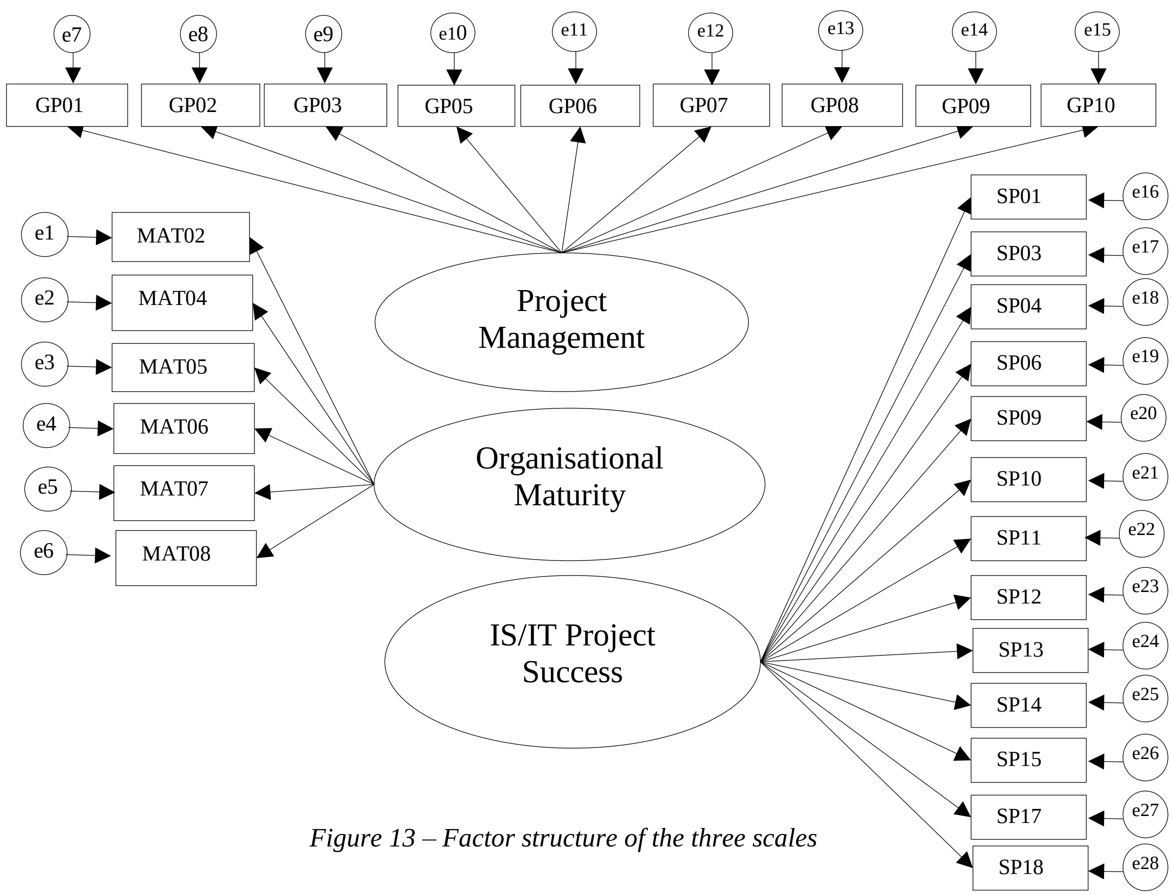

Figure 13 – Factor structure of the three scales

All items loaded significantly on their corresponding latent construct, thereby providing evidence of convergent validity. The AMOS (version 20) software was used to test whether data fit the proposed model. Constructs with one observed measure were constrained to exactly equal the value of the measure, as suggested by Bollen (1989). The variance of each construct was constrained to unity so that the parameters for each observed variable could be freely estimated. The CFA results indicate good convergent validity (Appendices J to L).

6.4.5 Indices of *goodness of fit*

There are several indicators of *goodness of fit* and most SEM scholars recommend evaluating the models by observing more than one of these indicators (Hair et al., 2010). To determine how well the models fit the sample data (Hooper et al., 2008) the following recommended *goodness of fit* indices and respective *cut-off values* were used.

The fit indices establish whether, overall, the model is acceptable. If the model is acceptable, then establish whether specific paths are significant. Acceptable fit indices do not imply the relationships are strong. Indeed, high fit indices are often easier to obtain when the relationships between variables are low rather than high, because the power to detect discrepancies from predictions are amplified.

While there is no consensus on the appropriate index for assessing overall *goodness of fit* of a model, the *chi-square* statistic has been the most widely used fit index (Ping 2004). The so called *absolute fit indices* determine how well an a priori model fits the sample data (McDonald and Ho, 2002) and demonstrates which proposed model has the most superior fit. These measures determine the degree to which the overall model (structural and measurement models) predicts the observed covariance or correlation matrix. Some of the best known are: *Chi-squared* test, RMSEA, GFI, AGFI, RMR, and SRMR (Hooper et al., 2008).

The *relative fit indices* compare the *chi-square* for the hypothesized model to one from a null model (McDonald and Ho, 2002). This null model almost always contains a model in which all the variables are uncorrelated, and as a result, has a very large *chi-*

square, which indicating a poor fit (Hooper et al., 2008). Some of the best known are: Comparative Fit Index (CFI) (Bentler, 1990), NFI (Normed-fit index) (Byrne, 1998) and TLI (Tucker and Lewis, 1973).

The values achieved (*Table 32*) suggesting an acceptable fit between the hypothesized model and the observed data for each scale (Hu and Bentler, 1999).

Fit indices	Organisational Maturity	Project Management	Project Success	*cut-off values*
χ^2	8.163	23.493	73.008	
(*df*)	(9)	(18)	(41)	
p	.518	0.172	.002	
χ^2/df	.907	1.395	1.781	*≤ 2 (Schreiber et al., 2006)*
NFI	.987	.986	.965	*≥ .95 (Hu and Bentler, 1999)*
CFI	1.000	.997	.984	*≥ .95 (Bentler, 1990)*
TLI	1.000	.993	.970	*≥ .95 (Tucker and Lewis, 1973)*
RMSEA	.000	.044	.075	*≤ .06 (Hu and Bentler, 1999)*
SRMR	.015	.016	.032	*≤ .08 (Hu and Bentler, 1999)*

Notes: χ^2 - Chi-Squared test; *df* = degree of freedom; *p* = *p-value*; NFI – Normed Fit Index; CFI – Comparative Fit Index; TLI – Tucker–Lewis Index; RMSEA = root mean square error and SRMR – Standardized root mean square residual. N=139.

Table 32 – Scales fit indices

6.4.6 Structural Equation Modelling (SEM)

The mediation model (*Figure 14*) was tested by a SEM with maximum likelihood (ML) estimation (Appendix M). Maximum likelihood (ML) is the default estimation method in most statistical packages and it is also the more widely used estimation method (Anderson and Gerbing, 1989). ML is quite consistent at producing efficient estimation and is rather robust against moderate violations of the normality (Anderson and Gerbing, 1988; Steenkamp and van Trijp, 1991).

SEM represents a suitable technique that can providing a robust means of studying interdependencies among a set of correlated variables. SEM is multivariate technique which allows for the examination of a set of relationships between multiple independent and multiple dependent variables (Smith and Langfield, 2004).

A non-parametric method (bootstrap) with 5000 subsamples was also implemented to validate the results, given that we have a small sample (N=139). Bootstrapping allows assigning measures of accuracy (defined in terms of bias, variance, confidence intervals, prediction error or some other such measure) to sample estimates (Efron and Tibshirani, 1993). This technique allows estimation of the sampling distribution of almost any statistic using random sampling methods (Varian, 2005).

Several *goodness of fit indices* was used to determine how well the SEM model fit the sample data (Hooper et al., 2008; Hu and Bentler, 1999). The hypothesized mediation model displayed a fair set of values for the fit to the data (*Table 33).*

goodness of fit indices
χ^2 = 629.142
df = 318
p = .000
$\chi 2/df$ = 1.978
NFI = .87
CFI = .93
TLI = .91
RMSEA = .08
SRMR = .07

Table 33 - SEM fit indices

The results obtained by the parametric method (maximum likelihood) were validated by the non-parametric method (bootstrap). The bias between the two methods was minimum (Appendix M).

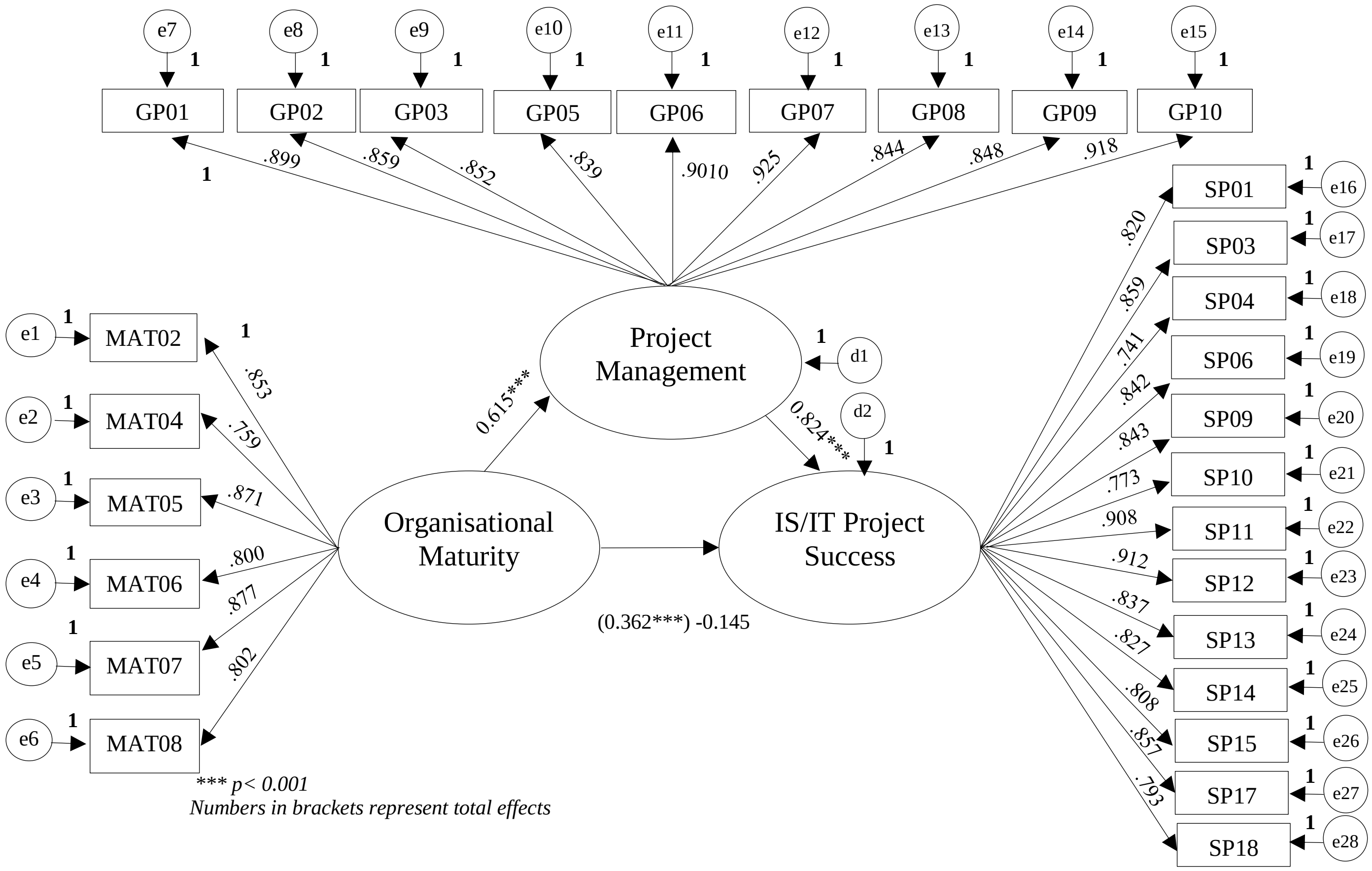

Figure 14 – Results for the SEM with standardized regression weights.

Results from the SEM model are the following:

1. Organisational maturity had a significant positive total effect on IS/IT project success ($\beta = .362$, $p < .001$, 95% IC =.203, .488);

2. When the mediator effect of Project Management was controlled, the Organisational Maturity accomplished a negative direct effect on IS/IT Project Success ($\beta = -.145$, $p = .028$[60], 95% IC = -.289, -.017);

[60] With a parametric method, we obtained a non-significant direct effect (p=0.072)

3. Organisational Maturity had a significant and positive indirect effect on IS/IT Project Success. More Organisational Maturity and more Project Management brings more IS/IT Project Success;

   (β = .507, p < .001, 95% IC = .366, .644).

4. Project Management had a mediating effect on the relationship between Organisational Maturity and IS/IT Project Success.

   However, it was a partial mediation because the direct effect of Organisational Maturity remained significant.

Chapter 7. Discussion

In this chapter, we discuss the research results and relate them with the existing literature. We also discuss results from the hypotheses tests using the data collected by means of an instrument administered through a web survey to health professionals.

In an initial phase of the work, the author had to carry out a set of conversations and exploratory meetings with the main intention of collecting information that would allow him to go ahaed with the development of the model that supports the study. This qualitative part of the research provided an important input for the research model construction and to later quantitative research, in terms of the model components. As presented before, our study explores the relation between Organisational Maturity and the Success of the IS/IT Projects in Healthcare. The research model explored the presence of a mediation effect exerted by Project Management practices.

The psychometric properties of the measurement scales were assessed in accordance with accepted practices (Gerbing and Anderson, 1988) and included establishment of content validity, reliability, discriminant and convergent validity.

Content validity was established through exploratory interviews with knowledgeable experts. Considerable effort was made during this field-based validation to ensure that the scale items were relevant and generalizable across the health sector in our sample.

All scales achieved good coefficient alphas (> .70) (Nunnally, 1978). Discriminant validity was assessed through CFA by comparing the χ^2 differences between a constrained confirmatory factor model (where the correlation factor is set to 1, indicating they are the same construct) and an unconstrained model (where the correlation factor was free). All χ^2 differences were found to be significant, providing evidence of discriminant validity (Anderson and Gerbing, 1988). CFA was also used to establish convergent validity by confirming that all scale items loaded significantly on their hypothesized construct factors (Anderson and Gerbing, 1988).

Following the two-step modelling method, a confirmatory factor analysis was put forward to test measurement equation and the hypothesized relationships between observed variables were tested and replaced in structural equation model.

SEM was applied to test the research model, highlighting the following advantages: SEM models can contain both measured and latent variables; measurement errors can be effectively dealt with and explicitly considered in the theoretical models. The use of latent variables improves the accuracy of the mediated effect measurement. The main findings answered to the research questions (see p. 137) and were now presented and discussed.

Finding 1: *Organisational Maturity had a significant positive total effect on IS/IT Project Success.*

For organisations to succeed in the today's global business competition, it is necessary that they accomplish a high standard of performance. A maturity model approach is a process-driven improvement with the essential elements for effective organisational change (Gomes et al., 2014; Stelzer and Mellis, 1998). Since when projects have been recognized as critical tools to organisational success, the maturity models are an essential framework that support the improvement of project management within organisations (Mullaly, 2014). Basically, a maturity model is a framework describing the idea of progression towards desired improvement using several successive stages or levels (Ghorbanali et., 2010). The understanding of the possible impact of the health organisational maturity on the success of the IS/IT projects is relevant to leverage the potential of benefits these investments could deliver to these organisations and their stakeholders. Scientific and academic literature establishes some bridges between organisational maturity and project success (e.g. Levin and Skulmoski, 2000; PwC, 2004; PwC, 2012; Sergeant et al., 2010; Skulmoski, 2001) although some criticism has been reported.

Khan and Spand (2013) found that organisational maturity has a significant positive relationship with project success. Their study identifies the importance of project related factors and organization maturity for achieving project success. It is suggested that organisations should address the project related factors during the planning phase of their project. They should focus on reducing the following three things: the complexity involved in the project; the potential risks in the project and the overall duration of the project.

In the present study, the Organisational Maturity construct was measured using the P3M3© framework. This approach is supported on a set of organisational *perspectives* (OGC, 2010a). Embedded within these perspectives were defined several *attributes*. The *specific attributes* are related only to a specific process perspective. The *generic attributes* are common to all process perspectives at a given maturity level, and include planning, information management, training and development.

When using P3M3© framework, an organization may choose to review only one specific or several *perspectives*. It is unlikely that an organization will have strengths in all areas or that the defined *perspectives* are applicable to all situations. So, depending on the sector of industry or business target, the organization may choose *what perspectives* are appropriate to be assessed.

Our research initially considered all the seven *perspective*s, but later we abandoned the *benefits management perspective*, since there is no clear evidence of the usage of these practices on Portuguese Health organisations. The answers to the survey compute a considerable level of *I don't know* answers (21.5%) for this *perspective*.

From the descriptive statistical point of view, the mean values for *perspectives* range between 2.35 to 2.78, where the Financial Management and Organisational Governance has the highest values and Risk Management the lowest. The standard deviation range between 1.203 to 1.350.

The internal consistency has an excellent score (α = .928), and values of convergent validity and discriminant validity proof clearly a strong connection to the construct (T*ables 29* and *30*). *Table 31* and *32* show a good fit with the data collected with the comparative indices are near 1.00 and the absolute indices close to .00.

Project Success was deducted from the academic literature considering mainly the contribution of the following authors *(Table 34).*

Authors	***Domains***					
Atkinson, 1999	Iron Triangle	Information System	Benefits to Organization		Benefits to Stakeholders	
Shenhar, Dvir, Levy and Maltz, 2001	Project efficiency		Business Success		Impact on Customer	Preparing the Future
Shenhar, Dvir and Levy, 1997 Shenhar and Dvir, 2007	Efficiency		Business Success	Impact on Team	Impact on Customer	Preparing the Future

Table 34 – Project Success domains

Project Success was initially organised with subscales, namely, Project Management Success, Strategic Alignment, Organisational Changes and Stakeholders Expectations. After the pretest analysis, the items were reduced from 21 to18 (see 5.7) and later reduced to 13 (see 6.2) and the subscales drop-off, mainly due to some redundancy issues

Project Success Construct (13 items) presents mean values between 4.87 to 5.99 (7-point Likert scale) where the question *Meets the schedule goal* has the lowest value and *Facilitates the storage of information for later use*, the highest value. Revealing the emergent importance of data sharing. The standard deviation range between 1.131 to 1.488.

The internal consistency presents a very good score (α = .967). The convergent validity and discriminant validity indicating clearly the items relation with the construct are strong (*Tables 29 and 30*). A good fit of IS/IT Project Success construct with the data collected.

Finding 2: *When the mediator effect of Project Management was controlled, Organisational Maturity accomplished a negative direct effect on IS/IT Project Success.*

Project management is an emerging discipline in business and management (Fabian, 2000) and its purpose is to ensure the success, promoting improvements in the professionals' skills while planning, deploying and managing activities in compliance with the objectives of the organization, by means of several tools (Jha and Iyer, 2006).

The search for excellence in project management by organisations is measured by its maturity level in managing their projects, by measuring how much the processes of companies are dedicated to their projects (Berssaneti, et al, 2012). Project management best practices are recognized as key tools for planning, structuring and tracking projects to achieve the objectives (schedule, budget, quality) and a means to achieve full stakeholder satisfaction.

The academic literature acknowledges a positive effect of the Organisational Maturity on IS/IT Project Success. So, there was an expectation that the introduction of Project Management practices could improve this effect in the Health organisations. Although, the study shows that when Project Management practices are present, the Organisational Maturity affects negatively the IS/IT Project Success.

A possible explanation could be found on the excessive centralization of the procurement decisions (SPMS). For this reason, Health organisations do not correctly appropriate the projects, do not get the ownership of the projects, and this stance apparently generates a misalignment between the internal processes and the Project Management practices.

Finding 3: *Organisational Maturity had a significant and positive indirect effect on IS/IT Project Success.*

Finding 4: *Project Management practices had a mediating effect on the relationship between Organisational Maturity and IS/IT Project Success. However, it was a partial mediation because the direct effect of Organisational Maturity remained significant.*

The Project Management construct considered the ten knowledge areas of PMBoK (version 5). In a closer analysis, we verify that the Cost Management item had a high level of I *don't know* answers (17.8%).

Apparently, the high rate of *I don't know* answers could be, again, due to a concentrated way of taking investment decisions on IS/IT projects and the related centrally decided procurement process. The IS/IT projects are centrally decided (SPMS) and the issues like cost are not really managed locally. The health professionals have little or no involvement in what relates to project costs. So, we've decided to remove this item from the Project Management construct.

Project Management was initially defined with ten subscales, with two items per subscale. Due to some redundancy concerns we were taken to consider only one item per knowledge area (see 5.7). Project Management construct presents mean values between 4.21 to 5.43 (7-point Likert scale) where the question related to *Risk Management* has the lowest value and the *Time Management* question the highest value. The standard deviation range between 1.513 to 1.744.

