Information Technology Project Management: Project Management Maturity and Its Effect on Project Success

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ABSTRACT

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Project Management Maturity and Its Effect on Project Success

Svetlana Sidenko

With the widely publicized project failure rates and related cost overruns, more companies today are turning to the various corporate approaches that may help them improve their project management practices (Judgev & Thomas, 2002). Given the latter trends in the corporate project management practice, several project management maturity models (PMMMs) were designed by industry practitioners to provide a framework emphasizing that an organization needs to purposefully and progressively develop its capabilities to deliver projects with consistent success. This popular industry movement however has not been supported to date by empirical research.

To breach the gap between academia and practice, this thesis investigated, through a survey of over 100 IT industry Project Management Professionals, the existence and specifics the relationship between project management maturity and project success. The sustained IT project management success appears to be attained by developing standard organizational project management practices, tools and techniques across several project management knowledge areas; in other words by increasing organizational project management maturity. Moreover, this research explores and highlights the relevance of different project success dimensions proposed in the theoretical literature. This study finds that out of four commonly named dimensions of project success - project efficiency, business benefits, preparing for the future and impact to the customer – the first two are the most relevant.

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1. Introduction

Cobb's Paradox:

"We know why projects fail,

we know how to prevent the failure...

so why do they still fail?"

Martin Cobb

Treasury Board of Canada

Secretariat

Project management has been very popular in the information technology (IT) field during the past several decades, with specific project management techniques and practices of organizations growing increasingly sophisticated. The advantages of this particular management style have led many IT organizations to "projectize" their operations (Kwak & Ibbs, 2000). Project management tools and practices proved to be helpful in meeting today's time-to-market, highly competitive IT business environment. Nowadays, projects are considered to be the vehicles by which organizations turn business opportunities into valued business assets. If a company runs good projects, it can increase its revenues, decrease life cycle costs, and use less capital to achieve its business goals (Lavingia, 2001).

Modern project management has its roots in the second world war, and was developed in a limited number of engineering based industries, including IT, during 1950s, 1960s and 1970s (Morris, 1994). More recently, the demand for project managers has

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increased significantly, as project-based performance has spread in a broad range of industries (Cooke-Davies & Arzymanow, 2003). Interestingly however, researchers continue to lean towards IT as their favorite field to study project management (Urli & Urli, 2000). The fact that project management in IT remains a strong preference for authors is possibly due to the lack of consistent evidence of sustainable project success in this domain, so that it is still a convenient field for which to develop new methods or new tools (Urli & Urli, 2000).

1.1. Importance of research

A survey conducted by the Standish Group (2003) found that only 34% of over thirteen thousands of IT projects surveyed were successful. Furthermore, the survey reported that 51% of projects incur significant (on average 43%) cost overruns, 82% time overruns, and often contain reduced functionality compared to original requirements. Another association survey of 400 CEOs indicated that only 55.6% of their information systems technology projects met the initial budget targets (AMA Newsletter for Chief Executives, 1998). Meanwhile, the business impact of the above problems on IT industry is significant and often threatens the profitability and survival of firms (Krishnan, Mukhopadhyay & Zubrow, 1999). Industry benchmarking has shown that the difference in cost and schedule between best and worst projects is about 30 percent (Lavingia, 2001). In today's competitive business environment this can mean a difference between a profitable company and one that becomes a takeover target. Under such circumstances, it is undisputable that successful project delivery is critical to the success of IT organizations

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that manage by projects or rely extensively upon projects to achieve their corporate goals (Pennypacker & Grant, 2003). Consequently, researchers and practitioners increasingly call for more structured approach to project management (Krishnan et al., 1999).

Since the 1950s most of the work in project management has focused on project scheduling problems, assuming that the development of better scheduling techniques would result in higher project successes (Belassi & Tukel, 1996). More recently however, a new set of processes and practices come into the picture as being determinant of consistently successful projects. In fact, it is "corporate project management practices" that are now thought to create the context for management practices on individual project levels (Cooke-Davies, 2002). Many businesses today recognize project management as a core competence and seek to deliver benefits to the business through effective management of projects (Hillson, 2003). Firms are turning to project management as part of their competitive advantage strategies. Projects are viewed as an essential building block of business value (Judgev & Thomas, 2002). Consequently, the importance of a formal and structured approach to project management is becoming increasingly recognized as organizations strive to develop capabilities to deliver the projects successfully (Hillson, 2003). For example, Pennypacker and Grand (2003) highlight that many organizations today implement enterprise wide project management processes. Additionally, organizations align project prioritization and selection decisions with corporate strategies. Moreover, managers establish explicit project success criteria to guide project performance. By leveraging the results of prior projects, organizations attempt to improve their processes, training and documentation. Ultimately, organizations strive to develop the capability to deliver projects successfully – time after time (Pennypacker & Grant, 2003).

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With the widely publicized project failure rates and related cost overruns (Standish Group, 2003), more companies today are turning to the described above corporate approaches that may help them improve their project management practices (Judgev & Thomas, 2002). Given the latter trends in the corporate project management practice, several project management maturity models (PMMMs) were designed by researchers and practitioners to provide a framework emphasizing that an organization needs to purposefully and progressively develop its capabilities to deliver projects with consistent success (Pennypacker & Grant, 2003). Over the past decade, these PMMMs emerged in the literature as concrete tangible ways of assessing aspects of a firm's project management maturity (Judgev & Thomas, 2002). Today these maturity models play an important part in the organizational project management process by defining a structured route to improvement (Hillson, 2003), as they help firms compare explicit competences at the project and program level relative to a standard (Judgev & Thomas, 2002).