The internal consistency was very good (α = .967). The values of convergent validity and discriminant validity shows a strong connection with the construct (*Tables 29 and 30*). *Table 31* and *32* show an acceptable fit of IS/IT Project Success construct with the data collected. The comparative indices are near 1.00 and the absolute indices close to .00.

Study shows that the Organisational Maturity has an *indirect effect* on IS/IT Project Success (β = .615 × .824 = .507, p < .001), which means that the Organisational Maturity has a positive effect on Project Management which in turn has also a *positive effect* on IS/IT Project Success.

Although the Project Management mediation, the Organisational Maturity compute a *significative effect* on IS/IT Project Success. In this case, the Organisational Maturity compute a *direct and indirect effec*t on IS/IT Project Success and for this reason we have a partial mediation (*Figure 15*).

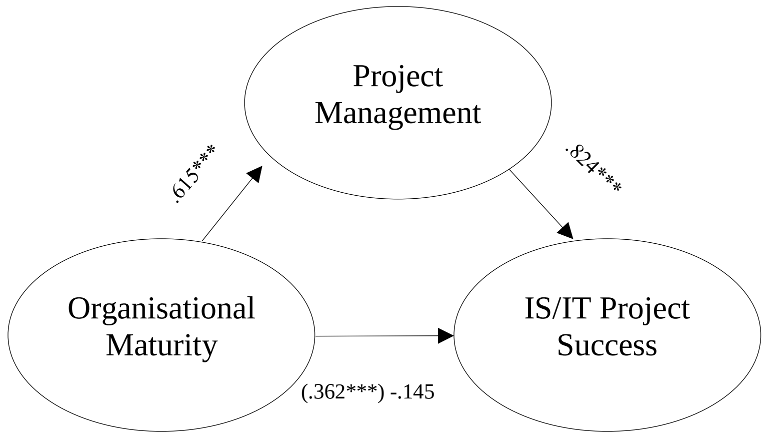

Figure 15 – Partial Mediation

As a synthesis of this discussion we can sustain that hypotheses H1 and H2 were statistically supported by the quantitative results. To summarize, this means that:

H1 - There is a direct relationship between Organisational Maturity (X) and the IS/IT Project Success (Y).

H2 - There is an indirect relationship between Organisational Maturity (X) and the IS/IT Project Success (Y), which is mediated by Project Management (M).

Chapter 8. Conclusions

8.1 Background

All countries in Europe are experiencing an ageing of their populations, with a decrease in the number of workers per employee retired. Expenditure on long-term healthcare is certainly going to increase with the current ageing of the population. Because of this, the growth effects on healthcare expenses are critical to governments. It seems to be consensual that appropriate measures should be implemented in time. Significant improvements in Portuguese population health status and in healthcare outcomes were achieved in the past decade. Although, some important challenges remain to be resolved, namely:

- Inequalities in health status between men and women and among geographical regions (OPSS[61], 2017; van Doorslaer & Koolman, 2004);
- Health expenditure both as a percentage of GDP and on a per-capita basis, has increased significantly over the past decade. The end users are concerned about healthcare costs in a near future (Barros, 2011; Delloite, 2011).
- Some surveys[62] suggest that the Portuguese have no confidence in the ability of the health system to provide good quality and affordable health care;
- Privacy and security risks are a concern to Portuguese healthcare end users;
- Studies[63] reported health information limitations that could restrict the capacity to develop, analyse and monitor the effectiveness of the policies and strategy for the sector.

[61] Observatório Português dos Sistemas de Saúde
[62] Deloitte (2011). 2011 Survey of Health Care Consumers in Portugal: Key Findings, Strategic Implications. Deloitte Center for Health Solutions. Washington, DC, USA: Deloitte.
[63] OECD (2015). OECD Reviews of Health Care Quality: Portugal 2015: Raising Standards. Paris: OECD Publishing. Available at: http://dx.doi.org/10.1787/9789264225985-en, 19/07/2017.

IS/IT have great potential to improve healthcare by enhancing access to health information and making health services more efficient. They can also contribute to improving the quality of services and reducing their cost.

A patient-centred information system can track individual health problems and treatment over time, giving insights about optimal diagnosis and treatment of the individual, as well as improving the delivery of services. As previously mentioned, the IS/IT investments in healthcare brings many benefits to day-by-day of the organisations. As also previously referred, these implementations have a large impact on all areas of the health organisations, professional staff, managers, politicians and public. Some of the following incidents remain current and actions are required for their minimization and resolution, namely:

- Increased speed in the provision of health services;
- Improved accuracy, completeness, and consistency of health care;
- Reducing costs, time and resources;
- Improved corporate memory to support the organization's learning ability;
- Quick identification of service gaps and inefficiencies;
- Rapid risk analysis;
- Automated compilation of areas for improvement;
- Maintaining and updating the information easier;
- Information in multiple formats to serve different end user;
- Management of the online information;
- Support for multiple users.

The challenge for the SNS is to maintain and improve the gains in health status, together with improving equity in healthcare, and be more responsive to the expectations and concerns of the Portuguese population. Enhancing health system performance with limited resources require the capacity of having health policy choices on allocating resources to the areas where they can be most effective.

Studies[64] confirms that the health management practices are strongly related to a quality of patient care and productivity outcomes. Managing the healthcare information systems become increasingly crucial to quality improvement in healthcare.

The understanding of the possible impact of Organisational Maturity through Projects Management practices on the IS/IT Project Succes is important to leverage its potential value. This is particularly important in the Healthcare, where the systems technologies involved are usually of a cutting-edge nature ands requires substantial investments.

Academics and practioners stressed the importance of the Organisational Maturity and Project Management on the IS/IT Project Success. Several studies recognise that these two constructs have a positive effect on IS/IT Project Success.

Nevertheless, it had not acknowledged a negative effect between Organisational Maturity and IS/IT Project Success when the Project Management practices are present. The introduction of IS/IT in Health promotes greater dissemination of information to all individuals, which ultimately facilitates the different internal processes and disseminates the information and knowledge across the organisations.

IS/IT implementations fosters the effects of an open organization and, as a result, information to all of the individuals is disseminated more widely.

Systematizing what was studied and evaluated, the present study adopted a mediation models to test the following hypotheses:

H1 - There is a direct relationship between Organisational Maturity (X) and the IS/IT Project Success (Y).

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[64] Dorgan, S., Layton, D., Bloom, N., Homkes, R., Sadun, R., & Van Reenen, J. (2011). Management in Healthcare: Why good practice really matters. LSE Research Online 2011. http://cep.lse.ac.uk/textonly/_new/research/productivity/management/PDF/Management_in_Healthcare_Report.pdf.

H2 - There is an indirect relationship between Organisational Maturity (X) and the IS/IT Project Success (Y), which is mediated by Project Management (M).

The methodology used an online questionnaire to collect the perception of health professionals, which was previously validated by a pretest. The content, convergent and discriminant validation and reliability analysis were performed.

The confirmatory factor analysis (CFA) assessed the constructs validity. All items loaded significantly on their corresponding latent construct, thereby providing evidence of convergent validity and confirmed that the data fited the hypothesized measurement model based on theory and previous analytic research.

The values achieved by the indices of *goodness-of-fit* suggested an acceptable fit between the hypothesized model and the observed data for each scale. The mediation model tested by a SEM with maximum likelihood (ML) estimation and a non-parametric method (bootstrap) with 5000 subsamples validated the results. Bootstrapping allowed us to assign accuracy to the measurements. The hypothesized mediation model displayed a fair set of values for the fit to the data.

Both hypotheses were confirmed, and a partial mediation were achieved. The influence of the Organizational Maturity on IS/IT Project Success remains significant despite the mediation of Project Management.

The study has shown that Organizational Maturity had a significant total effect on IS/IT Project Success. Organisational Maturity acknowledges a direct and an indirect effect on the IS/IT Project Success.

The research also shows that Organisational Maturity has a positive effect on Project Management and Project Management has a positive effect on the IS/IT Project Success.

An interesting, although unexpected, part of our research came out from how Organisational Maturity influenced the IS/IT Project Success, in the strict context of the study, the public health sector (public hospitals).

The research confirmed some of the previous assumptions:

- Public health organisations behave similarly to organisations from other industries, or in other words, mature public health organisations have more chances to increase the likelihood of having IS/IT successful projects.
- More mature health organisations facilitate the use of methods and tools, namely, Project Management practices, which in turn will enhance the success of IS/IT projects.
- In general, the Project Management practices adopted n public health organisations and used according to the main practitioner standards (PMBOK, NCB, amongst others) enhance the likelihood of successful projects in IS/IT.
- The mediation testing reveals that in presence of Project Management, the Organisational Maturity continues to make its influence on the success of IS/IT projects, although negatively in certain circumstances.

Finally, the study highlighted that when the Project Management practices are present as a mediator, the Organisational Maturity has a significant effect on the IS/IT Project Success but with a negative signal/effect.

Some testimonials recorded in conversations, interviews (Appendix E) and information collected in the pretest questionnaire already pointed out some problems that could be the origin of the obtained results, namely:

- The centralised decision-making process concerning investments in large IS/IT projects, where some key stakeholders (e.g. members of the board of hospitals) are not part of the decision-making process.
- The considerable lack of active communication between the central health administration and the distributed health units, namely the central and regional hospitals
- Lack of training programs on the systems and technologies in use.
- Few information sessions about the potential impacts of the new strategic IS/IT applications, or even about the systems and technologies which support them.

This has caused a lack of active involvement, participation and diffusion effect from the part of the key users of those applications, with a strong influence on feedback for IS/IT project success

- Lack of motivational sessions showing the pros of the needed changes.
- Absence of a strategic alignment between the different levels of the health sector. A centralized decision-making process on investments for IS/IT applications creates a difficult consensus about the more adjusted projects portfolio for this type of investments. Consequently, this has a strong impact on the ownership process concerning the adoption of the IS/IT applications caming out from the centralized IS/IT organisation that develops and deploys them (SPMS).

8.2 Limitations

The study was developed in the Portuguese public Healthcare organisations, in a specific context of strong rationalization and cost containment. This is, nowadays, a reality also shared by most European countries.

According to the OECD (2015a) the health spending in Portugal dropped in 2013 by 3.7%. Public health spending has been continuously reduced since 2010 after moderate growth in previous years. Several cost-containment measures have been taken in the wake of the economic crisis to reduce public spending on health, but with prospects for improvement in the short to medium term. This situation led to sector reorganization with the creation of a public body that centralizes and manages all health expenditures. On one hand, centralization of the procurement has the potential to reduce costs. But on other hand, it reduces or completely removes autonomy from health organisations, causing a huge gap between the internal processes of organisations and initiatives emanating superiorly that end up interfering with the day-to-day activities of organisations.

8.3 Contributions and recommendations

The results provide several theoretical contributions:

- Through the literature review process, it was possible to systematize the academic topics of Organizational Maturity, Project Management and IS/IT Project Success in the context of the healthcare;
- To understand the different relations and their respective effects among the different variables;
- Analyze the observed results and confront them with the results of the academic literature;
- Deduce some recommendations that derive directly from the results that were obtained from the present study.

In terms of recommendations, we think some initiatives could be performed:

- Disseminating good Project Management practices, both those centrally (e.g. better communication, better stakeholder management…), as well as at the level of decentralized organizations.
- As far as we know and has been publicly assumed, the Health Ministry has published a decree-law establishing the provisions and determines the principles of governance and management of the National Strategy for Health Information Ecosystem (ENESIS) 2020, where some of these concerns are addressed and partially to be solved. We claim that these governance principles should be extended and aligned with the governance of IS/IT, letting clear the way IS/IT investments are managed and whose stakeholders are to be considered in the complex decision-making process.
- About of the portfolio of the most relevant applications of health, should be clear who defines, selection criteria, and who establishes the priorities for this type of valuation of projects in the portfolio.

The study also identifies several opportunities for improvement, namely:

- More participation of the health unities on the decision process concerning the IS/IT investments

- Promoting the internal IS/IT initiatives, explaining the reasons for the investments, expected benefits for the organisations and for the professionals
- Engaging the health professionals in the IS/IT adoption and knowledge dissemination.
- A sustainable adoption of project management practices in new initiatives concerning IS/IT application developments, following the entire project life cycle, and aimed at collecting the promised benefits.

8.3 Future studies

Enterprise Governance of IS/IT was not scoped for this research project. Then, our first proposal for a further phase of the research is to consider this specific dimension in our research model. As we could see from the achieved results, this can generate useful explanations about the effects of a decision-making centrality for the investments in IS/IT applications process.

Second proposal is to analyse the effect of each of the Organizational Maturity perspectives, according to de P3M3 on IS/IT Project Success.

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Appendix A Project definitions

The common themes in these definitions is that projects are unique in their output, having a definite starting and ending point, are temporary in nature and are carried out to manifest the organisation's strategic objectives. These temporary structures are playing a vital role in today's modern organisations and a growing interest is recorded in the significance of these temporary structures in organisations.

Oxford Learner's Dictionaries[65]	"A planned piece of work that is designed to find information about something, to produce something new, or to improve something".
Gaddis (1959)	A project is an organization unit dedicated to the attainment of a goal - generally the successful completion of a developmental product on time, within budget, and in conformance with predetermined performance specifications.
Olsen (1971, p.12)	"Project Management is the application of a collection of tools and techniques (such as the CPM and matrix organization) to direct the use of diverse resources toward the accomplishment of a unique, complex, one-time task within time, cost and quality constrains. Each task requires a particular mix of these tools and techniques structured to fit the task environment and life cycle (from conception to completion) of the task."
Lundin and Soderholm (1995)	Finite activities, with low levels of repetition, carried out by temporary organisations
Wysocki, Beck and Crane (2000)	A sequence of unique, complex, and connected activities having one goal or purpose that must be completed by a specific time, within budget, and according to specification.
Maylor (2001)	Passing achievements of variable size, and applicable to a very wide range of sectors of activity and are repeatedly used by organisations to respond to various challenges and requests.
Cooke-Davies (2001, p.20).	Project has been termed as a human endeavour and may legitimately beregarded by its stakeholders as a project when it encompasses a unique scope of work that is constrained by cost and time, the purpose of which is to create or modify a product or service to achieve beneficial change defined by quantitative and qualitative objectives.
Bradley (2002)	A project is a regarded as a business case that indicates the benefits and risks of the venture, demonstrating a unique set of deliverables,

[65] Oxford Learner's Dictionaries. Retrieved from: http://www.oxfordlearnersdictionaries.com/definition/english/project_1?q=project

	with a finite life-span, by using identified resources with identified responsibilities.
ISO 10006:2003	"Unique process, consisting of a set of coordinated and controlled activities… with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including the constraints of time, cost and resources".
Turner and Muller (2003)	an endeavor in which human, material and financial resources are organised in a novel way, to undertake a unique scope of work, of given specification, within constraints of cost and time, to achieve beneficial change defined by quantitative and qualitative objectives.
Ohara (2005, p.15)	Value creation undertaking based on specifics, which is completed in a given or agreed timeframe and under constraints, including resources and external circumstances.
Cleland and Ireland (2006)	A project is a combination of organizational resources pulled together to create something that did not previously exist and that will provide a performance capability in the design and execution of organizational strategies.
Merna and Al-Thani (eds.) (2008)	A unique investment of resources to achieve specific objectives, such as the production of goods or services, in order to make a profit or to provide a service for a community.
APM (2006, p. 150)	"A unique, transient endeavour undertaken to achieve planned objectives."
Turner (2008)	A transitory organization to which resources are assigned to do a job and deliver a beneficial change.
Meredith and Mantel (2009)	A project is a specific, finite task to be accomplished.
Kerzner (2009)	A project is a series of multi-functional activities and tasks that have a specific objective to be completed within certain specifications, defined start and end dates, funding limits, and consume human and non-human resources.
Kerzner (2014)	A development with goal well defined, which consume resources and operates under the pressure of time, cost and quality.
Pemsel et al. (2014)	Projects are defined as a locus of attention for strategy implementation and organizational and project learning.
IPMA (2015, p. 27)	"A project is a unique, temporary, multidisciplinary and organised endeavour to realize agreed deliverables within predefined requirements and constraints".
PMI (2016, p. 8)	"A temporary endeavour undertaken to create a product, service or result".

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Appendix C Exploratory meetings and interviews

Contact	Organisation	Expertise	Date
Prof. Dr. James Werbel	ISEG	Research Strategies	June 2013
Prof Dra. Winnie Picoto	ISEG	IS/IT Research Strategies	July 2013
Prof. Dr Palma dos Reis	ISEG	IS/IT Research Methodologies	July 2013
Prof. Dr. Pedro Isaías	ISEG	IS/IT Research Methodologies	July 2013
Prof. Dr. Mário Caldeira	ISEG	IS/IT Research Strategies	28/11/2013
Prof. Dra. Helena Carvalho	ISCTE	Quantitative Methods	11/07/2013 11/10/2013 07/02/2014 22/05/2014
Prof. Dr. Mário Caldeira	ISEG	IS/IT Management	29/01/2014
Dr. Cid Silva	British Hospital	IS/IT in Healthcare	02/04/2014
Prof Dr. Henrique O´Neil	ISCTE	IS/IT Governance in Health	07/04/2014
Prof Dr. Steven de Haes	Antwerp University	Information Systems Management	22/04/2014
Dr. Rui Gomes	Hospital Fernando Fonseca	IS/IT Governance in Health	06/05/2014
Dr. Luis Vaz Henriques	Lusíadas Saúde	IT/IS Management	23/05/2014
Prof. Dr. António Serrano	Hospital Espirito Santo, Évora	Health Administration	26/05/2014
Dr. Carlos Costa	Hospital Fernando Fonseca	IT/IS Management in Healthcare	27/05/2014
Prof. Dr. Henrique Martins	SPMS	IT/IS governance in Healthcare	04/07/2014, 24/07/2014
Prof. Dr. Mira Godinho Prof. Dra P. Albuquerque	ISEG	EIT-Health	28/01/2015
Ane Linden	UNISINOS, Brasil	Healthcare Safety	05/02/2015
Prof. Dr. James Werbel	ISEG	Research and manuscripts publication	05/05/2015, 12/05/2015

Appendix D Questionnaire (Portuguese version)

O SUCESSO DOS PROJETOS DE SISTEMAS E TECNOLOGIAS DA INFORMAÇÃO E COMUNICAÇÃO NA SAÚDE

Este questionário faz parte de uma tese de doutoramento, em desenvolvimento no Instituto Superior de Economia e Gestão da Universidade de Lisboa (ISEG), subordinada ao tema "O Sucesso dos Projetos de Sistema e Tecnologias da Informação e Comunicação na Saúde", cujo principal objetivo visa analisar a relação entre a Maturidade das Organizações de Saúde e o Sucesso dos Projetos em Sistemas e Tecnologias da Informação e da Comunicação no setor público da Saúde.

Com a aplicação do presente questionário pretende-se avaliar a perceção dos vários profissionais das Instituições de Saúde no que respeita à implementação e desenvolvimento de projetos em Sistemas e Tecnologias da Informação e Comunicação. Este estudo conta com a colaboração técnico-científica dos Serviços Partilhados do Ministério da Saúde (SPMS), no âmbito do protocolo de colaboração celebrado entre o ISEG e a SPMS. O questionário está organizado em 5 blocos de questões com um tempo estimado de preenchimento de 15 minutos. As respostas serão tratadas com total confidencialidade, sendo os resultados analisados de forma agregada e garantido o anonimato dos respondentes. A sua colaboração é determinante para a concretização deste estudo e por isso agradece-se desde já a sua atenção. No caso de qualquer dúvida no preenchimento, por favor, contacte Dr. Jorge Gomes, através do seguinte *e-mail* para jorge.gomes@phd.iseg.ulisboa.pt ou pelo telemóvel 967083177.

Uma Observação sobre Privacidade

Este inquérito é anónimo. O registo guardado das suas respostas ao inquérito não contém nenhuma informação identificativa a seu respeito, salvo se alguma pergunta do inquérito o pediu expressamente. Se respondeu a um inquérito que utilizasse algum código identificativo para lhe permitir aceder-lhe, pode ter a certeza de que o código identificativo não foi guardado com as respostas. É gerido numa base de dados separada e será atualizado apenas para indicar se completou ou não este inquérito. Não é possível relacionar os códigos de identificação com as respostas a este inquérito.

I – Perfil

Dados de caraterização pessoal, da Instituição de Saúde e do projeto de Sistemas e Tecnologias da Informação e Comunicação.

Função na Instituição

Escolha a função que desempenha atualmente na sua instituição de saúde

Escolha apenas uma das opções seguintes:

- Administração Hospitalar
- Médico
- Enfermeiro
- Sistemas e Tecnologias
- Técnico Superior
- Técnico de Diagnóstico e Terapêutica
- Administrativo
- Outro ____________________________

Grau Académico

Indique o grau académico obtido

Escolha apenas uma das opções seguintes

- Licenciado
- Mestrado
- Doutorado
- Outro ____________________________

Sexo

Escolha apenas uma das opções seguintes:

- ☐ Feminino
- ☐ Masculino

Ano de nascimento

Ano: __________

Nome da Instituição

Instituição: ____

Identifique sumariamente o projeto TIC que acompanhou/participou

Projeto: ____

Participação no projeto

Indique de que forma participou no projeto:

Escolha apenas uma das opções seguintes:

- ☐ Promotor do projeto
- ☐ Gestor do projeto
- ☐ Equipa do projeto
- ☐ Utilizador do projeto
- ☐ Outro ______________________________

II – Maturidade Organizacional

As questões neste bloco pretendem avaliar o nível de maturidade manifestado através do grau de organização processual das áreas funcionais. As opções em cada questão são incrementais na escolha da resposta. Quer isto dizer, que o grau de maturidade da organização cresce com a escolha do nível no sentido do Nível 1 para Nível 5. Todas as opções anteriores subentendem-se incluídas quando escolhemos um nível superior.

Por cada dimensão da organização identificada será avaliada a forma como processos operacionais ou projetos se estruturam tendo em conta os seguintes aspetos:

Nível 1 - Os processos ou projetos são informais, geridos sem normalização e não estão documentados nas diferentes áreas da organização.

Nível 2 - Os processos ou projetos estão normalizados com especificações mínimas. As organizações apresentam evidências de gestão de projetos, nomeadamente, no planeamento e na gestão da mudança embora de forma pouco consistente e diferenciada.

Nível 3 - A organização tem processos ou projetos centralmente definidos e normalizados e são seguidos em todos os projetos. Tem ferramentas para controlo dos projetos. Responsabilidades definidas.

Nível 4 - A organização tem processos ou projetos definidos, normalizados e geridos com recurso a medições quantitativas para avaliação do desempenho dos projetos ou processos.

Nível 5 - Organizações tem de medições quantitativas para a melhoria contínua dos seus processos ou projetos. Pro-atividade na gestão de problemas e otimização de processos.

1. Avaliação global da maturidade da organização

Esta questão pretende verificar qual das cinco descrições melhor reflete os processos operativos gerais da organização.

Escolha apenas uma das opções seguintes:

☐ Nível 1- Os processos são informais sem normalização e não estão documentados.

☐ Nível 2 - Os processos estão normalizados com especificações minimais.

☐ Nível3 - Os processos estão centralmente definidos e controlados. Responsabilidades definidas.

☐ Nível 4 - O desempenho dos processos é avaliado por medições quantitativas.

☐ Nível 5 - Os processos utilizam a melhoria contínua para a sua otimização.

☐ Não sabe.

2. Controlo de Gestão

Caracterizado por uma evidência clara de liderança e foco nos objetivos, âmbito, planeamento e revisão durante os projetos. Objetivos e descrições claras do que é necessário realizar ou entregar. Estruturas internas alinhadas com os projetos através do foco no controlo dos processos.

Escolha apenas uma das opções seguintes:

☐ Nível 1. A gestão de projetos não é prática corrente. Projetos geridos de acordo com preferências individuais.

☐ Nível 2. O conceito de gestão de projetos está apreendido pela organização.

☐ Nível 3. Existe uma abordagem de gestão de projetos documentada e centralizada. Aplicada a todos os projetos.

☐ Nível 4. A gestão de projetos é vista com ferramenta de mudança organizacional. Medições e análise do desempenho.

☐ Nível 5. Controlo de gestão assegura que o projeto realiza objetivos e mudanças organizacionais. Melhoria contínua.

☐ Não sabe

3. Gestão de Benefícios

Abordagem que assegura que as mudanças organizacionais preconizadas são claramente definidas, monitorizadas, avaliadas e mensuradas de forma atingir a sua plena realização. Todos os benefícios devem ter um responsável e planos credíveis que levem à sua concretização.

Escolha apenas uma das opções seguintes:

☐ Nível 1. É reconhecido o conceito de gestão de benefícios em projetos.

☐ Nível 2. A gestão de benefícios está incluída no estudo de viabilidade do projeto. Definição de responsabilidades.

☐ Nível 3. Existem mecanismos centralizados que garantem a monitorização e a realização dos benefícios.

☐ Nível 4. A gestão de benefícios está integrada na gestão de projetos. Monitorizada por processos quantitativos.

□ Nível 5. A gestão de benefícios está integrada na organização e promove a mudança estratégica. Melhoria contínua.

□ Não sabe.

4. **Gestão Financeira**

Garante que os custos prováveis para o projeto são corretamente estimados através da apresentação formal de um estudo de viabilidade e que essas estimativas são adequadamente geridas ao longo do ciclo de vida do investimento.

Escolha apenas uma das opções seguintes:

□ Nível 1. Controlo financeiro dos projetos é reduzido. Falha na prestação de contas e controlo de despesas.

□ Nível 2. Os estudos de viabilidade são produzidos sem normalização. Os custos totais dos projetos são monitorizados.

□ Nível 3. Existem regras de elaboração dos estudos de viabilidade. Existem processos para a sua gestão ao longo da execução.

□ Nível 4. Capacidade para priorizar investimentos face aos recursos disponíveis. Orçamentos eficazmente geridos.

□ Nível 5. Controlo financeiro dos projetos está integrado na organização. Melhoria contínua.

□ Não sabe.

5. **Compromisso das partes interessadas**

Os interessados nos projetos são a chave para o sucesso de qualquer iniciativa. Dentro ou fora da organização, eles devem ser analisados e geridos de forma a obter o seu compromisso e motivação para a obtenção dos objetivos.

Escolha apenas uma das opções seguintes:

□ Nível 1. As técnicas para o comprometimento, motivação e comunicação são pouco utilizadas nos projetos.

□ Nível 2. Os projetos são comunicados através de iniciativas individuais e não organizacionais.

□ Nível 3. Existem procedimentos para o comprometimento, motivação e comunicação usados em todos os projetos.

□ Nível 4. Utilização de técnicas para medição quantitativa do compromisso das partes interessadas no projeto.

□ Nível 5. Comunicação é otimizada para disseminação de conhecimento na organização. Melhoria contínua.

□ Não sabe.

6. Gestão do Risco

A forma como a organização trata as ameaças e oportunidades dos projetos. Mantém o foco no equilíbrio entre ameaças e oportunidades, através de ações de gestão apropriadas para minimizar a probabilidade da ocorrência de qualquer ameaça, ou para minimizar o seu impacto e maximizar as oportunidades.

Escolha apenas uma das opções seguintes:

□ Nível 1. Evidência minimal da utilização da gestão de riscos em projetos.

□ Nível 2. A gestão de risco é reconhecida e usada em projetos. As abordagens não são normalizadas.

□ Nível 3. A gestão de risco é suportada em processos definidos e normalizados e é usada consistentemente.

□ Nível 4. A gestão de risco funciona eficazmente e é possível demonstrar o seu valor.

□ Nível 5. A gestão de riscos está integrada na cultura da organização e sustenta as decisões. Melhoria contínua.

□ Não sabe.

7. Governo Organizacional

Análise da forma como a realização dos projetos segue a estratégia da organização. Controlo da iniciação e encerramento aos projetos e monitorização do cumprimento do ciclo de vida estabelecido para o projeto.

Escolha apenas uma das opções seguintes:

□ Nível 1. Governação informal dos projetos sem ligação ao controlo organizacional.

□ Nível 2. Gestão de projetos em fase inicial com controlo pouco consistente.

□ Nível 3. Controlo organizacional centralizado e aplicado consistentemente a todos os projetos.

☐ Nível 4. Alinhamento do processo de decisão com a governação da organização. Medições quantitativas.

Nível 5. A governação dos projetos é central no controlo organizacional. Melhoria contínua.

☐ Não sabe.

8. Gestão de Recursos

A gestão de recursos humanos, equipamentos, ferramentas, informação, consumíveis e equipas de suporte. O elemento chave é o processo de aquisição e a forma como a cadeia de fornecimento é gerida com foco na maximização do uso efetivo dos recursos.

Escolha apenas uma das opções seguintes:

☐ Nível 1. A organização reconhece a necessidade de gerir os recursos para potenciar o sucesso dos projetos.

☐ Nível 2. Os recursos são distribuídos pelos projetos. Processo de aquisições sem planeamento.

☐ Nível 3. Sistema centralizado para os processos de aquisições, planeamento e gestão de recursos.

☐ Nível 4. Gestão de recursos é considerada estratégica na organização. Medições quantitativas.

☐ Nível 5. Otimização dos recursos. Gestão equilibrada entre recursos externos e internos. Melhoria Contínua.

☐ Não sabe.

9. Avaliação global da gestão de projetos

Esta questão pretende verificar qual das cinco descrições melhor reflete a gestão de projetos na organização.

Escolha apenas uma das opções seguintes:

☐ Nível 1. A organização reconhece os projetos, mas faz uma gestão diferenciada e informal.

☐ Nível 2. A organização assegura a execução dos seus projetos de acordos com processos normalizados.

 Nível 3. A organização tem processos normalizados e ferramentas para controlar os projetos.

 Nível 4. A organização gere projetos com recurso a medições e indicadores de desempenho.

 Nível 5. A organização gere e monitoriza quantitativamente os processos numa ótica da melhoria contínua.

 Não sabe.

III - Gestão de Projetos de Tecnologias da Informação e Comunicação

Neste bloco de questões pretende-se analisar que práticas de gestão de projetos são efetivamente utilizadas nos projetos de TIC. Dê-nos a sua opinião relativamente aos investimentos em sistemas e tecnologias da informação e comunicação que tenham sido realizados internamente e que práticas de gestão foram utilizadas.

Gestão de Projetos - Por favor escolha uma resposta por cada item:

	1 (Nunca)	2	3	4	5	6	7 (Sempre)	Não sabe
É formalizado o início do projeto?	○	○	○	○	○	○	○	○
É definido e controlado claramente o âmbito do projeto?	○	○	○	○	○	○	○	○
É estabelecido um calendário geral das fases do projeto?	○	○	○	○	○	○	○	○
É estabelecido um plano para o controlo de custos?	○	○	○	○	○	○	○	○
São identificados os requisitos de qualidade para o projeto?	○	○	○	○	○	○	○	○
É assegurada a formação da equipa do projeto?	○	○	○	○	○	○	○	○
É estabelecido um plano de comunicações?	○	○	○	○	○	○	○	○
São identificados os riscos do projeto?	○	○	○	○	○	○	○	○
São definidos procedimentos para as aquisições?	○	○	○	○	○	○	○	○

	1 (Nunca)	2	3	4	5	6	7 (Sempre)	Não sabe
São identificados todos os interessados no projeto?	○	○	○	○	○	○	○	○

IV - Sucesso dos Projetos de Sistemas e Tecnologias da Informação

Pretende-se avaliar os resultados da implementação dos projetos

Sucesso dos Projetos - Por favor escolha uma resposta por cada item:

	1 (Nunca)	2	3	4	5	6	7 (Sempre)	Não sabe
Cumpriu os objetivos definidos?	○	○	○	○	○	○	○	○
Cumpriu os benefícios esperados?	○	○	○	○	○	○	○	○
Cumpriu os requisitos técnicos previstos?	○	○	○	○	○	○	○	○
Cumpriu o calendário planeado?	○	○	○	○	○	○	○	○
Cumpriu o orçamento previsto?	○	○	○	○	○	○	○	○
Os resultados estão alinhados com a estratégia da organização?	○	○	○	○	○	○	○	○
Os resultados identificaram novas oportunidades de melhoria?	○	○	○	○	○	○	○	○
Os resultados alteraram a forma de trabalhar?	○	○	○	○	○	○	○	○
Os resultados alteraram os processos internos da organização?	○	○	○	○	○	○	○	○
Os resultados alteraram o perfil de competências dos profissionais?	○	○	○	○	○	○	○	○
Facilita o acesso à informação sobre Saúde em geral?	○	○	○	○	○	○	○	○
Facilita a comunicação e partilha entre profissionais de saúde?	○	○	○	○	○	○	○	○
Facilita as tarefas diárias?	○	○	○	○	○	○	○	○

	1 (Nunca)	2	3	4	5	6	7 (Sempre)	Não sabe
Facilita o armazenamento da informação para posterior utilização?	○	○	○	○	○	○	○	○
Facilita a melhoria do desempenho no tratamento do paciente?	○	○	○	○	○	○	○	○
Facilita a normalização de procedimentos e rotinas?	○	○	○	○	○	○	○	○
Melhora a qualidade da informação disponível para utilização?	○	○	○	○	○	○	○	○
Facilita a integração da informação entre os vários sistemas?	○	○	○	○	○	○	○	○

Comentários

Espaço livre para comentários

Appendix E Pretest exploratory meetings

Contact	Health Institution	Type	Date
Prof. Dr. Henrique Martins	SPMS of Ministry of Health	Presential	28/10/2014
Dra Ana d'Avo	SPMS of Ministry of Health	Presential	02/12/2014
Dr. João Viana	Hospital São Francisco Xavier	Presential	03/12/2014
Enfª Carla Munhoz	ACES - Estuário do Tejo	Presential	10/12/2014
Dra. Anabela Santos	Hospital Dr. Fernando Fonseca	Presential	10/12/2014
Enfª Carla Munhoz	ACES Estuário do Tejo	Presential	08/01/2015
Dr. Fernando Rosa	Hospital Beatriz Ângelo Matosinhos	Email	27/01/2015
Dr. Miguel Castelo-Branco Sousa	Centro Hospitalar Cova da Beira - Hospital Universitário	Email	04/02/2015
Dr. Mário Lazaro	Hospital de Faro	Email	13/03/2015
Dr. Carlos Sousa	Hospital Dr. Fernando Fonseca	Email	28/04/2015
Dra. Rita Mendes	SPMS - Ministry of Health	Presential Presential Presential Presential Presential Presential	17/07/2015 28/07/2015 27/08/2015 08/10/2015 15/10/2015 23/10/2015
Prof. Dr. Henrique Martins	SPMS - Ministry of Health	Presential	28/10/2015

Appendix F Scale variability discussion

Likert (1932)	Proposed that scales should offer five points.
Bendig (1954)	Found that ratings using either 2-, 3-, 5-, 7-, or 9-point scales were equivalently reliable.
Osgood, Suci, & Tannenbaum's (1957)	Uses 7-points scale in a semantic differential[66]
Garner (1960)	Noted if more response categories are proposed, more information about the variable of interest can be obtained.
Matell & Jacoby (1971)	Indicating that collapsing scales longer than 3 points discarded reliable information, because long scales provided more information than short scales and were no less reliable.
Matell & Jacoby (1971), Schuman & Presser (1981), Rosenstone, Hansen & Kinder (1986), Smith (1994)	Different studies have typically found that concurrent validity improves with increasing scale length
Lewis (1993)	Found that 7-point scales resulted in stronger correlations with t-test results.
Lissitz & Green (1975)	Explored the relation of number of scale points to reliability using simulations. Cross-sectional and test–retest reliability increased from 2- to 3- to 5-point scales but were equivalent thereafter for 7-, 9-, and 14-point scales
Morin (1993), (Sussman, 1978)	Rating scales used to measure public approval of the U.S. president's job performance vary from 2 to 5 points.
Givon & Shapira (1984)	Found pronounced improvements in item reliability when moving from 2-point scales toward 7-point scales. Reliability continued to increase up to lengths of 11 points, but the increases beyond 7 points were quite minimal for single items.
Birkett (1986), Komorita & Graham (1965), Matell & Jacoby (1971), Masters (1974)	Similar results to Bendig (1954) have been reported for scales ranging from 2 to 7 points and for longer scales ranging from 2 to 19 points.
Wedell & Parducci (1988), Wedell, Parducci, & Lane (1990)	Several studies suggest that longer scales are less susceptible to question order effects.

[66] Semantic Differential (SD) is a type of a rating scale designed to measure the connotative meaning of objects, events, and concepts.

Preston & Colman (2000)	There is some support for seven-point scales, but the popularity of five-point scales seems to be less justified.
Cock et al, (2001)	Claimed that in increasing the number of response alternatives used, will automatically increase score variance, and that this has the potential to increase score reliability.
Dawes (2008)	Argued that comparable results are obtained from 7- to 10-point scales, which may yield more information than a shorter scale would.
Cook &Beckman (2009)	compared nine- versus five-point rating scales and concluded that nine-point scales appeared to provide more accurate scores
Johns (2010)	Research confirms that data from Likert items (and those with similar rating scales) becomes significantly less accurate when the number of scale points drops below five or above seven.
Revilla et al, (2014)	Shows that if researchers want to use Agree-Disagree scales, they should offer 5 answer categories rather than 7 or 11, because the latter yield data of lower quality.

Appendix G SPMS/ISEG agreement

SPMS EPE
Serviços Partilhados do Ministério da Saúde

LISBOA
SCHOOL OF ECONOMICS & MANAGEMENT

SPMS EPE
Serviços Partilhados do Ministério da Saúde

A SOLUÇÃO ESTÁ NA PARTILHA!

Proposta de Protocolo para a realização de tese de doutoramento

1/5

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SPMS EPE
Serviços Partilhados do Ministério da Saúde

LISBOA SCHOOL OF ECONOMICS & MANAGEMENT

Mário Caldeira

Protocolo para a realização de tese de doutoramento

Entre

SPMS – Serviços Partilhados do Ministério da Saúde, EPE, pessoa coletiva de direito pública de natureza empresarial, titular do número único de matrícula e de pessoa coletiva 509 540 716, com sede na Av. João Crisóstomo nº 9, 3º em Lisboa e o capital estatutário de EUR 6.000.000 (Seis milhões de euros), aqui representada pelo Prof. Doutor Henrique Martins, na qualidade de Presidente do Conselho de Administração, com poderes suficientes para o ato, adiante designado por **SPMS**, como primeiro outorgante;

Instituto Superior de Economia e Gestão ISEG, pessoa coletiva com o NIPC 502 488 603 com sede em Rua do Quelhas, nº 6, 1200-781, Lisboa aqui representado pelo seu Presidente, Professor Doutor Mário Fernando Maciel Caldeira, com poderes suficientes para o ato, adiante designado por **ISEG**, como segundo outorgante;

E

O Mestre Jorge Manuel Vareda Gomes, aluno doutorando do ISEG, com o número de identificação fiscal 161 951 252, residente na Rua Sousa Lopes GH 6ºEsq., 1600-207 Lisboa, como terceiro outorgante.

Considerando que a **SPMS, EPE** atribui elevada importância à colaboração institucional em projetos e trabalhos de pesquisa e desenvolvimento técnico e científico, nomeadamente na área das tecnologias de informação e comunicação.

Considerando que o **ISEG** possui meios técnicos, científicos e recursos humanos altamente especializados para dar apoio aos seus alunos, nomeadamente aos do curso de Doutoramento.

Considerando que a criação de sinergias, entre a empresa e o meio académico, poderá constituir, no futuro, uma mais-valia na aplicação e recolha de contributos nos domínios da investigação científica e tecnológica, que poderá ter reflexos no desenvolvimento de projetos, assim como na partilha de experiências na área das TIC.

As partes acordam cooperar no âmbito da tese de doutoramento sobre a Plataforma de Dados de Saúde, promovida pelo ISEG, de forma a possibilitar a realização dos trabalhos de investigação realizados no âmbito da elaboração da tese de doutoramento, acolhendo, a SPMS, o estudante nos termos do presente Protocolo, o qual se rege pelas seguintes cláusulas:

CLÁUSULA PRIMEIRA

O presente documento tem em como objetivo, estabelecer um protocolo de colaboração entre a SPMS e o ISEG, para a realização de uma tese de doutoramento sobre a Plataforma de Dados de Saúde (PDS). A concretização deste protocolo, irá permitir que se desenvolvam contributos no âmbito das Tecnologias de informação e comunicação na Saúde, em concreto na PDS.

CLÁUSULA SEGUNDA

1. O **ISEG** disponibiliza-se:
   a) Enviar para a SPMS o estudante, para a realização da supra mencionada tese de doutoramento;
   b) Propor o orientador e coorientador, se aplicável, da tese, bem como assegurar as condições necessárias ao bom acompanhamento do estudante por parte dos mesmos;
   c) Assegurar as condições necessárias à realização das provas públicas.

CLÁUSULA TERCEIRA

1. A **SPMS** disponibiliza-se a:
   a) Receber o referido estudante, para a realização dos trabalhos de investigação realizados no âmbito da elaboração da tese de doutoramento;

b) Acompanhar o estudante nos trabalhos a realizar no âmbito da proposta de tese, nas áreas de responsabilidade direta da SPMS. Caso haja necessidade de envolvimento de terceiras entidades, o acompanhamento ficará sujeito à autorização das respectivas entidades;

c) Acompanhar e orientar a execução dos trabalhos de investigação no âmbito da tese de doutoramento, facultando ao estudante as condições necessárias para a realização dos mesmos;

d) Facultar ao estudante informação que seja de âmbito público necessária para a prossecução das atividades definidas no protocolo da tese de doutoramento (em anexo), bem como para a redação da respetiva tese de doutoramento.

CLÁUSULA QUARTA

1. O estudante disponibiliza-se a:

a) Respeitar os horários definidos na SPMS, EPE, bem como outras regras internas da organização de acolhimento;

b) Cumprir todas as regras de sigilo profissional;

c) Participar em todas as reuniões para as quais seja convocado, realizadas no âmbito da tese de doutoramento, com o orientador, coorientador e demais intervenientes;

d) Elaborar planos de trabalho e relatórios julgados necessários, assim como atas das reuniões efetuadas.

CLÁUSULA QUINTA

1. O Presente protocolo não implica custos para os outorgantes envolvidos.
2. O doutorando sob a orientação científica do ISEG compromete-se a desenvolver dois *workshops* sobre maturidade da PDS, em local a designar pela SPMS, sem encargos para o ISEG.
3. Em caso de acidente/incidente do estudante dentro das instalações da SPMS, esta não assume qualquer responsabilidade.

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4. O doutorando está abrangido pelo seguro escolar existente para alunos do ISEG de acordo com as condições do mesmo.

O presente protocolo vigora desde a data da sua assinatura, até ao termo da tese de doutoramento, podendo ser modificado por mútuo acordo, devidamente justificado.

Feito em triplicado, Lisboa, 10 de Setembro de 2014.

Pela SPMS

____

(Prof. Doutor Henrique Martins)

Pelo ISEG

____

(Prof. Doutor Mário Maciel Caldeira)

O doutorando

____

(Eng. Jorge Gomes)

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Appendix H Presentation letter and reminders

Caro (a) profissional de saúde,

O meu nome é Jorge Gomes sou estudante do Programa de Doutoramento em Gestão do Instituto Superior de Economia e Gestão e estou a desenvolver uma tese no âmbito dos Sistemas e Tecnologias da informação e Comunicação na Saúde, denominados TIC.

Atendendo à ausência de informação disponível para a realização deste estudo foi assinado um protocolo assinado entre o ISEG e a SPMS para dar enquadramento ao processo de investigação. Neste sentido apela-se à sua colaboração para a dinamização e mobilização dos profissionais de saúde da sua Instituição para o preenchimento de um questionário on-line cujo objetivo principal é o de analisar a relação entre a Maturidade das Instituições de Saúde e o Sucesso dos Projetos de Sistemas e Tecnologias da Informação e Comunicação, e a eventual utilização de práticas de Gestão de Projetos na implementação destes investimentos.

A sua colaboração é fundamental para o sucesso deste estudo. Solicito desta forma a sua disponibilidade para contatar dentro da sua unidade de saúde, os profissionais de saúde, que de alguma forma tiveram contato com implementações de Projetos nas áreas dos Sistemas e Tecnologias da Informação e Comunicação (TIC).

Uma participação representativa é essencial para que o estudo apresente a fiabilidade necessária ao subsequente tratamento estatístico e para que possam ser extraídas conclusões relevantes e desta forma permitam melhorias em futuros investimentos nestas áreas. Queria ainda sublinhar alguns aspetos que identifico como fundamentais para o bom desenvolvimento deste estudo:

1) Os respondentes devem um bom conhecimento dos processos internos da sua Instituição.
2) Ter acompanhado de alguma forma o desenvolvimento e/ou implementação de um projeto de Sistemas e Tecnologias da Informação e Comunicação.
3) Os respondentes podem ser todos os profissionais das Instituições de Saúde (Administração Hospitalar, Médicos, Enfermeiros, profissionais das Tecnologias, Técnicos Superiores, Administrativos…)
4) O número esperado de questionários preenchidos por unidade de saúde é de 12.
5) O presente estudo representa um processo de investigação académico, isento é da total responsabilidade do ISEG sendo garantido o anonimato dos respondentes.

Poderá encontrar o questionário neste endereço eletrónico
http://pascal.iseg.utl.pt/lsinq/index.php?sid=74554&lang=pt

Informa-se ainda que o questionário só será considerado válido se for devidamente preenchido. O tempo médio estimado para responder a este questionário é de 15 min.

Grato pela atenção dispensada, apresento os meus melhores cumprimentos,

Jorge Manuel Vareda Gomes

SPMS EPE Serviços Partilhados do Ministério da Saúde

LISBOA SCHOOL OF ECONOMICS & MANAGEMENT

Exmos Senhores,

O meu nome é **Jorge Gomes,** sou aluno do Programa de Doutoramento em Gestão do **ISEG** (Instituto Superior de Economia e Gestão) e estou a desenvolver uma tese no âmbito dos Sistemas e Tecnologias da informação e Comunicação na Saúde, denominados TIC.

Atendendo à ausência de informação relevante para a realização do estudo foi assinado um protocolo entre o **ISEG** e a **SPMS** para dar enquadramento técnico-científico ao processo de investigação. Neste sentido apelo à sua colaboração na dinamização e mobilização dos profissionais de saúde da sua Instituição para o preenchimento de um questionário on-line.

O objetivo principal do estudo é o de estabelecer uma relação entre a Maturidade das Instituições de Saúde e o Sucesso dos Projetos de Sistemas e Tecnologias da Informação e Comunicação, e a eventual utilização de práticas de Gestão de Projetos na implementação destes investimentos.

A sua colaboração é fundamental para o sucesso deste estudo. Solicito desta forma a sua atenção e disponibilidade para contatar dentro da sua unidade de saúde, os profissionais de saúde, que de alguma forma tiveram contato com este tipo de implementações. Uma participação representativa é essencial para que o estudo apresente a fiabilidade necessária ao subsequente tratamento estatístico e para que possam ser extraídas conclusões relevantes para eventuais melhorias em futuros investimentos nestas áreas. No que respeita aos potenciais respondentes identifico alguns aspetos que considero fundamentais para o bom desenvolvimento do estudo:

- O conhecimento dos processos internos da Instituição em que colabora e ter acompanhado de alguma forma o desenvolvimento e/ou implementação de um projeto de Sistemas e Tecnologias da Informação e Comunicação.
- Todos os profissionais das Instituições de Saúde, nomeadamente; Administração Hospitalar, Médicos, Enfermeiros, Sistemas e Tecnologias, Técnicos Superiores, Técnicos de Diagnóstico e Terapêutica, Administrativos, entre outros.

O presente estudo representa um processo de investigação académico, isento é da total responsabilidade do **ISEG** sendo garantido o anonimato dos respondentes. O questionário está disponível no seguinte endereço eletrónico.

http://pascal.iseg.utl.pt/lsinq/index.php?sid=74554&lang=pt

A duração estimada para o total preenchimento é de 15 mn.

Grato pela atenção dispensada, apresento os meus melhores cumprimentos,

Jorge Gomes
Aluno do Programa de Doutoramento em Gestão - ISEG
jorge.gomes@phd.iseg.ulisboa.pt
967083177

Exmo(a) Senhor(a),

Serve o presente para recordar que está disponível até ao final do mês de Julho de 2016, o questionário online, cujo objetivo principal é o estudo da relação entre a Maturidade das Instituições de Saúde e o Sucesso dos Projetos de Sistemas e Tecnologias da Informação e Comunicação, com a eventual utilização de práticas de Gestão de Projetos.

A sua participação é fundamental para a viabilização do estudo.

Pode encontrar o questionário no endereço eletrónico seguinte.

http://pascal.iseg.utl.pt/lsinq/index.php?sid=74554&lang=pt

Grato pela atenção dispensada, apresento os meus melhores cumprimentos,

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Appendix I Comparison between samples

Sociodemographic data

	N=242	N=139	Variation
Professional Position	%	%	%
Hospital Administration	9,1	12,9	3,9
Doctors	27,3	24,5	-2,8
Nurses	27,7	25,2	-2,5
Systems and Technologies	12,4	16,5	4,2
Senior Technician	6,6	6,5	-0,1
Diagnoses and Therapeutically Technician	5,4	5,8	0,4
Administrative staff	4,5	1,4	-3,1
Other	7,0	7,2	0,2
Health regions			
ARS Norte	30,2	28,8	-1,4
ARS Centro	19,0	18,0	-1,0
ARS Lisboa e Vale do Tejo	27,7	28,1	0,4
ARS Alentejo	9,5	10,8	1,3
ARS Algarve	4,1	3,6	-0,5
Madeira e Açores	3,3	2,9	-0,4
Other	6,2	7,9	1,7
Project Involvement			
User	43,4	31,7	-11,7
Project Team	27,3	32,4	5,1
Project Manager	12,8	15,8	3,0
Sponsor	7,9	12,9	5,1
Education			
Graduation	57,0	59,7	2,7
Master of Science	28,9	26,6	-2,3
Ph.D.	7,4	8,6	1,2
Other	6,6	5,0	-1,6
Sex			
Male	45,0	52,5	7,5
Female	55,0	47,5	-7,5
Ages			
Until 35 years	14,9	15,1	0,2
36 - 45 years	28,9	30,2	1,3
46 - 55 years	32,6	36,7	4,0
Greater than 55 years	23,6	18,0	-5,6

Descriptive statistics

Organisational Maturity

	Mean		SD		Skewness		Kurtosis	
	(n=242)	(n=139)	(n=242)	(n=139)	(n=242)	(n=139)	n=242)	(n=139)
MAT02	2,68	2,76	1,368	1,203	,304	,585	-,733	-,611
MAT04	2,12	2,78	1,571	1,228	,286	,555	-,795	-,666
MAT05	2,45	2,57	1,396	1,325	,532	,591	-,758	-,728
MAT06	2,00	2,35	1,458	1,350	,689	,872	-,282	-,369
MAT07	2,51	2,78	1,435	1,240	,213	,527	-,684	-,717
MAT08	2,42	2,68	1,383	1,205	,444	,623	-,537	-,470

Project Management

	Mean		SD		Skewness		Kurtosis	
	(n=242)	(n=139)	(n=242)	(n=139)	(n=242)	(n=139)	(n=242)	(n=139)
GP01	4,36	4,82	2,138	1,729	-,479	-,384	-,787	-,892
GP02	4,67	5,17	2,058	1,644	-,734	-,557	-,354	-,808
GP03	4,94	5,43	1,960	1,513	-,906	-,676	,142	-,548
GP05	4,42	4,99	2,185	1,613	-,628	-,430	-,598	-,821
GP06	4,25	4,70	2,070	1,680	-,409	-,368	-,845	-,764
GP07	3,98	4,40	1,985	1,666	-,272	-,191	-,908	-1,095
GP08	3,52	4,21	2,076	1,683	-,062	,073	-,927	-,992
GP09	4,08	4,92	2,256	1,597	-,443	-,399	-,915	-,870
GP10	4,14	4,65	2,121	1,744	-,328	-,367	-,965	-,946

Project Success

	Mean		SD		Skewness		Kurtosis	
	(n=242)	(n=139)	(n=242)	(n=139)	(n=242)	(n=139)	(n=242)	(n=139)
SP01	4,79	5,38	1,924	1,276	-1,174	-,792	,783	,298
SP03	4,49	5,24	2,019	1,300	-,923	-,873	,016	,214
SP04	4,22	4,87	2,103	1,488	-,606	-,591	-,623	-,462
SP06	4,68	5,40	2,133	1,361	-1,003	-,799	,013	,192
SP09	4,80	5,35	1,916	1,244	-1,274	-,950	,886	,798
SP10	4,51	5,05	1,909	1,321	-1,039	-1,013	,299	,969
SP11	5,24	5,70	1,822	1,214	-1,468	-1,323	1,600	1,796
SP12	5,33	5,77	1,756	1,131	-1,608	-1,362	2,232	2,479
SP13	5,16	5,53	1,748	1,332	-1,245	-1,223	1,104	1,374
SP14	5,12	5,99	1,854	1,189	-1,261	-1,588	,920	2,955
SP15	5,46	5,62	1,709	1,326	-1,620	-1,498	2,397	2,379
SP17	5,23	5,88	1,855	1,158	-1,279	-1,436	1,002	2,439
SP18	5,63	5,83	1,700	1,219	-1,811	-1,356	3,133	1,992

Appendix J Confirmatory Factor Analysis of Project Management

Analysis Summary

Date and Time: 27 de dezembro de 2016, 13:50:06. **Title:** Project Management

Groups: Group number 1 (Group number 1). Notes for Group (Group number 1)

The model is recursive.

Sample size = 139

Variable Summary (Group number 1). Your model contains the following variables (Group number 1)

Observed, endogenous variables: GP08, GP07, GP06, GP05, GP03, GP02, GP01, GP10, GP09
Unobserved, exogenous variables: e8, e7, e6, e5, e3, e2, e1, e10, e9, Project_Management

Variable counts (Group number 1)

Number of variables in your model:	19
Number of observed variables:	9
Number of unobserved variables:	10
Number of exogenous variables:	10
Number of endogenous variables:	9

Parameter Summary (Group number 1)

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	10	0	0	0	0	10
Labeled	8	0	10	0	0	18
Unlabeled	0	9	0	0	0	9
Total	18	9	10	0	0	37

Assessment of normality (Group number 1)

Variable	min	max	skew	c.r.	kurtosis	c.r.
GP09	1,000	7,000	-,284	-1,453	-1,049	-2,682
GP10	1,000	7,000	-,229	-1,171	-1,103	-2,821
GP01	1,000	7,000	-,263	-1,346	-1,075	-2,750
GP02	1,000	7,000	-,422	-2,161	-,936	-2,394
GP03	1,000	7,000	-,514	-2,629	-,719	-1,839
GP05	1,000	7,000	-,304	-1,554	-,968	-2,475
GP06	1,000	7,000	-,279	-1,425	-,955	-2,443
GP07	1,000	7,000	-,082	-,418	-1,209	-3,091
GP08	1,000	7,000	,165	,842	-1,026	-2,623
Multivariate					55,449	24,688

Models

Project Management (Project Management). Notes for Model (Project Management)

Computation of degrees of freedom (Project Management)

Number of distinct sample moments:	45
Number of distinct parameters to be estimated:	27
Degrees of freedom (45 - 27):	18

Result (Project Management)

Minimum was achieved
Chi-square = 23,493
Degrees of freedom = 18
Probability level = ,172

Group number 1 (Group number 1 - Project Management)

Estimates (Group number 1 - Project Management)
Scalar Estimates (Group number 1 - Project Management)
Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Project Management)

			Estimate	S.E.	C.R.	P	Label
GP03	←	Project_Management	,860	,062	13,796	***	W5
GP05	←	Project_Management	,935	,066	14,116	***	W3
GP06	←	Project_Management	1,041	,067	15,506	***	W2
GP08	←	Project_Management	1,000				
GP09	←	Project_Management	,952	,067	14,234	***	W8
GP10	←	Project_Management	1,125	,065	17,212	***	W9
GP02	←	Project_Management	,921	,067	13,762	***	W6
GP01	←	Project_Management	1,079	,069	15,556	***	W7
GP07	←	Project_Management	1,067	,053	20,025	***	W1

Standardized Regression Weights: (Group number 1 - Project Management)

			Estimate
GP03	←	Project_Management	,836
GP05	←	Project_Management	,851
GP06	←	Project_Management	,886
GP08	←	Project_Management	,858
GP09	←	Project_Management	,847
GP10	←	Project_Management	,936
GP02	←	Project_Management	,833
GP01	←	Project_Management	,890
GP07	←	Project_Management	,918

Covariances: (Group number 1 - Project Management)

			Estimate	S.E.	C.R.	P	Label
e3	↔	e10	-,218	,050	-4,376	***	
e3	↔	e2	,237	,062	3,794	***	
e5	↔	e2	,287	,071	4,035	***	
e8	↔	e7	,191	,058	3,305	***	
e7	↔	e6	,146	,053	2,743	,006	
e5	↔	e1	-,208	,063	-3,293	***	
e7	↔	e9	-,138	,048	-2,864	,004	
e5	↔	e10	-,147	,053	-2,763	,006	
e7	↔	e1	-,136	,048	-2,828	,005	

Correlations: (Group number 1 - Project Management)

			Estimate
e3	↔	e10	-,423
e3	↔	e2	,319
e5	↔	e2	,379
e8	↔	e7	,323
e7	↔	e6	,271
e5	↔	e1	-,303
e7	↔	e9	-,235
e5	↔	e10	-,279
e7	↔	e1	-,249

Variances: (Group number 1 - Project Management)

	Estimate	S.E.	C.R.	P	Label
Project Management	2,152	,321	6,701	***	V1
e8	,770	,094	8,186	***	V2
e7	,454	,066	6,868	***	V3
e6	,640	,081	7,951	***	V4
e5	,714	,096	7,429	***	V5
e3	,686	,085	8,033	***	V7
e2	,803	,095	8,473	***	V8
e1	,660	,087	7,581	***	V9
e10	,388	,062	6,305	***	V10
e9	,767	,093	8,251	***	V11

Squared Multiple Correlations: (Group number 1 - Project Management)

	Estimate
GP09	,718
GP10	,875
GP01	,792
GP02	,695
GP03	,699
GP05	,725
GP06	,785
GP07	,844
GP08	,736

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Project Management	27	23,493	18	,172	1,305
Saturated model	45	,000	0		
Independence model	9	1667,538	36	,000	46,321

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Project Management	,044	,968	,921	,387
Saturated model	,000	1,000		
Independence model	1,927	,177	-,028	,142

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Project Management	,986	,972	,997	,993	,997
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Project Management	,500	,493	,498
Saturated model	,000	,000	,000
Independence model	1,000	,000	,000

NCP

Model	NCP	LO 90	HI 90
Project Management	5,493	,000	22,197
Saturated model	,000	,000	,000
Independence model	1631,538	1501,566	1768,876

FMIN

Model	FMIN	F0	LO 90	HI 90
Project Management	,151	,035	,000	,142
Saturated model	,000	,000	,000	,000
Independence model	10,689	10,459	9,625	11,339

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Project Management	,044	,000	,089	,536
Independence model	,539	,517	,561	,000

AIC

Model	AIC	BCC	BIC	CAIC
Project Management	77,493	81,192	160,012	187,012
Saturated model	90,000	96,164	227,531	272,531
Independence model	1685,538	1686,771	1713,044	1722,044

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Project Management	,497	,462	,604	,520
Saturated model	,577	,577	,577	,616
Independence model	10,805	9,972	11,685	10,813

HOELTER

Model	HOELTER .05	HOELTER .01
Project Management	192	232
Independence model	5	6

Appendix K Confirmatory Factor Analysis of Organisational Maturity

Analysis Summary

Date and Time: 27 de dezembro de 2016, 15:20:45

Title: Organisational Maturity

Groups: Group number 1 (Group number 1). Notes for Group (Group number 1)

The model is recursive. **Sample size = 139**

Variable Summary (Group number 1)

Your model contains the following variables (Group number 1)

Observed, endogenous variables : MAT08, MAT07, MAT06, MAT05, MAT04, MAT02

Unobserved, exogenous variables: e7, e6, e5, e4, e2, Organisational_Maturity, e1

Variable counts (Group number 1)

Number of variables in your model:	13
Number of observed variables:	6
Number of unobserved variables:	7
Number of exogenous variables:	7
Number of endogenous variables:	6

Parameter Summary (Group number 1)

	Weights	**Covariances**	**Variances**	**Means**	**Intercepts**	**Total**
Fixed	7	0	0	0	0	7
Labeled	0	0	1	0	0	1
Unlabeled	5	0	6	0	0	11
Total	12	0	7	0	0	19

Assessment of normality (Group number 1)

Variable	**min**	**max**	**skew**	**c.r.**	**kurtosis**	**c.r.**
MAT02	1,000	5,000	,579	2,787	-,632	-1,520
MAT04	1,000	5,000	,549	2,642	-,685	-1,648
MAT05	1,000	5,000	,584	2,812	-,745	-1,793
MAT06	1,000	5,000	,863	4,154	-,399	-,959
MAT07	1,000	5,000	,521	2,507	-,735	-1,768
MAT08	1,000	5,000	,617	2,967	-,496	-1,195
Multivariate					29,036	17,470

Observations farthest from the centroid (Mahalanobis distance) (Group number 1)

Models

Organisational Maturity (Organisational Maturity)

Notes for Model (Organisational Maturity)

Computation of degrees of freedom (Organisational Maturity)

Number of distinct sample moments:	21
Number of distinct parameters to be estimated:	12
Degrees of freedom (21 - 12):	9

Result (Organisational Maturity)

Minimum was achieved
Chi-square = 8,163
Degrees of freedom = 9
Probability level = ,518

Group number 1 (Group number 1 - Organisational Maturity)

Estimates (Group number 1 - Organisational Maturity)
Scalar Estimates (Group number 1 - Organisational Maturity)
Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Organisational Maturity)

			Estimate	S.E.	C.R.	P	Label
MAT05	←	Organisational_Maturity	1,000				
MAT06	←	Organisational_Maturity	,926	,078	11,909	***	
MAT07	←	Organisational_Maturity	,938	,066	14,268	***	
MAT08	←	Organisational_Maturity	,830	,069	11,991	***	
MAT04	←	Organisational_Maturity	,799	,073	10,922	***	
MAT02	←	Organisational_Maturity	,884	,066	13,484	***	

Standardized Regression Weights: (Group number 1 - Organisational Maturity)

			Estimate
MAT05	←	Organisational_Maturity	,876
MAT06	←	Organisational_Maturity	,796
MAT07	←	Organisational_Maturity	,878
MAT08	←	Organisational_Maturity	,799
MAT04	←	Organisational_Maturity	,756
MAT02	←	Organisational_Maturity	,853

Variances: (Group number 1 - Organisational Maturity)

	Estimate	S.E.	C.R.	P	Label
Organisational_Maturity	1,338	,208	6,427	***	V1
e7	,521	,072	7,254	***	
e6	,349	,056	6,276	***	
e5	,663	,091	7,277	***	
e4	,404	,064	6,314	***	
e2	,642	,085	7,517	***	
e1	,392	,058	6,708	***	

Squared Multiple Correlations: (Group number 1 - Organisational Maturity)

	Estimate
MAT02	,727
MAT04	,571
MAT05	,768
MAT06	,634
MAT07	,771
MAT08	,639

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Organisational Maturity	12	8,163	9	,518	,907
Saturated model	21	,000	0		
Independence model	6	613,416	15	,000	40,894

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Organisational Maturity	,024	,981	,955	,420
Saturated model	,000	1,000		
Independence model	,911	,299	,019	,214

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Organisational Maturity	,987	,978	1,001	1,002	1,000
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Organisational Maturity	,600	,592	,600
Saturated model	,000	,000	,000
Independence model	1,000	,000	,000

NCP

Model	NCP	LO 90	HI 90
Organisational Maturity	,000	,000	9,947
Saturated model	,000	,000	,000
Independence model	598,416	521,101	683,138

FMIN

Model	FMIN	F0	LO 90	HI 90
Organisational Maturity	,059	,000	,000	,072
Saturated model	,000	,000	,000	,000
Independence model	4,445	4,336	3,776	4,950

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Organisational Maturity	,000	,000	,089	,743
Independence model	,538	,502	,574	,000

AIC

Model	AIC	BCC	BIC	CAIC
Organisational Maturity	32,163	33,445	67,377	79,377
Saturated model	42,000	44,244	103,624	124,624
Independence model	625,416	626,058	643,023	649,023

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Organisational Maturity	,233	,239	,311	,242
Saturated model	,304	,304	,304	,321
Independence model	4,532	3,972	5,146	4,537

HOELTER

Model	HOELTER .05	HOELTE .01
Organisational Maturity	287	367
Independence model	6	7

Appendix L Confirmatory Factor Analysis of Project Success

Analysis Summary

Date and Time: Date: 26 de dezembro de 2016, 18:35:42

Title: New cfa success scale

Groups: Group number 1 (Group number 1). Notes for Group (Group number 1)

The model is recursive. **Sample size = 139**

Variable Summary (Group number 1). Your model contains the following variables (Group number 1)
Observed, endogenous variables: SP18, SP12, SP13, SP06, SP09, SP11, SP03, SP14, SP15, SP17, SP04, SP10, SP01

Unobserved, exogenous variables: e13, e8, e9, e4, e5, e7, e2, e10, e11, e12, Project Success, e3, e6, e1

Variable counts (Group number 1)

Number of variables in your model:	27
Number of observed variables:	13
Number of unobserved variables:	14
Number of exogenous variables:	14
Number of endogenous variables:	13

Parameter Summary (Group number 1)

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	14	0	0	0	0	14
Labeled	0	0	1	0	0	1
Unlabeled	12	24	13	0	0	49
Total	26	24	14	0	0	64

Assessment of normality (Group number 1)

Variable	min	max	skew	c.r.	kurtosis	c.r.
SP01	1,000	7,000	-,783	-3,769	,244	,588
SP10	1,000	7,000	-1,002	-4,824	,891	2,145
SP04	1,000	7,000	-,585	-2,813	-,489	-1,176
SP17	1,000	7,000	-1,420	-6,835	2,309	5,558
SP15	1,000	7,000	-1,482	-7,134	2,251	5,418
SP14	1,000	7,000	-1,571	-7,561	2,807	6,756
SP03	1,000	7,000	-,864	-4,159	,164	,395
SP11	1,000	7,000	-1,309	-6,301	1,689	4,065
SP09	1,000	7,000	-,940	-4,524	,727	1,749
SP06	1,000	7,000	-,791	-3,806	,142	,341
SP13	1,000	7,000	-1,210	-5,822	1,283	3,087
SP12	1,000	7,000	-1,348	-6,486	2,348	5,650
SP18	1,000	7,000	-1,342	-6,458	1,879	4,521
Multivariate					152,853	45,627

Models

Project Success (subscales) (Project Success (subscales))

Notes for Model (Project Success (subscales))

Computation of degrees of freedom (Project Success (subscales))

Number of distinct sample moments:	91
Number of distinct parameters to be estimated:	50
Degrees of freedom (91 - 50):	41

Result (Project Success (subscales))

Minimum was achieved

Chi-square = 73,008

Degrees of freedom = 41

Probability level = ,002

Group number 1 (Group number 1 - Project Success (subscales)

Estimates (Group number 1 - Project Success (subscales)

Scalar Estimates (Group number 1 - Project Success (subscales)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Project Success (subscales)

			Estimate	S.E.	C.R.	P	Label
SP18	←	Project_Success	,926	,084	11,037	***	
SP17	←	Project_Success	,916	,066	13,973	***	
SP15	←	Project_Success	,966	,084	11,505	***	
SP14	←	Project_Success	,896	,072	12,435	***	
SP09	←	Project_Success	,905	,076	11,987	***	
SP06	←	Project_Success	,986	,065	15,186	***	
SP13	←	Project_Success	1,047	,085	12,291	***	
SP11	←	Project_Success	,979	,069	14,273	***	
SP12	←	Project_Success	,900	,065	13,881	***	
SP04	←	Project_Success	,978	,073	13,476	***	
SP03	←	Project_Success	1,000				
SP10	←	Project_Success	,893	,083	10,769	***	
SP01	←	Project_Success	,931	,050	18,786	***	

Standardized Regression Weights: (Group number 1 - Project Success (subscales))

			Estimate
SP18	←	Project_Success	,841
SP17	←	Project_Success	,883
SP15	←	Project_Success	,811
SP14	←	Project_Success	,844
SP09	←	Project_Success	,809
SP06	←	Project_Success	,807
SP13	←	Project_Success	,876
SP11	←	Project_Success	,897
SP12	←	Project_Success	,883
SP04	←	Project_Success	,730
SP03	←	Project_Success	,853
SP10	←	Project_Success	,756
SP01	←	Project_Success	,808

Covariances: (Group number 1 - Project Success (subscales))

			Estimate	S.E.	C.R.	P	Label
e13	↔	e2	-,159	,037	-4,255	***	
e13	↔	e10	,151	,040	3,760	***	
e8	↔	e7	,081	,032	2,533	,011	
e8	↔	e6	-,126	,035	-3,561	***	
e9	↔	e2	-,117	,036	-3,276	,001	
e2	↔	e11	-,049	,035	-1,431	,152	
e9	↔	e1	-,085	,036	-2,365	,018	
e4	↔	e2	,211	,062	3,418	***	
e2	↔	e10	-,026	,026	-,999	,318	
e4	↔	e3	,297	,077	3,852	***	
e4	↔	e12	-,031	,032	-,991	,322	
e5	↔	e6	,191	,057	3,329	***	
e2	↔	e3	,319	,072	4,411	***	
e2	↔	e1	,311	,062	5,041	***	
e10	↔	e12	,117	,030	3,914	***	
e11	↔	e12	,104	,037	2,840	,005	
e3	↔	e1	,394	,079	5,001	***	
e3	↔	e6	,204	,058	3,532	***	
e9	↔	e10	,002	,030	,071	,943	
e9	↔	e11	,163	,049	3,325	***	
e4	↔	e1	,198	,064	3,117	,002	
e13	↔	e7	-,109	,031	-3,542	***	
e13	↔	e1	-,121	,037	-3,311	***	
e8	↔	e10	,075	,026	2,877	,004	

Correlations: (Group number 1 - Project Success (subscales))

			Estimate
e13	↔	e2	-,356
e13	↔	e10	,362
e8	↔	e7	,285
e8	↔	e6	-,278
e9	↔	e2	-,269
e2	↔	e11	-,094
e9	↔	e1	-,176
e4	↔	e2	,389
e2	↔	e10	-,062
e4	↔	e3	,367
e4	↔	e12	-,072
e5	↔	e6	,306
e2	↔	e3	,465
e2	↔	e1	,608
e10	↔	e12	,344
e11	↔	e12	,249
e3	↔	e1	,517
e3	↔	e6	,235
e9	↔	e10	,005
e9	↔	e11	,330
e4	↔	e1	,329
e13	↔	e7	-,308
e13	↔	e1	-,245
e8	↔	e10	,224

Variances: (Group number 1 - Project Success (subscales))

	Estimate	S.E.	C.R.	P	Label
Project_Success	1,226	,199	6,174	***	V1
e13	,434	,060	7,269	***	
e8	,282	,039	7,132	***	
e9	,409	,058	7,073	***	
e4	,640	,085	7,514	***	
e5	,532	,068	7,790	***	
e7	,287	,044	6,540	***	
e2	,460	,067	6,827	***	
e10	,398	,054	7,318	***	
e11	,596	,078	7,673	***	
e12	,292	,039	7,442	***	
e3	1,024	,126	8,117	***	
e6	,733	,091	8,042	***	
e1	,568	,078	7,319	***	

Squared Multiple Correlations: (Group number 1 - Project Success (subscales))

	Estimate
SP01	,652
SP10	,572
SP04	,534
SP17	,779
SP15	,657
SP14	,712
SP03	,727
SP11	,804
SP09	,654
SP06	,651
SP13	,767
SP12	,779
SP18	,708

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Project Success (subscales)	50	73,008	41	,002	1,781
Saturated model	91	,000	0		
Independence model	13	2100,741	78	,000	26,933

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Project Success (subscales)	,051	,925	,835	,417
Saturated model	,000	1,000		
Independence model	1,050	,143	,001	,123

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Project Success (subscales)	,965	,934	,984	,970	,984
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Project Success (subscales)	,526	,507	,517
Saturated model	,000	,000	,000
Independence model	1,000	,000	,000

NCP

Model	NCP	LO 90	HI 90
Project Success (subscales)	32,008	12,002	59,856
Saturated model	,000	,000	,000
Independence model	2022,741	1876,999	2175,843

FMIN

Model	FMIN	F0	LO 90	HI 90
Project Success (subscales)	,529	,232	,087	,434
Saturated model	,000	,000	,000	,000
Independence model	15,223	14,658	13,601	15,767

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Project Success (subscales)	,075	,046	,103	,074
Independence model	,433	,418	,450	,000

AIC

Model	AIC	BCC	BIC	CAIC
Project Success (subscales)	173,008	184,299	319,732	369,732
Saturated model	182,000	202,548	449,037	540,037
Independence model	2126,741	2129,676	2164,889	2177,889

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Project Success (subscales)	1,254	1,109	1,455	1,335
Saturated model	1,319	1,319	1,319	1,468
Independence model	15,411	14,355	16,521	15,432

HOELTER

Model	HOELTER .05	HOELTER .01
Project Success (subscales)	108	123
Independence model	7	8

Appendix M Structural Equation Modeling (SEM)

Analysis Summary

Date and Time: 27 de dezembro de 2016, 15:26:03

Title: New mediation model (26 dec)

Groups: Group number 1 (Group number 1). Notes for Group (Group number 1)

The model is recursive.

Sample size = 139

Variable Summary (Group number 1)

Your model contains the following variables (Group number 1)

Observed, endogenous variables: SP14, SP09, SP10, SP03, SP04, SP06, SP01, SP11, SP12, SP13, MAT02, MAT08, MAT07, MAT06, MAT05, GP10, GP05, GP06, GP01, GP02, GP03, GP07, GP08, GP09, MAT04, SP15, SP17, SP18

Unobserved, endogenous variables: Project Success, Project Management

Unobserved, exogenous variables: e25, e20, e21, e17, e18, e19, e16, e22, e23, e24, e1, e6, e5, e4, e3, Organiz_Maturity, e15, e10, e11, e7, e8, e9, e12, e13, e14, d1, d2, e2, e26, e27, e28

Variable counts (Group number 1)

Number of variables in your model:	61
Number of observed variables:	28
Number of unobserved variables:	33
Number of exogenous variables:	31
Number of endogenous variables:	30

Parameter Summary (Group number 1)

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	33	0	0	0	0	33
Labeled	0	0	1	0	0	1
Unlabeled	28	29	30	0	0	87
Total	61	29	31	0	0	121

Assessment of normality (Group number 1)

Variable	min	max	skew	c.r.	kurtosis	c.r.
SP18	1,000	7,000	-1,342	-6,458	1,879	4,521
SP17	1,000	7,000	-1,420	-6,835	2,309	5,558
SP15	1,000	7,000	-1,482	-7,134	2,251	5,418
MAT04	1,000	5,000	,549	2,642	-,685	-1,648
GP09	1,000	7,000	-,395	-1,901	-,882	-2,122
GP08	1,000	7,000	,072	,345	-1,000	-2,406
GP07	1,000	7,000	-,189	-,912	-1,099	-2,646
GP03	1,000	7,000	-,668	-3,216	-,571	-1,375
GP02	1,000	7,000	-,551	-2,652	-,822	-1,978
GP01	1,000	7,000	-,379	-1,826	-,903	-2,174
GP06	1,000	7,000	-,364	-1,753	-,780	-1,877
GP05	1,000	7,000	-,425	-2,046	-,834	-2,008
GP10	1,000	7,000	-,363	-1,749	-,955	-2,298
MAT05	1,000	5,000	,584	2,812	-,745	-1,793
MAT06	1,000	5,000	,863	4,154	-,399	-,959
MAT07	1,000	5,000	,521	2,507	-,735	-1,768
MAT08	1,000	5,000	,617	2,967	-,496	-1,195
MAT02	1,000	5,000	,579	2,787	-,632	-1,520
SP13	1,000	7,000	-1,210	-5,822	1,283	3,087
SP12	1,000	7,000	-1,348	-6,486	2,348	5,650
SP11	1,000	7,000	-1,309	-6,301	1,689	4,065
SP01	1,000	7,000	-,783	-3,769	,244	,588
SP06	1,000	7,000	-,791	-3,806	,142	,341
SP04	1,000	7,000	-,585	-2,813	-,489	-1,176
SP03	1,000	7,000	-,864	-4,159	,164	,395
SP10	1,000	7,000	-1,002	-4,824	,891	2,145
SP09	1,000	7,000	-,940	-4,524	,727	1,749
SP14	1,000	7,000	-1,571	-7,561	2,807	6,756
Multivariate					283,330	40,749

Observations farthest from the centroid (Mahalanobis distance) (Group number 1)

Models

Mediation Model (Mediation Model)

Notes for Model (Mediation Model)

Computation of degrees of freedom (Mediation Model)

Number of distinct sample moments:	406
Number of distinct parameters to be estimated:	88
Degrees of freedom (406 - 88):	318

Result (Mediation Model)

Minimum was achieved
Chi-square = 629,142
Degrees of freedom = 318
Probability level = ,000

Group number 1 (Group number 1 - Mediation Model)

Estimates (Group number 1 - Mediation Model)
Scalar Estimates (Group number 1 - Mediation Model)
Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Mediation Model)

			Estimate	S.E.	C.R.	P	Label
Project Management	←	Organiz_Maturity	,959	,127	7,552	***	
Project_Success	←	Project Management	,539	,063	8,537	***	
Project_Success	←	Organiz_Maturity	-,148	,082	-1,797	,072	
SP14	←	Project_Success	,942	,079	11,905	***	
SP13	←	Project_Success	1,065	,088	12,158	***	
SP12	←	Project_Success	,985	,071	13,823	***	
SP11	←	Project_Success	1,052	,076	13,884	***	
SP04	←	Project_Success	1,048	,077	13,613	***	
SP03	←	Project_Success	1,062	,056	18,983	***	
SP01	←	Project_Success	1,000				
SP10	←	Project_Success	,973	,092	10,623	***	
SP06	←	Project_Success	1,090	,090	12,129	***	
SP09	←	Project_Success	1,001	,082	12,148	***	
MAT02	←	Organiz_Maturity	1,000				
MAT05	←	Organiz_Maturity	1,125	,084	13,392	***	
MAT06	←	Organiz_Maturity	1,052	,091	11,580	***	
MAT07	←	Organiz_Maturity	1,060	,078	13,560	***	
MAT08	←	Organiz_Maturity	,942	,081	11,638	***	
GP10	←	Project Management	1,000				
GP09	←	Project Management	,846	,056	15,163	***	
GP08	←	Project Management	,888	,059	15,015	***	
GP07	←	Project Management	,964	,050	19,148	***	
GP02	←	Project Management	,878	,056	15,709	***	
GP01	←	Project Management	,970	,055	17,611	***	
GP06	←	Project Management	,945	,053	17,887	***	
GP03	←	Project Management	,805	,061	13,273	***	
GP05	←	Project Management	,844	,057	14,710	***	
MAT04	←	Organiz_Maturity	,908	,085	10,667	***	
SP15	←	Project_Success	1,017	,088	11,522	***	
SP17	←	Project_Success	,946	,075	12,616	***	
SP18	←	Project_Success	,916	,082	11,208	***	

Standardized Regression Weights: (Group number 1 - Mediation Model)

			Estimate
Project Management	←	Organiz_Maturity	,615
Project_Success	←	Project Management	,824
Project_Success	←	Organiz_Maturity	-,145
SP14	←	Project_Success	,827
SP13	←	Project_Success	,837
SP12	←	Project_Success	,912
SP11	←	Project_Success	,908
SP04	←	Project_Success	,741
SP03	←	Project_Success	,859
SP01	←	Project_Success	,820
SP10	←	Project_Success	,773
SP06	←	Project_Success	,842
SP09	←	Project_Success	,843
MAT02	←	Organiz_Maturity	,853
MAT05	←	Organiz_Maturity	,871
MAT06	←	Organiz_Maturity	,800
MAT07	←	Organiz_Maturity	,877
MAT08	←	Organiz_Maturity	,802
GP10	←	Project Management	,918
GP09	←	Project Management	,848
GP08	←	Project Management	,844
GP07	←	Project Management	,925
GP02	←	Project Management	,859
GP01	←	Project Management	,899
GP06	←	Project Management	,901
GP03	←	Project Management	,852
GP05	←	Project Management	,839
MAT04	←	Organiz_Maturity	,759
SP15	←	Project_Success	,808
SP17	←	Project_Success	,857
SP18	←	Project_Success	,793

Correlations: (Group number 1 - Mediation Model)

			Estimate
e26	↔	e27	,260
e12	↔	e13	,332
e10	↔	e8	,378
e24	↔	e26	,394
e18	↔	e16	,467
e17	↔	e16	,564
e17	↔	e18	,400
e25	↔	e27	,423
e25	↔	e28	,498
e8	↔	e9	,272
e24	↔	e28	,225
e21	↔	e23	-,500
e20	↔	e21	,282
e10	↔	e12	,192
e10	↔	e7	-,237
e21	↔	e18	,209
e20	↔	e23	-,396
e18	↔	e19	,158
e21	↔	e19	-,168
e19	↔	e23	-,287
e25	↔	e18	-,161
e25	↔	e19	-,159
e27	↔	e28	,229
e12	↔	e14	-,297
e8	↔	e13	-,137
e17	↔	e19	,172
e7	↔	e12	-,324
e10	↔	e11	,038
e15	↔	e9	-,365

Variances: (Group number 1 - Mediation Model)

	Estimate	S.E.	C.R.	P	Label
Organiz_Maturity	1,045	,170	6,158	***	v1
d1	1,584	,234	6,766	***	
d2	,486	,085	5,690	***	
e25	,446	,057	7,838	***	
e20	,446	,061	7,280	***	
e21	,696	,091	7,665	***	
e17	,434	,055	7,827	***	
e18	,981	,118	8,314	***	
e19	,530	,074	7,209	***	
e16	,529	,067	7,916	***	
e22	,258	,035	7,313	***	
e23	,215	,034	6,246	***	
e24	,528	,066	7,966	***	
e1	,391	,058	6,768	***	
e6	,514	,071	7,274	***	
e5	,351	,055	6,375	***	
e4	,653	,089	7,292	***	
e3	,420	,065	6,488	***	
e15	,473	,068	7,003	***	
e10	,764	,101	7,554	***	
e11	,526	,071	7,413	***	
e7	,571	,081	7,079	***	
e8	,698	,089	7,869	***	
e9	,625	,082	7,615	***	
e12	,398	,063	6,359	***	
e13	,808	,105	7,663	***	
e14	,712	,093	7,634	***	
e2	,635	,084	7,533	***	
e26	,598	,074	8,096	***	
e27	,353	,044	7,923	***	
e28	,538	,066	8,148	***	

Squared Multiple Correlations: (Group number 1 - Mediation Model)

	Estimate
Project Management	,378
Project_Success	,553
SP18	,630
SP17	,734
SP15	,653
MAT04	,576
GP09	,719
GP08	,713
GP07	,856
GP03	,725
GP02	,738
GP01	,808
GP06	,812
GP05	,704
GP10	,843
MAT05	,759
MAT06	,639
MAT07	,770
MAT08	,643
MAT02	,728
SP13	,701
SP12	,831
SP11	,824
SP01	,673
SP06	,709
SP04	,549
SP03	,739
SP10	,597
SP09	,710
SP14	,684

Matrices (Group number 1 - Mediation Model)

Implied Covariances (Group number 1 - Mediation Model)

Implied Correlations (Group number 1 - Mediation Model)

Total Effects (Group number 1 - Mediation Model)

	Organiz_Maturity	**Project Management**	**Project_Success**
Project Management	,959	,000	,000
Project_Success	,369	,539	,000
SP18	,338	,494	,916
SP17	,349	,510	,946
SP15	,375	,548	1,017
MAT04	,908	,000	,000
GP09	,811	,846	,000
GP08	,852	,888	,000
GP07	,925	,964	,000
GP03	,772	,805	,000
GP02	,842	,878	,000
GP01	,931	,970	,000
GP06	,907	,945	,000
GP05	,810	,844	,000
GP10	,959	1,000	,000
MAT05	1,125	,000	,000
MAT06	1,052	,000	,000
MAT07	1,060	,000	,000
MAT08	,942	,000	,000
MAT02	1,000	,000	,000
SP13	,393	,574	1,065
SP12	,363	,531	,985
SP11	,388	,567	1,052
SP01	,369	,539	1,000
SP06	,402	,588	1,090
SP04	,387	,565	1,048
SP03	,392	,572	1,062
SP10	,359	,524	,973
SP09	,369	,540	1,001
SP14	,347	,507	,942

Standardized Total Effects (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,615	,000	,000
Project_Success	,362	,824	,000
SP18	,287	,654	,793
SP17	,310	,706	,857
SP15	,292	,666	,808
MAT04	,759	,000	,000
GP09	,521	,848	,000
GP08	,519	,844	,000
GP07	,569	,925	,000
GP03	,523	,852	,000
GP02	,528	,859	,000
GP01	,552	,899	,000
GP06	,554	,901	,000
GP05	,516	,839	,000
GP10	,564	,918	,000
MAT05	,871	,000	,000
MAT06	,800	,000	,000
MAT07	,877	,000	,000
MAT08	,802	,000	,000
MAT02	,853	,000	,000
SP13	,303	,690	,837
SP12	,330	,751	,912
SP11	,328	,748	,908
SP01	,297	,676	,820
SP06	,305	,694	,842
SP04	,268	,611	,741
SP03	,311	,708	,859
SP10	,279	,637	,773
SP09	,305	,694	,843
SP14	,299	,681	,827

Direct Effects (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,959	,000	,000
Project_Success	-,148	,539	,000
SP18	,000	,000	,916
SP17	,000	,000	,946
SP15	,000	,000	1,017
MAT04	,908	,000	,000
GP09	,000	,846	,000
GP08	,000	,888	,000
GP07	,000	,964	,000
GP03	,000	,805	,000
GP02	,000	,878	,000
GP01	,000	,970	,000
GP06	,000	,945	,000
GP05	,000	,844	,000
GP10	,000	1,000	,000
MAT05	1,125	,000	,000
MAT06	1,052	,000	,000
MAT07	1,060	,000	,000
MAT08	,942	,000	,000
MAT02	1,000	,000	,000
SP13	,000	,000	1,065
SP12	,000	,000	,985
SP11	,000	,000	1,052
SP01	,000	,000	1,000
SP06	,000	,000	1,090
SP04	,000	,000	1,048
SP03	,000	,000	1,062
SP10	,000	,000	,973
SP09	,000	,000	1,001
SP14	,000	,000	,942

Standardized Direct Effects (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,615	,000	,000
Project_Success	-,145	,824	,000
SP18	,000	,000	,793
SP17	,000	,000	,857
SP15	,000	,000	,808
MAT04	,759	,000	,000
GP09	,000	,848	,000
GP08	,000	,844	,000
GP07	,000	,925	,000
GP03	,000	,852	,000
GP02	,000	,859	,000
GP01	,000	,899	,000
GP06	,000	,901	,000
GP05	,000	,839	,000
GP10	,000	,918	,000
MAT05	,871	,000	,000
MAT06	,800	,000	,000
MAT07	,877	,000	,000
MAT08	,802	,000	,000
MAT02	,853	,000	,000
SP13	,000	,000	,837
SP12	,000	,000	,912
SP11	,000	,000	,908
SP01	,000	,000	,820
SP06	,000	,000	,842
SP04	,000	,000	,741
SP03	,000	,000	,859
SP10	,000	,000	,773
SP09	,000	,000	,843
SP14	,000	,000	,827

Indirect Effects (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,000	,000	,000
Project_Success	,517	,000	,000
SP18	,338	,494	,000
SP17	,349	,510	,000
SP15	,375	,548	,000
MAT04	,000	,000	,000
GP09	,811	,000	,000
GP08	,852	,000	,000
GP07	,925	,000	,000
GP03	,772	,000	,000
GP02	,842	,000	,000
GP01	,931	,000	,000
GP06	,907	,000	,000
GP05	,810	,000	,000
GP10	,959	,000	,000
MAT05	,000	,000	,000
MAT06	,000	,000	,000
MAT07	,000	,000	,000
MAT08	,000	,000	,000
MAT02	,000	,000	,000
SP13	,393	,574	,000
SP12	,363	,531	,000
SP11	,388	,567	,000
SP01	,369	,539	,000
SP06	,402	,588	,000
SP04	,387	,565	,000
SP03	,392	,572	,000
SP10	,359	,524	,000
SP09	,369	,540	,000
SP14	,347	,507	,000

Standardized Indirect Effects (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,000	,000	,000
Project_Success	,507	,000	,000
SP18	,287	,654	,000
SP17	,310	,706	,000
SP15	,292	,666	,000
MAT04	,000	,000	,000
GP09	,521	,000	,000
GP08	,519	,000	,000
GP07	,569	,000	,000
GP03	,523	,000	,000
GP02	,528	,000	,000
GP01	,552	,000	,000
GP06	,554	,000	,000
GP05	,516	,000	,000
GP10	,564	,000	,000
MAT05	,000	,000	,000
MAT06	,000	,000	,000
MAT07	,000	,000	,000
MAT08	,000	,000	,000
MAT02	,000	,000	,000
SP13	,303	,690	,000
SP12	,330	,751	,000
SP11	,328	,748	,000
SP01	,297	,676	,000
SP06	,305	,694	,000
SP04	,268	,611	,000
SP03	,311	,708	,000
SP10	,279	,637	,000
SP09	,305	,694	,000
SP14	,299	,681	,000

Modification Indices (Group number 1 - Mediation Model)

Covariances: (Group number 1 - Mediation Model)

			M.I.	Par Change
e23	↔	e15	11,511	-,103

Variances: (Group number 1 - Mediation Model)

	M.I.	Par Change

Regression Weights: (Group number 1 - Mediation Model)

	M.I.	Par Change

Bootstrap (Group number 1 - Mediation Model)

Bootstrap standard errors (Group number 1 - Mediation Model)

Scalar Estimates (Group number 1 - Mediation Model)

Regression Weights: (Group number 1 - Mediation Model)

Parameter			SE	SE-SE	Mean	Bias	SE-Bias
Project Management	←	Organiz_Maturity	,113	,001	,959	,000	,002
Project_Success	←	Project Management	,074	,001	,539	,000	,001
Project_Success	←	Organiz_Maturity	,069	,001	-,146	,002	,001
SP14	←	Project_Success	,098	,001	,941	,000	,001
SP13	←	Project_Success	,098	,001	1,073	,008	,001
SP12	←	Project_Success	,099	,001	,986	,001	,001
SP11	←	Project_Success	,080	,001	1,057	,005	,001
SP04	←	Project_Success	,086	,001	1,051	,002	,001
SP03	←	Project_Success	,066	,001	1,065	,003	,001
SP01	←	Project_Success	,000	,000	1,000	,000	,000
SP10	←	Project_Success	,100	,001	,973	,000	,001
SP06	←	Project_Success	,082	,001	1,095	,005	,001
SP09	←	Project_Success	,084	,001	1,002	,001	,001
MAT02	←	Organiz_Maturity	,000	,000	1,000	,000	,000
MAT05	←	Organiz_Maturity	,062	,001	1,131	,006	,001
MAT06	←	Organiz_Maturity	,105	,001	1,055	,003	,001
MAT07	←	Organiz_Maturity	,081	,001	1,069	,009	,001
MAT08	←	Organiz_Maturity	,092	,001	,952	,010	,001
GP10	←	Project Management	,000	,000	1,000	,000	,000
GP09	←	Project Management	,048	,000	,848	,002	,001
GP08	←	Project Management	,053	,001	,888	,000	,001
GP07	←	Project Management	,044	,000	,966	,002	,001
GP02	←	Project Management	,051	,001	,878	,001	,001
GP01	←	Project Management	,050	,000	,972	,002	,001
GP06	←	Project Management	,051	,001	,948	,003	,001
GP03	←	Project Management	,054	,001	,805	,001	,001
GP05	←	Project Management	,058	,001	,846	,002	,001
MAT04	←	Organiz_Maturity	,092	,001	,913	,005	,001
SP15	←	Project_Success	,089	,001	1,023	,005	,001

SP17	←	Project_Success	,093	,001	,946	,000	,001
SP18	←	Project_Success	,090	,001	,914	-,002	,001

Standardized Regression Weights: (Group number 1 - Mediation Model)

Parameter			SE	SE-SE	Mean	Bias	SE-Bias
Project Management	←	Organiz_Maturity	,060	,001	,611	-,004	,001
Project_Success	←	Project Management	,062	,001	,822	-,002	,001
Project_Success	←	Organiz_Maturity	,069	,001	-,144	,001	,001
SP14	←	Project_Success	,049	,000	,821	-,006	,001
SP13	←	Project_Success	,037	,000	,837	,000	,001
SP12	←	Project_Success	,032	,000	,907	-,005	,000
SP11	←	Project_Success	,024	,000	,908	,000	,000
SP04	←	Project_Success	,051	,001	,738	-,004	,001
SP03	←	Project_Success	,034	,000	,857	-,002	,000
SP01	←	Project_Success	,047	,000	,818	-,002	,001
SP10	←	Project_Success	,057	,001	,769	-,003	,001
SP06	←	Project_Success	,035	,000	,840	-,003	,000
SP09	←	Project_Success	,043	,000	,840	-,003	,001
MAT02	←	Organiz_Maturity	,041	,000	,850	-,003	,001
MAT05	←	Organiz_Maturity	,033	,000	,870	-,001	,000
MAT06	←	Organiz_Maturity	,055	,001	,795	-,004	,001
MAT07	←	Organiz_Maturity	,045	,000	,879	,002	,001
MAT08	←	Organiz_Maturity	,051	,001	,804	,002	,001
GP10	←	Project Management	,019	,000	,917	-,001	,000
GP09	←	Project Management	,033	,000	,848	,000	,000
GP08	←	Project Management	,035	,000	,843	-,002	,000
GP07	←	Project Management	,021	,000	,924	-,001	,000
GP02	←	Project Management	,027	,000	,857	-,002	,000
GP01	←	Project Management	,023	,000	,898	-,001	,000
GP06	←	Project Management	,020	,000	,901	,000	,000
GP03	←	Project Management	,031	,000	,850	-,001	,000
GP05	←	Project Management	,029	,000	,837	-,002	,000
MAT04	←	Organiz_Maturity	,059	,001	,756	-,002	,001
SP15	←	Project_Success	,058	,001	,809	,001	,001
SP17	←	Project_Success	,040	,000	,853	-,004	,001
SP18	←	Project_Success	,051	,001	,785	-,008	,001

Covariances: (Group number 1 - Mediation Model)

Parameter			SE	SE-SE	Mean	Bias	SE-Bias
e26	↔	e27	,055	,001	,115	-,004	,001
e12	↔	e13	,070	,001	,193	,005	,001
e10	↔	e8	,085	,001	,275	-,001	,001
e24	↔	e26	,112	,001	,224	,003	,002
e18	↔	e16	,116	,001	,334	-,003	,002
e17	↔	e16	,077	,001	,267	-,004	,001
e17	↔	e18	,077	,001	,260	-,001	,001
e25	↔	e27	,069	,001	,168	,000	,001
e25	↔	e28	,071	,001	,246	,002	,001
e8	↔	e9	,074	,001	,184	,004	,001
e24	↔	e28	,084	,001	,121	,001	,001
e21	↔	e23	,053	,001	-,184	,009	,001
e20	↔	e21	,093	,001	,155	-,002	,001
e10	↔	e12	,071	,001	,104	-,002	,001
e10	↔	e7	,057	,001	-,151	,005	,001
e21	↔	e18	,075	,001	,172	-,001	,001
e20	↔	e23	,040	,000	-,117	,006	,001
e18	↔	e19	,112	,001	,121	,007	,002
e21	↔	e19	,070	,001	-,093	,009	,001
e19	↔	e23	,048	,000	-,093	,004	,001
e25	↔	e18	,059	,001	-,096	,011	,001
e25	↔	e19	,063	,001	-,074	,003	,001
e27	↔	e28	,064	,001	,104	,004	,001
e12	↔	e14	,075	,001	-,159	-,001	,001
e8	↔	e13	,080	,001	-,094	,009	,001
e17	↔	e19	,048	,000	,079	-,003	,001
e7	↔	e12	,068	,001	-,149	,006	,001
e10	↔	e11	,066	,001	,022	-,002	,001
e15	↔	e9	,075	,001	-,194	,005	,001

Correlations: (Group number 1 - Mediation Model)

Parameter			SE	SE-SE	Mean	Bias	SE-Bias
e26	↔	e27	,123	,001	,264	,004	,002
e12	↔	e13	,097	,001	,341	,010	,001
e10	↔	e8	,100	,001	,378	,000	,001
e24	↔	e26	,135	,001	,393	-,001	,002
e18	↔	e16	,105	,001	,459	-,008	,001
e17	↔	e16	,088	,001	,558	-,006	,001
e17	↔	e18	,087	,001	,400	-,001	,001
e25	↔	e27	,130	,001	,420	-,003	,002
e25	↔	e28	,100	,001	,502	,003	,001
e8	↔	e9	,113	,001	,284	,012	,002
e24	↔	e28	,135	,001	,221	-,003	,002
e21	↔	e23	,099	,001	-,481	,019	,001
e20	↔	e21	,152	,002	,281	-,001	,002
e10	↔	e12	,113	,001	,180	-,011	,002
e10	↔	e7	,088	,001	-,234	,002	,001
e21	↔	e18	,079	,001	,208	-,001	,001
e20	↔	e23	,141	,001	-,392	,004	,002
e18	↔	e19	,143	,001	,160	,002	,002
e21	↔	e19	,111	,001	-,153	,016	,002
e19	↔	e23	,156	,002	-,287	,000	,002
e25	↔	e18	,086	,001	-,145	,016	,001
e25	↔	e19	,122	,001	-,151	,008	,002
e27	↔	e28	,145	,001	,243	,013	,002
e12	↔	e14	,148	,001	-,308	-,011	,002
e8	↔	e13	,107	,001	-,126	,011	,002
e17	↔	e19	,096	,001	,166	-,006	,001
e7	↔	e12	,148	,001	-,324	,000	,002
e10	↔	e11	,105	,001	,032	-,006	,001
e15	↔	e9	,135	,001	-,364	,002	,002

Variances: (Group number 1 - Mediation Model)

Parameter	SE	SE-SE	Mean	Bias	SE-Bias
Organiz_Maturity	,159	,002	1,033	-,013	,002
d1	,216	,002	1,566	-,018	,003
d2	,095	,001	,475	-,011	,001
e25	,098	,001	,444	-,002	,001
e20	,097	,001	,440	-,006	,001
e21	,159	,002	,689	-,007	,002
e17	,076	,001	,428	-,006	,001
e18	,164	,002	,976	-,005	,002
e19	,101	,001	,528	-,002	,001
e16	,104	,001	,520	-,008	,001
e22	,062	,001	,251	-,007	,001
e23	,060	,001	,217	,002	,001
e24	,129	,001	,522	-,007	,002
e1	,097	,001	,391	-,001	,001
e6	,116	,001	,499	-,016	,002
e5	,123	,001	,341	-,010	,002
e4	,148	,001	,649	-,004	,002
e3	,091	,001	,413	-,007	,001
e15	,102	,001	,473	-,001	,001
e10	,109	,001	,758	-,006	,002
e11	,087	,001	,517	-,009	,001
e7	,108	,001	,563	-,008	,002
e8	,111	,001	,693	-,005	,002
e9	,114	,001	,619	-,006	,002
e12	,102	,001	,399	,001	,001
e13	,153	,002	,800	-,008	,002
e14	,130	,001	,700	-,012	,002
e2	,138	,001	,629	-,006	,002
e26	,207	,002	,593	-,006	,003
e27	,066	,001	,347	-,005	,001
e28	,111	,001	,544	,006	,002

Squared Multiple Correlations: (Group number 1 - Mediation Model)

Parameter	SE	SE-SE	Mean	Bias	SE-Bias
Project Management	,073	,001	,377	-,001	,001
Project_Success	,069	,001	,556	,003	,001
SP18	,078	,001	,619	-,010	,001
SP17	,067	,001	,729	-,006	,001
SP15	,093	,001	,658	,005	,001
MAT04	,088	,001	,576	,000	,001
GP09	,056	,001	,720	,001	,001
GP08	,058	,001	,712	-,001	,001
GP07	,039	,000	,854	-,002	,001
GP03	,053	,001	,724	-,001	,001
GP02	,046	,000	,736	-,002	,001
GP01	,042	,000	,807	-,001	,001
GP06	,035	,000	,813	,000	,000
GP05	,048	,000	,702	-,002	,001
GP10	,035	,000	,841	-,002	,001
MAT05	,057	,001	,759	,000	,001
MAT06	,085	,001	,636	-,003	,001
MAT07	,078	,001	,775	,005	,001
MAT08	,081	,001	,649	,006	,001
MAT02	,069	,001	,724	-,004	,001
SP13	,062	,001	,702	,002	,001
SP12	,057	,001	,823	-,008	,001
SP11	,044	,000	,824	,001	,001
SP01	,076	,001	,671	-,002	,001
SP06	,058	,001	,706	-,003	,001
SP04	,074	,001	,547	-,003	,001
SP03	,057	,001	,736	-,002	,001
SP10	,086	,001	,595	-,002	,001
SP09	,071	,001	,707	-,003	,001
SP14	,079	,001	,677	-,007	,001

Bootstrap Confidence (Group number 1 - Mediation Model)

Percentile method (Group number 1 - Mediation Model)

95% confidence intervals (percentile method)

Scalar Estimates (Group number 1 - Mediation Model)

Regression Weights: (Group number 1 - Mediation Model)

Parameter			Estimate	Lower	Upper	P
Project Management	←	Organiz_Maturity	,959	,735	1,185	,000
Project_Success	←	Project Management	,539	,397	,685	,000
Project_Success	←	Organiz_Maturity	-,148	-,291	-,018	,028
SP14	←	Project_Success	,942	,744	1,132	,000
SP13	←	Project_Success	1,065	,901	1,298	,000
SP12	←	Project_Success	,985	,796	1,191	,000
SP11	←	Project_Success	1,052	,916	1,229	,000
SP04	←	Project_Success	1,048	,900	1,236	,000
SP03	←	Project_Success	1,062	,952	1,208	,000
SP01	←	Project_Success	1,000	1,000	1,000	...
SP10	←	Project_Success	,973	,792	1,187	,000
SP06	←	Project_Success	1,090	,955	1,280	,000
SP09	←	Project_Success	1,001	,846	1,175	,000
MAT02	←	Organiz_Maturity	1,000	1,000	1,000	...
MAT05	←	Organiz_Maturity	1,125	1,015	1,265	,000
MAT06	←	Organiz_Maturity	1,052	,843	1,266	,000
MAT07	←	Organiz_Maturity	1,060	,922	1,241	,000
MAT08	←	Organiz_Maturity	,942	,779	1,144	,000
GP10	←	Project Management	1,000	1,000	1,000	...
GP09	←	Project Management	,846	,752	,941	,000
GP08	←	Project Management	,888	,782	,991	,000
GP07	←	Project Management	,964	,881	1,055	,000
GP02	←	Project Management	,878	,778	,979	,000
GP01	←	Project Management	,970	,874	1,069	,000
GP06	←	Project Management	,945	,849	1,050	,000
GP03	←	Project Management	,805	,701	,911	,000
GP05	←	Project Management	,844	,733	,964	,000
MAT04	←	Organiz_Maturity	,908	,733	1,098	,000
SP15	←	Project_Success	1,017	,861	1,217	,000

SP17	←	Project_Success	,946	,759	1,134	,000
SP18	←	Project_Success	,916	,731	1,092	,000

Standardized Regression Weights: (Group number 1 - Mediation Model)

Parameter			**Estimate**	**Lower**	**Upper**	**P**
Project Management	←	Organiz_Maturity	,615	,481	,717	,000
Project_Success	←	Project Management	,824	,696	,944	,000
Project_Success	←	Organiz_Maturity	-,145	-,289	-,017	,028
SP14	←	Project_Success	,827	,715	,903	,000
SP13	←	Project_Success	,837	,757	,902	,000
SP12	←	Project_Success	,912	,830	,955	,000
SP11	←	Project_Success	,908	,854	,951	,000
SP04	←	Project_Success	,741	,629	,827	,000
SP03	←	Project_Success	,859	,780	,910	,000
SP01	←	Project_Success	,820	,711	,896	,000
SP10	←	Project_Success	,773	,646	,867	,000
SP06	←	Project_Success	,842	,766	,900	,000
SP09	←	Project_Success	,843	,744	,910	,000
MAT02	←	Organiz_Maturity	,853	,760	,920	,000
MAT05	←	Organiz_Maturity	,871	,798	,925	,000
MAT06	←	Organiz_Maturity	,800	,673	,888	,000
MAT07	←	Organiz_Maturity	,877	,780	,951	,000
MAT08	←	Organiz_Maturity	,802	,694	,893	,000
GP10	←	Project Management	,918	,873	,948	,000
GP09	←	Project Management	,848	,775	,905	,000
GP08	←	Project Management	,844	,770	,903	,000
GP07	←	Project Management	,925	,875	,958	,000
GP02	←	Project Management	,859	,799	,905	,000
GP01	←	Project Management	,899	,846	,939	,000
GP06	←	Project Management	,901	,858	,935	,000
GP03	←	Project Management	,852	,784	,905	,000
GP05	←	Project Management	,839	,775	,889	,000
MAT04	←	Organiz_Maturity	,759	,627	,858	,000
SP15	←	Project Success	,808	,685	,907	,000
SP17	←	Project Success	,857	,764	,919	,000
SP18	←	Project_Success	,793	,676	,873	,000

Total Effects (Group number 1 - Mediation Model)

Total Effects - Lower Bounds (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,735	,000	,000
Project_Success	,187	,397	,000
SP18	,174	,363	,731
SP17	,175	,371	,759
SP15	,193	,408	,861
MAT04	,733	,000	,000
GP09	,611	,752	,000
GP08	,625	,782	,000
GP07	,708	,881	,000
GP03	,584	,701	,000
GP02	,657	,778	,000
GP01	,702	,874	,000
GP06	,687	,849	,000
GP05	,596	,733	,000
GP10	,735	1,000	,000
MAT05	1,015	,000	,000
MAT06	,843	,000	,000
MAT07	,922	,000	,000
MAT08	,779	,000	,000
MAT02	1,000	,000	,000
SP13	,209	,438	,901
SP12	,192	,399	,796
SP11	,205	,432	,916
SP01	,187	,397	1,000
SP06	,214	,451	,955
SP04	,202	,422	,900
SP03	,198	,424	,952
SP10	,169	,367	,792
SP09	,182	,394	,846
SP14	,182	,367	,744

Total Effects - Upper Bounds (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	1,185	,000	,000
Project_Success	,565	,685	,000
SP18	,512	,630	1,092
SP17	,533	,656	1,134
SP15	,566	,693	1,217
MAT04	1,098	,000	,000
GP09	1,023	,941	,000
GP08	1,078	,991	,000
GP07	1,141	1,055	,000
GP03	,979	,911	,000
GP02	1,045	,979	,000
GP01	1,175	1,069	,000
GP06	1,140	1,050	,000
GP05	1,023	,964	,000
GP10	1,185	1,000	,000
MAT05	1,265	,000	,000
MAT06	1,266	,000	,000
MAT07	1,241	,000	,000
MAT08	1,144	,000	,000
MAT02	1,000	,000	,000
SP13	,584	,720	1,298
SP12	,544	,672	1,191
SP11	,580	,716	1,229
SP01	,565	,685	1,000
SP06	,590	,728	1,280
SP04	,582	,710	1,236
SP03	,595	,723	1,208
SP10	,561	,684	1,187
SP09	,567	,695	1,175
SP14	,529	,662	1,132

Total Effects - Two Tailed Significance (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,000	...	...
Project_Success	,000	,000	...
SP18	,000	,000	,000
SP17	,000	,000	,000
SP15	,000	,000	,000
MAT04	,000	...	...
GP09	,000	,000	...
GP08	,000	,000	...
GP07	,000	,000	...
GP03	,000	,000	...
GP02	,000	,000	...
GP01	,000	,000	...
GP06	,000	,000	...
GP05	,000	,000	...
GP10	,000	...	...
MAT05	,000	...	...
MAT06	,000	...	...
MAT07	,000	...	...
MAT08	,000	...	...
MAT02	...	...	...
SP13	,000	,000	,000
SP12	,000	,000	,000
SP11	,000	,000	,000
SP01	,000	,000	...
SP06	,000	,000	,000
SP04	,000	,000	,000
SP03	,000	,000	,000
SP10	,000	,000	,000
SP09	,000	,000	,000
SP14	,000	,000	,000

Standardized Total Effects (Group number 1 - Mediation Model)

Standardized Total Effects - Lower Bounds (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,481	,000	,000
Project_Success	,203	,696	,000
SP18	,156	,521	,676
SP17	,168	,575	,764
SP15	,153	,526	,685
MAT04	,627	,000	,000
GP09	,399	,775	,000
GP08	,390	,770	,000
GP07	,442	,875	,000
GP03	,402	,784	,000
GP02	,410	,799	,000
GP01	,426	,846	,000
GP06	,428	,858	,000
GP05	,393	,775	,000
GP10	,437	,873	,000
MAT05	,798	,000	,000
MAT06	,673	,000	,000
MAT07	,780	,000	,000
MAT08	,694	,000	,000
MAT02	,760	,000	,000
SP13	,164	,564	,757
SP12	,183	,625	,830
SP11	,182	,624	,854
SP01	,158	,534	,711
SP06	,164	,561	,766
SP04	,140	,475	,629
SP03	,164	,569	,780
SP10	,139	,481	,646
SP09	,156	,550	,744
SP14	,164	,552	,715

Standardized Total Effects - Upper Bounds (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,717	,000	,000
Project_Success	,488	,944	,000
SP18	,399	,766	,873
SP17	,426	,823	,919
SP15	,418	,806	,907
MAT04	,858	,000	,000
GP09	,620	,905	,000
GP08	,625	,903	,000
GP07	,667	,958	,000
GP03	,620	,905	,000
GP02	,624	,905	,000
GP01	,654	,939	,000
GP06	,654	,935	,000
GP05	,615	,889	,000
GP10	,664	,948	,000
MAT05	,925	,000	,000
MAT06	,888	,000	,000
MAT07	,951	,000	,000
MAT08	,893	,000	,000
MAT02	,920	,000	,000
SP13	,425	,808	,902
SP12	,447	,858	,955
SP11	,448	,865	,951
SP01	,421	,806	,896
SP06	,423	,809	,900
SP04	,383	,736	,827
SP03	,436	,830	,910
SP10	,404	,784	,867
SP09	,431	,829	,910
SP14	,410	,799	,903

Standardized Total Effects - Two Tailed Significance (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,000	...	...
Project_Success	,000	,000	...
SP18	,000	,000	,000
SP17	,000	,000	,000
SP15	,000	,000	,000
MAT04	,000	...	...
GP09	,000	,000	...
GP08	,000	,000	...
GP07	,000	,000	...
GP03	,000	,000	...
GP02	,000	,000	...
GP01	,000	,000	...
GP06	,000	,000	...
GP05	,000	,000	...
GP10	,000	,000	...
MAT05	,000	...	...
MAT06	,000	...	...
MAT07	,000	...	...
MAT08	,000	...	...
MAT02	,000	...	...
SP13	,000	,000	,000
SP12	,000	,000	,000
SP11	,000	,000	,000
SP01	,000	,000	,000
SP06	,000	,000	,000
SP04	,000	,000	,000
SP03	,000	,000	,000
SP10	,000	,000	,000
SP09	,000	,000	,000
SP14	,000	,000	,000

Direct Effects (Group number 1 - Mediation Model)

Direct Effects - Lower Bounds (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,735	,000	,000
Project_Success	-,291	,397	,000
SP18	,000	,000	,731
SP17	,000	,000	,759
SP15	,000	,000	,861
MAT04	,733	,000	,000
GP09	,000	,752	,000
GP08	,000	,782	,000
GP07	,000	,881	,000
GP03	,000	,701	,000
GP02	,000	,778	,000
GP01	,000	,874	,000
GP06	,000	,849	,000
GP05	,000	,733	,000
GP10	,000	1,000	,000
MAT05	1,015	,000	,000
MAT06	,843	,000	,000
MAT07	,922	,000	,000
MAT08	,779	,000	,000
MAT02	1,000	,000	,000
SP13	,000	,000	,901
SP12	,000	,000	,796
SP11	,000	,000	,916
SP01	,000	,000	1,000
SP06	,000	,000	,955
SP04	,000	,000	,900
SP03	,000	,000	,952
SP10	,000	,000	,792
SP09	,000	,000	,846
SP14	,000	,000	,744

Direct Effects - Upper Bounds (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	1,185	,000	,000
Project_Success	-,018	,685	,000
SP18	,000	,000	1,092
SP17	,000	,000	1,134
SP15	,000	,000	1,217
MAT04	1,098	,000	,000
GP09	,000	,941	,000
GP08	,000	,991	,000
GP07	,000	1,055	,000
GP03	,000	,911	,000
GP02	,000	,979	,000
GP01	,000	1,069	,000
GP06	,000	1,050	,000
GP05	,000	,964	,000
GP10	,000	1,000	,000
MAT05	1,265	,000	,000
MAT06	1,266	,000	,000
MAT07	1,241	,000	,000
MAT08	1,144	,000	,000
MAT02	1,000	,000	,000
SP13	,000	,000	1,298
SP12	,000	,000	1,191
SP11	,000	,000	1,229
SP01	,000	,000	1,000
SP06	,000	,000	1,280
SP04	,000	,000	1,236
SP03	,000	,000	1,208
SP10	,000	,000	1,187
SP09	,000	,000	1,175
SP14	,000	,000	1,132

Direct Effects - Two Tailed Significance (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,000	...	...
Project_Success	,028	,000	...
SP18	...	...	,000
SP17	...	...	,000
SP15	...	...	,000
MAT04	,000	...	...
GP09	...	,000	...
GP08	...	,000	...
GP07	...	,000	...
GP03	...	,000	...
GP02	...	,000	...
GP01	...	,000	...
GP06	...	,000	...
GP05	...	,000	...
GP10	...	...	...
MAT05	,000	...	...
MAT06	,000	...	...
MAT07	,000	...	...
MAT08	,000	...	...
MAT02	...	...	...
SP13	...	...	,000
SP12	...	...	,000
SP11	...	...	,000
SP01	...	...	...
SP06	...	...	,000
SP04	...	...	,000
SP03	...	...	,000
SP10	...	...	,000
SP09	...	...	,000
SP14	...	...	,000

Standardized Direct Effects (Group number 1 - Mediation Model)

Standardized Direct Effects - Lower Bounds (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	**Project Management**	**Project_Success**
Project Management	,481	,000	,000
Project_Success	-,289	,696	,000
SP18	,000	,000	,676
SP17	,000	,000	,764
SP15	,000	,000	,685
MAT04	,627	,000	,000
GP09	,000	,775	,000
GP08	,000	,770	,000
GP07	,000	,875	,000
GP03	,000	,784	,000
GP02	,000	,799	,000
GP01	,000	,846	,000
GP06	,000	,858	,000
GP05	,000	,775	,000
GP10	,000	,873	,000
MAT05	,798	,000	,000
MAT06	,673	,000	,000
MAT07	,780	,000	,000
MAT08	,694	,000	,000
MAT02	,760	,000	,000
SP13	,000	,000	,757
SP12	,000	,000	,830
SP11	,000	,000	,854
SP01	,000	,000	,711
SP06	,000	,000	,766
SP04	,000	,000	,629
SP03	,000	,000	,780
SP10	,000	,000	,646
SP09	,000	,000	,744
SP14	,000	,000	,715

Standardized Direct Effects - Upper Bounds (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,717	,000	,000
Project_Success	-,017	,944	,000
SP18	,000	,000	,873
SP17	,000	,000	,919
SP15	,000	,000	,907
MAT04	,858	,000	,000
GP09	,000	,905	,000
GP08	,000	,903	,000
GP07	,000	,958	,000
GP03	,000	,905	,000
GP02	,000	,905	,000
GP01	,000	,939	,000
GP06	,000	,935	,000
GP05	,000	,889	,000
GP10	,000	,948	,000
MAT05	,925	,000	,000
MAT06	,888	,000	,000
MAT07	,951	,000	,000
MAT08	,893	,000	,000
MAT02	,920	,000	,000
SP13	,000	,000	,902
SP12	,000	,000	,955
SP11	,000	,000	,951
SP01	,000	,000	,896
SP06	,000	,000	,900
SP04	,000	,000	,827
SP03	,000	,000	,910
SP10	,000	,000	,867
SP09	,000	,000	,910
SP14	,000	,000	,903

Standardized Direct Effects - Two Tailed Significance (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,000	...	...
Project_Success	,028	,000	...
SP18	...	...	,000
SP17	...	...	,000
SP15	...	...	,000
MAT04	,000	...	...
GP09	...	,000	...
GP08	...	,000	...
GP07	...	,000	...
GP03	...	,000	...
GP02	...	,000	...
GP01	...	,000	...
GP06	...	,000	...
GP05	...	,000	...
GP10	...	,000	...
MAT05	,000	...	...
MAT06	,000	...	...
MAT07	,000	...	...
MAT08	,000	...	...
MAT02	,000	...	...
SP13	...	...	,000
SP12	...	...	,000
SP11	...	...	,000
SP01	...	...	,000
SP06	...	...	,000
SP04	...	...	,000
SP03	...	...	,000
SP10	...	...	,000
SP09	...	...	,000
SP14	...	...	,000

Indirect Effects (Group number 1 - Mediation Model)

Indirect Effects - Lower Bounds (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,000	,000	,000
Project_Success	,345	,000	,000
SP18	,174	,363	,000
SP17	,175	,371	,000
SP15	,193	,408	,000
MAT04	,000	,000	,000
GP09	,611	,000	,000
GP08	,625	,000	,000
GP07	,708	,000	,000
GP03	,584	,000	,000
GP02	,657	,000	,000
GP01	,702	,000	,000
GP06	,687	,000	,000
GP05	,596	,000	,000
GP10	,735	,000	,000
MAT05	,000	,000	,000
MAT06	,000	,000	,000
MAT07	,000	,000	,000
MAT08	,000	,000	,000
MAT02	,000	,000	,000
SP13	,209	,438	,000
SP12	,192	,399	,000
SP11	,205	,432	,000
SP01	,187	,397	,000
SP06	,214	,451	,000
SP04	,202	,422	,000
SP03	,198	,424	,000
SP10	,169	,367	,000
SP09	,182	,394	,000
SP14	,182	,367	,000

Indirect Effects - Upper Bounds (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,000	,000	,000
Project_Success	,717	,000	,000
SP18	,512	,630	,000
SP17	,533	,656	,000
SP15	,566	,693	,000
MAT04	,000	,000	,000
GP09	1,023	,000	,000
GP08	1,078	,000	,000
GP07	1,141	,000	,000
GP03	,979	,000	,000
GP02	1,045	,000	,000
GP01	1,175	,000	,000
GP06	1,140	,000	,000
GP05	1,023	,000	,000
GP10	1,185	,000	,000
MAT05	,000	,000	,000
MAT06	,000	,000	,000
MAT07	,000	,000	,000
MAT08	,000	,000	,000
MAT02	,000	,000	,000
SP13	,584	,720	,000
SP12	,544	,672	,000
SP11	,580	,716	,000
SP01	,565	,685	,000
SP06	,590	,728	,000
SP04	,582	,710	,000
SP03	,595	,723	,000
SP10	,561	,684	,000
SP09	,567	,695	,000
SP14	,529	,662	,000

Indirect Effects - Two Tailed Significance (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	...	...	...
Project_Success	,000	...	...
SP18	,000	,000	...
SP17	,000	,000	...
SP15	,000	,000	...
MAT04	...	...	...
GP09	,000	...	...
GP08	,000	...	...
GP07	,000	...	...
GP03	,000	...	...
GP02	,000	...	...
GP01	,000	...	...
GP06	,000	...	...
GP05	,000	...	...
GP10	,000	...	...
MAT05	...	...	...
MAT06	...	...	...
MAT07	...	...	...
MAT08	...	...	...
MAT02	...	...	...
SP13	,000	,000	...
SP12	,000	,000	...
SP11	,000	,000	...
SP01	,000	,000	...
SP06	,000	,000	...
SP04	,000	,000	...
SP03	,000	,000	...
SP10	,000	,000	...
SP09	,000	,000	...
SP14	,000	,000	...

Standardized Indirect Effects (Group number 1 - Mediation Model)

Standardized Indirect Effects - Lower Bounds (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,000	,000	,000
Project_Success	,366	,000	,000
SP18	,156	,521	,000
SP17	,168	,575	,000
SP15	,153	,526	,000
MAT04	,000	,000	,000
GP09	,399	,000	,000
GP08	,390	,000	,000
GP07	,442	,000	,000
GP03	,402	,000	,000
GP02	,410	,000	,000
GP01	,426	,000	,000
GP06	,428	,000	,000
GP05	,393	,000	,000
GP10	,437	,000	,000
MAT05	,000	,000	,000
MAT06	,000	,000	,000
MAT07	,000	,000	,000
MAT08	,000	,000	,000
MAT02	,000	,000	,000
SP13	,164	,564	,000
SP12	,183	,625	,000
SP11	,182	,624	,000
SP01	,158	,534	,000
SP06	,164	,561	,000
SP04	,140	,475	,000
SP03	,164	,569	,000
SP10	,139	,481	,000
SP09	,156	,550	,000
SP14	,164	,552	,000

Standardized Indirect Effects - Upper Bounds (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,000	,000	,000
Project_Success	,644	,000	,000
SP18	,399	,766	,000
SP17	,426	,823	,000
SP15	,418	,806	,000
MAT04	,000	,000	,000
GP09	,620	,000	,000
GP08	,625	,000	,000
GP07	,667	,000	,000
GP03	,620	,000	,000
GP02	,624	,000	,000
GP01	,654	,000	,000
GP06	,654	,000	,000
GP05	,615	,000	,000
GP10	,664	,000	,000
MAT05	,000	,000	,000
MAT06	,000	,000	,000
MAT07	,000	,000	,000
MAT08	,000	,000	,000
MAT02	,000	,000	,000
SP13	,425	,808	,000
SP12	,447	,858	,000
SP11	,448	,865	,000
SP01	,421	,806	,000
SP06	,423	,809	,000
SP04	,383	,736	,000
SP03	,436	,830	,000
SP10	,404	,784	,000
SP09	,431	,829	,000
SP14	,410	,799	,000

Standardized Indirect Effects - Two Tailed Significance (PC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	...	...	...
Project_Success	,000	...	...
SP18	,000	,000	...
SP17	,000	,000	...
SP15	,000	,000	...
MAT04	...	...	...
GP09	,000	...	...
GP08	,000	...	...
GP07	,000	...	...
GP03	,000	...	...
GP02	,000	...	...
GP01	,000	...	...
GP06	,000	...	...
GP05	,000	...	...
GP10	,000	...	...
MAT05	...	...	...
MAT06	...	...	...
MAT07	...	...	...
MAT08	...	...	...
MAT02	...	...	...
SP13	,000	,000	...
SP12	,000	,000	...
SP11	,000	,000	...
SP01	,000	,000	...
SP06	,000	,000	...
SP04	,000	,000	...
SP03	,000	,000	...
SP10	,000	,000	...
SP09	,000	,000	...
SP14	,000	,000	...

Bias-corrected percentile method (Group number 1 - Mediation Model)

95% confidence intervals (bias-corrected percentile method)

Scalar Estimates (Group number 1 - Mediation Model)

Regression Weights: (Group number 1 - Mediation Model)

Parameter			Estimate	Lower	Upper	P
Project Management	←	Organiz_Maturity	,959	,735	1,184	,000
Project_Success	←	Project Management	,539	,398	,686	,000
Project_Success	←	Organiz_Maturity	-,148	-,301	-,025	,019
SP14	←	Project_Success	,942	,740	1,129	,000
SP13	←	Project_Success	1,065	,900	1,294	,000
SP12	←	Project_Success	,985	,797	1,191	,000
SP11	←	Project_Success	1,052	,918	1,232	,000
SP04	←	Project_Success	1,048	,906	1,250	,000
SP03	←	Project_Success	1,062	,957	1,214	,000
SP01	←	Project_Success	1,000	1,000	1,000	...
SP10	←	Project_Success	,973	,801	1,198	,000
SP06	←	Project_Success	1,090	,962	1,294	,000
SP09	←	Project_Success	1,001	,849	1,182	,000
MAT02	<---	Organiz_Maturity	1,000	1,000	1,000	...
MAT05	←	Organiz_Maturity	1,125	1,010	1,258	,001
MAT06	←	Organiz_Maturity	1,052	,835	1,260	,000
MAT07	←	Organiz_Maturity	1,060	,914	1,231	,001
MAT08	←	Organiz_Maturity	,942	,769	1,126	,001
GP10	←	Project Management	1,000	1,000	1,000	...
GP09	←	Project Management	,846	,747	,935	,001
GP08	←	Project Management	,888	,779	,986	,001
GP07	←	Project Management	,964	,880	1,053	,000
GP02	←	Project Management	,878	,776	,978	,000
GP01	←	Project Management	,970	,872	1,065	,001
GP06	←	Project Management	,945	,844	1,045	,001
GP03	←	Project Management	,805	,701	,911	,000
GP05	←	Project Management	,844	,730	,961	,000
MAT04	←	Organiz_Maturity	,908	,723	1,087	,001
SP15	←	Project_Success	1,017	,861	1,217	,000
SP17	←	Project_Success	,946	,755	1,131	,000
SP18	←	Project_Success	,916	,733	1,094	,000

Standardized Regression Weights: (Group number 1 - Mediation Model)

Parameter			Estimate	Lower	Upper	P
Project Management	←	Organiz_Maturity	,615	,479	,716	,000
Project_Success	←	Project Management	,824	,696	,944	,000
Project_Success	←	Organiz_Maturity	-,145	-,299	-,023	,020
SP14	←	Project_Success	,827	,714	,903	,000
SP13	←	Project_Success	,837	,752	,899	,001
SP12	←	Project_Success	,912	,833	,956	,000
SP11	←	Project_Success	,908	,851	,949	,001
SP04	←	Project_Success	,741	,629	,826	,000
SP03	←	Project_Success	,859	,774	,908	,001
SP01	←	Project_Success	,820	,707	,893	,001
SP10	←	Project_Success	,773	,643	,864	,001
SP06	←	Project_Success	,842	,767	,901	,000
SP09	←	Project_Success	,843	,739	,908	,001
MAT02	←	Organiz_Maturity	,853	,759	,919	,000
MAT05	←	Organiz_Maturity	,871	,791	,922	,001
MAT06	←	Organiz_Maturity	,800	,668	,887	,000
MAT07	←	Organiz_Maturity	,877	,765	,946	,001
MAT08	←	Organiz_Maturity	,802	,678	,886	,001
GP10	←	Project Management	,918	,870	,947	,001
GP09	←	Project Management	,848	,769	,901	,001
GP08	←	Project Management	,844	,766	,901	,001
GP07	←	Project Management	,925	,872	,956	,001
GP02	←	Project Management	,859	,799	,904	,000
GP01	←	Project Management	,899	,843	,937	,001
GP06	←	Project Management	,901	,855	,933	,001
GP03	←	Project Management	,852	,782	,904	,000
GP05	←	Project Management	,839	,774	,889	,000
MAT04	←	Organiz_Maturity	,759	,624	,856	,000
SP15	←	Project_Success	,808	,668	,901	,001
SP17	←	Project_Success	,857	,764	,919	,000
SP18	←	Project_Success	,793	,686	,880	,000

Covariances: (Group number 1 - Mediation Model)

Parameter			Estimate	Lower	Upper	P
e26	↔	e27	,120	,019	,237	,021
e12	↔	e13	,188	,060	,333	,005
e10	↔	e8	,276	,117	,452	,000
e24	↔	e26	,221	,052	,495	,004
e18	↔	e16	,337	,147	,612	,000
e17	↔	e16	,270	,147	,456	,000
e17	↔	e18	,261	,134	,444	,000
e25	↔	e27	,168	,046	,320	,005
e25	↔	e28	,244	,123	,411	,000
e8	↔	e9	,180	,045	,328	,010
e24	↔	e28	,120	-,006	,325	,068
e21	↔	e23	-,193	-,324	-,106	,000
e20	↔	e21	,157	-,003	,364	,056
e10	↔	e12	,106	-,019	,259	,098
e10	↔	e7	-,156	-,277	-,053	,003
e21	↔	e18	,173	,042	,341	,007
e20	↔	e23	-,123	-,213	-,055	,001
e18	↔	e19	,114	-,079	,364	,250
e21	↔	e19	-,102	-,271	,013	,080
e19	↔	e23	-,097	-,204	-,013	,025
e25	↔	e18	-,106	-,253	-,009	,035
e25	↔	e19	-,077	-,229	,028	,145
e27	↔	e28	,100	-,011	,235	,084
e12	↔	e14	-,158	-,301	-,009	,037
e8	↔	e13	-,103	-,277	,039	,156
e17	↔	e19	,082	-,003	,185	,060
e7	↔	e12	-,154	-,317	-,041	,009
e10	↔	e11	,024	-,092	,168	,625
e15	↔	e9	-,199	-,359	-,061	,003

Correlations: (Group number 1 - Mediation Model)

Parameter			Estimate	Lower	Upper	P
e26	↔	e27	,260	,014	,491	,039
e12	↔	e13	,332	,108	,489	,010
e10	↔	e8	,378	,168	,560	,001
e24	↔	e26	,394	,106	,629	,008
e18	↔	e16	,467	,244	,651	,000
e17	↔	e16	,564	,373	,717	,000
e17	↔	e18	,400	,221	,563	,000
e25	↔	e27	,423	,116	,637	,009
e25	↔	e28	,498	,281	,679	,001
e8	↔	e9	,272	,054	,497	,014
e24	↔	e28	,225	-,021	,494	,084
e21	↔	e23	-,500	-,708	-,315	,000
e20	↔	e21	,282	-,041	,554	,084
e10	↔	e12	,192	-,053	,388	,110
e10	↔	e7	-,237	-,415	-,070	,005
e21	↔	e18	,209	,049	,355	,011
e20	↔	e23	-,396	-,711	-,147	,002
e18	↔	e19	,158	-,132	,423	,280
e21	↔	e19	-,168	-,404	,032	,098
e19	↔	e23	-,287	-,645	-,030	,029
e25	↔	e18	-,161	-,347	-,005	,043
e25	↔	e19	-,159	-,415	,075	,169
e27	↔	e28	,229	-,042	,506	,111
e12	↔	e14	-,297	-,573	,000	,050
e8	↔	e13	-,137	-,351	,063	,184
e17	↔	e19	,172	-,016	,364	,074
e7	↔	e12	-,324	-,634	-,059	,016
e10	↔	e11	,038	-,163	,253	,651
e15	↔	e9	-,365	-,628	-,100	,005

Variances: (Group number 1 - Mediation Model)

Parameter	Estimate	Lower	Upper	P
Organiz_Maturity	1,045	,746	1,374	,000
d1	1,584	1,238	2,107	,000
d2	,486	,327	,709	,000
e25	,446	,281	,681	,000
e20	,446	,292	,677	,000
e21	,696	,433	1,062	,000
e17	,434	,317	,630	,000
e18	,981	,703	1,357	,000
e19	,530	,358	,766	,000
e16	,529	,353	,773	,000
e22	,258	,151	,398	,000
e23	,215	,124	,364	,000
e24	,528	,323	,844	,000
e1	,391	,229	,614	,000
e6	,514	,319	,790	,000
e5	,351	,161	,661	,000
e4	,653	,399	,992	,000
e3	,420	,275	,638	,000
e15	,473	,313	,719	,000
e10	,764	,564	,992	,000
e11	,526	,377	,736	,000
e7	,571	,383	,823	,000
e8	,698	,505	,939	,000
e9	,625	,428	,886	,000
e12	,398	,239	,645	,000
e13	,808	,553	1,157	,000
e14	,712	,498	1,018	,000
e2	,635	,403	,957	,000
e26	,598	,295	1,141	,000
e27	,353	,239	,505	,000
e28	,538	,349	,779	,000

Squared Multiple Correlations: (Group number 1 - Mediation Model)

Parameter	Estimate	Lower	Upper	P
Project Management	,378	,230	,512	,000
Project_Success	,553	,400	,677	,001
SP18	,630	,471	,774	,000
SP17	,734	,583	,845	,000
SP15	,653	,446	,811	,001
MAT04	,576	,389	,733	,000
GP09	,719	,592	,813	,001
GP08	,713	,586	,811	,001
GP07	,856	,761	,915	,001
GP03	,725	,611	,817	,000
GP02	,738	,638	,817	,000
GP01	,808	,710	,877	,001
GP06	,812	,731	,870	,001
GP05	,704	,600	,790	,000
GP10	,843	,756	,897	,001
MAT05	,759	,626	,849	,001
MAT06	,639	,446	,786	,000
MAT07	,770	,586	,896	,001
MAT08	,643	,460	,785	,001
MAT02	,728	,576	,844	,000
SP13	,701	,565	,809	,001
SP12	,831	,693	,914	,000
SP11	,824	,725	,901	,001
SP01	,673	,499	,798	,001
SP06	,709	,588	,812	,000
SP04	,549	,395	,683	,000
SP03	,739	,599	,824	,001
SP10	,597	,414	,747	,001
SP09	,710	,546	,824	,001
SP14	,684	,510	,816	,000

Standardized Total Effects (Group number 1 - Mediation Model)

Standardized Total Effects - Lower Bounds (BC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,479	,000	,000
Project_Success	,195	,696	,000
SP18	,158	,532	,686
SP17	,169	,583	,764
SP15	,153	,526	,668
MAT04	,624	,000	,000
GP09	,398	,769	,000
GP08	,392	,766	,000
GP07	,441	,872	,000
GP03	,405	,782	,000
GP02	,414	,799	,000
GP01	,426	,843	,000
GP06	,429	,855	,000
GP05	,394	,774	,000
GP10	,440	,870	,000
MAT05	,791	,000	,000
MAT06	,668	,000	,000
MAT07	,765	,000	,000
MAT08	,678	,000	,000
MAT02	,759	,000	,000
SP13	,160	,565	,752
SP12	,184	,638	,833
SP11	,178	,627	,851
SP01	,155	,537	,707
SP06	,164	,566	,767
SP04	,141	,482	,629
SP03	,162	,575	,774
SP10	,138	,485	,643
SP09	,154	,557	,739
SP14	,168	,563	,714

Standardized Total Effects - Upper Bounds (BC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,716	,000	,000
Project_Success	,485	,944	,000
SP18	,401	,777	,880
SP17	,427	,828	,919
SP15	,418	,806	,901
MAT04	,856	,000	,000
GP09	,620	,901	,000
GP08	,626	,901	,000
GP07	,667	,956	,000
GP03	,621	,904	,000
GP02	,626	,904	,000
GP01	,654	,937	,000
GP06	,654	,933	,000
GP05	,615	,889	,000
GP10	,667	,947	,000
MAT05	,922	,000	,000
MAT06	,887	,000	,000
MAT07	,946	,000	,000
MAT08	,886	,000	,000
MAT02	,919	,000	,000
SP13	,420	,808	,899
SP12	,447	,869	,956
SP11	,447	,866	,949
SP01	,420	,808	,893
SP06	,422	,814	,901
SP04	,384	,741	,826
SP03	,433	,834	,908
SP10	,403	,788	,864
SP09	,431	,835	,908
SP14	,412	,811	,903

Standardized Total Effects - Two Tailed Significance (BC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,000	...	...
Project_Success	,000	,000	...
SP18	,000	,000	,000
SP17	,000	,000	,000
SP15	,000	,000	,001
MAT04	,000	...	...
GP09	,000	,001	...
GP08	,000	,001	...
GP07	,000	,001	...
GP03	,000	,000	...
GP02	,000	,000	...
GP01	,000	,001	...
GP06	,000	,001	...
GP05	,000	,000	...
GP10	,000	,001	...
MAT05	,001	...	...
MAT06	,000	...	...
MAT07	,001	...	...
MAT08	,001	...	...
MAT02	,000	...	...
SP13	,000	,000	,001
SP12	,000	,000	,000
SP11	,000	,000	,001
SP01	,000	,000	,001
SP06	,000	,000	,000
SP04	,000	,000	,000
SP03	,000	,000	,001
SP10	,000	,000	,001
SP09	,000	,000	,001
SP14	,000	,000	,000

Standardized Direct Effects (Group number 1 - Mediation Model)

Standardized Direct Effects - Lower Bounds (BC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,479	,000	,000
Project_Success	-,299	,696	,000
SP18	,000	,000	,686
SP17	,000	,000	,764
SP15	,000	,000	,668
MAT04	,624	,000	,000
GP09	,000	,769	,000
GP08	,000	,766	,000
GP07	,000	,872	,000
GP03	,000	,782	,000
GP02	,000	,799	,000
GP01	,000	,843	,000
GP06	,000	,855	,000
GP05	,000	,774	,000
GP10	,000	,870	,000
MAT05	,791	,000	,000
MAT06	,668	,000	,000
MAT07	,765	,000	,000
MAT08	,678	,000	,000
MAT02	,759	,000	,000
SP13	,000	,000	,752
SP12	,000	,000	,833
SP11	,000	,000	,851
SP01	,000	,000	,707
SP06	,000	,000	,767
SP04	,000	,000	,629
SP03	,000	,000	,774
SP10	,000	,000	,643
SP09	,000	,000	,739
SP14	,000	,000	,714

Standardized Direct Effects - Upper Bounds (BC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,716	,000	,000
Project_Success	-,023	,944	,000
SP18	,000	,000	,880
SP17	,000	,000	,919
SP15	,000	,000	,901
MAT04	,856	,000	,000
GP09	,000	,901	,000
GP08	,000	,901	,000
GP07	,000	,956	,000
GP03	,000	,904	,000
GP02	,000	,904	,000
GP01	,000	,937	,000
GP06	,000	,933	,000
GP05	,000	,889	,000
GP10	,000	,947	,000
MAT05	,922	,000	,000
MAT06	,887	,000	,000
MAT07	,946	,000	,000
MAT08	,886	,000	,000
MAT02	,919	,000	,000
SP13	,000	,000	,899
SP12	,000	,000	,956
SP11	,000	,000	,949
SP01	,000	,000	,893
SP06	,000	,000	,901
SP04	,000	,000	,826
SP03	,000	,000	,908
SP10	,000	,000	,864
SP09	,000	,000	,908
SP14	,000	,000	,903

Standardized Direct Effects - Two Tailed Significance (BC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,000	...	...
Project_Success	,020	,000	...
SP18	...	...	,000
SP17	...	...	,000
SP15	...	...	,001
MAT04	,000	...	...
GP09	...	,001	...
GP08	...	,001	...
GP07	...	,001	...
GP03	...	,000	...
GP02	...	,000	...
GP01	...	,001	...
GP06	...	,001	...
GP05	...	,000	...
GP10	...	,001	...
MAT05	,001	...	...
MAT06	,000	...	...
MAT07	,001	...	...
MAT08	,001	...	...
MAT02	,000	...	...
SP13	...	...	,001
SP12	...	...	,000
SP11	...	...	,001
SP01	...	...	,001
SP06	...	...	,000
SP04	...	...	,000
SP03	...	...	,001
SP10	...	...	,001
SP09	...	...	,001
SP14	...	...	,000

Standardized Indirect Effects (Group number 1 - Mediation Model)

Standardized Indirect Effects - Lower Bounds (BC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,000	,000	,000
Project_Success	,377	,000	,000
SP18	,158	,532	,000
SP17	,169	,583	,000
SP15	,153	,526	,000
MAT04	,000	,000	,000
GP09	,398	,000	,000
GP08	,392	,000	,000
GP07	,441	,000	,000
GP03	,405	,000	,000
GP02	,414	,000	,000
GP01	,426	,000	,000
GP06	,429	,000	,000
GP05	,394	,000	,000
GP10	,440	,000	,000
MAT05	,000	,000	,000
MAT06	,000	,000	,000
MAT07	,000	,000	,000
MAT08	,000	,000	,000
MAT02	,000	,000	,000
SP13	,160	,565	,000
SP12	,184	,638	,000
SP11	,178	,627	,000
SP01	,155	,537	,000
SP06	,164	,566	,000
SP04	,141	,482	,000
SP03	,162	,575	,000
SP10	,138	,485	,000
SP09	,154	,557	,000
SP14	,168	,563	,000

Standardized Indirect Effects - Upper Bounds (BC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	,000	,000	,000
Project_Success	,654	,000	,000
SP18	,401	,777	,000
SP17	,427	,828	,000
SP15	,418	,806	,000
MAT04	,000	,000	,000
GP09	,620	,000	,000
GP08	,626	,000	,000
GP07	,667	,000	,000
GP03	,621	,000	,000
GP02	,626	,000	,000
GP01	,654	,000	,000
GP06	,654	,000	,000
GP05	,615	,000	,000
GP10	,667	,000	,000
MAT05	,000	,000	,000
MAT06	,000	,000	,000
MAT07	,000	,000	,000
MAT08	,000	,000	,000
MAT02	,000	,000	,000
SP13	,420	,808	,000
SP12	,447	,869	,000
SP11	,447	,866	,000
SP01	,420	,808	,000
SP06	,422	,814	,000
SP04	,384	,741	,000
SP03	,433	,834	,000
SP10	,403	,788	,000
SP09	,431	,835	,000
SP14	,412	,811	,000

Standardized Indirect Effects - Two Tailed Significance (BC) (Group number 1 - Mediation Model)

	Organiz_Maturity	Project Management	Project_Success
Project Management	...	...	...
Project_Success	,000	...	...
SP18	,000	,000	...
SP17	,000	,000	...
SP15	,000	,000	...
MAT04	...	...	...
GP09	,000	...	...
GP08	,000	...	...
GP07	,000	...	...
GP03	,000	...	...
GP02	,000	...	...
GP01	,000	...	...
GP06	,000	...	...
GP05	,000	...	...
GP10	,000	...	...
MAT05	...	...	...
MAT06	...	...	...
MAT07	...	...	...
MAT08	...	...	...
MAT02	...	...	...
SP13	,000	,000	...
SP12	,000	,000	...
SP11	,000	,000	...
SP01	,000	,000	...
SP06	,000	,000	...
SP04	,000	,000	...
SP03	,000	,000	...
SP10	,000	,000	...
SP09	,000	,000	...
SP14	,000	,000	...
	1320,330	|*	
	1415,607	|*	
		|--------------------	

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Mediation Model	88	629,142	318	,000	1,978
Saturated model	406	,000	0		
Independence model	28	4869,824	378	,000	12,883

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Mediation Model	,145	,776	,713	,607
Saturated model	,000	1,000		
Independence model	1,116	,103	,036	,096

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Mediation Model	,871	,846	,932	,918	,931
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Mediation Model	,841	,733	,783
Saturated model	,000	,000	,000
Independence model	1,000	,000	,000

NCP

Model	NCP	LO 90	HI 90
Mediation Model	311,142	243,672	386,399
Saturated model	,000	,000	,000
Independence model	4491,824	4270,303	4720,623

FMIN

Model	FMIN	F0	LO 90	HI 90
Mediation Model	4,559	2,255	1,766	2,800
Saturated model	,000	,000	,000	,000
Independence model	35,289	32,549	30,944	34,207

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Mediation Model	,084	,075	,094	,000
Independence model	,293	,286	,301	,000

AIC

Model	AIC	BCC	BIC	CAIC
Mediation Model	805,142	851,968	1063,376	1151,376
Saturated model	812,000	1028,037	2003,396	2409,396
Independence model	4925,824	4940,723	5007,989	5035,989

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Mediation Model	5,834	5,345	6,380	6,174
Saturated model	5,884	5,884	5,884	7,450
Independence model	35,694	34,089	37,352	35,802

HOELTER

Model	HOELTER .05	HOELTER .01
Mediation Model	80	84
Independence model	13	13