The project management maturity models are gaining interest as companies and academics strive to make sense of why some projects succeed while others do not. Many industry specialists claim that the PMMMs enable firms to achieve a sustainable project management success. However, no thorough exploration of these claims has been yet made in the academic literature. Except for a theoretical article of Judgev and Thomas (2002), the literature on project success has not yet been empirically linked to the literature on PMMMs.

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1.2. Research Question and Research Objective

The purpose of this thesis research is to explore the foundations of the commonly assumed cause-and-effect relationship between the organizational project management maturity and the project success. The quest for link between organizational project management maturity and project management success has resulted in many publications.

The extensive and thorough review of the literature on project success and organizational project management maturity revealed an interesting picture. While various project management maturity models are becoming more and more popular among practitioners, there is no empirical evidence to confirm that firms with higher PMMM scores are performing better and achieve higher project success than those with lower PMMM scores.

Yet several researchers have come to some tentative conclusions regarding the cause-and-effect relationship between project management maturity and project success. To address this gap between the theory and the practice, this thesis research was conducted with three major objectives in mind.

To investigate project management maturity within IT outsourcing industry.

To explore the four dimensions of the project success when applied to IT setting.

To examine whether project management maturity is related to the project success.

The latter of the above dictates the main research question of this thesis: *Does organizational project management maturity determine project success?*

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1.3. Thesis Structure

Aimed at examining organizational project management maturity construct and assessing it as a factor of project management success, this thesis is structured as follows. Section 4 presents the theoretical background by surveying the literature, developing a list of project success dimensions as well as organizational project management maturity models claimed to be critical to project success. Then, *PM Solutions Project Management Maturity Model* is introduced and justified as bases for the study. Section 5 describes a conceptual research model and hypothesis regarding cause-effect relationship between organizational project management maturity levels and project success dimensions. Section 6 describes the research design; construct measures and data collection techniques. Section 7 presents the analyses of statistical correlations between project management maturity levels and project success dimensions. Section 8 summarizes the study and discusses the implications of the findings for the practice of project management.

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2. Literature Review

Before proceeding any further investigating the relationship between the success of the projects and the project management maturity of the organizations, it seems important to establish a clear meaning of these constructs. Although academic interest for the project management discipline is growing, no affirmative link has been established yet between project success and organizational project management maturity.

One of the major barriers to understanding the reasons behind the success of projects has been the lack of specificity of the constructs applied in project management studies (Dvir et al., 1998). According to Pinto and Slevin (1988) "there are few topics in the field of project management that are so frequently discussed and yet so rarely agreed upon as the notion of project success". Similarly, the recent proliferation on different organizational project management maturity models points to the absence of general agreement among researched and practitioners regarding the essence of this construct. Given the above, an extensive literature review was conducted in order to identify the most encompassing and clear definitions of the variables in question.

2.1. Definition of Project Success

The conventional approach to studying issue of project success is searching for a simple formula that is easy to apply (Dvir et al., 2003). Under such approach, measures of project success typically focused on the operational level, whereby project success and failure were determined with regard to its performance on initially specified time, cost, and scope objectives (Pinto, 1988). These basic criteria of cost, time and quality, the so-called

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"Iron Triangle" have been traditionally used as project success criteria (Yu, Flett, & Bowers, 2005).

Yet recently, researchers started pointing out that it is important to make a distinction between project success, which can not be measured until after the project is complete, and project performance, which can be measured during the life of the project (Cooke-Davies, 2002). In fact, there are many cases where projects are executed as planned, on time, on budget and achieve the planned performance goals, but turn out to be complete failures because they failed to produce actual benefits to the customer or adequate revenue and profit for the performing organization (Baker, Murphy, & Fisher, 1988; Dvir et al., 2003). On the other hand, quite often what seemed to be a troubled project, with extensive delays and overruns, turned out later to be a great business success (Shenhar, Dvir, Levy, & Maltz, 2001). Today, practitioners increasingly recognize that although project performance is the enabler providing the means to a project success, good project performance does not necessarily imply project success (Cooke-Davies, 2002).

Then, what does project success mean? In an era when projects have become increasingly common in organizations, this question is more relevant than ever (Shenhar et al., 2001). In today's business environment, the question of project success is strongly linked to an organization's effectiveness and its success in the long run (Dvir et al., 2003). Consequently, researchers are calling for a new framework that would allow organizations to measure project success in terms of strategic value (Cooke-Davies, 2002). Nowadays, projects are powerful strategic endeavors initiated to create economic value and competitive advantage. Defining project success is therefore a strategic management concept (Shenhar et al., 2001).

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Considering a growing agreement among practitioners and academics that there is more to project success than meeting time and budget, this study takes position that projects are a part of strategic management in organizations. More specifically, this thesis follows the suggestion of Shenhar et al. (2001) that in today's rapidly changing business environment all projects have to be managed strategically in order to create economic value and competitive advantage. Moreover, projects in the future will no longer be just operational tools for executing strategy – they will become the engines that drive strategy into new directions. Clearly most projects today are conceived with a business goal in mind (e.g., more profits, additional growth, and improved market position). Ironically however, when project managers are engaged in day-to-day project execution their focus is rather operational. This mindset may help finish the job efficiently by not wasting time and money, yet it may lead to disappointing business results. At present, the project managers can not be any more only responsible for "getting the job done" and expect that other managers will be responsible for business aspects (Shenhar et al., 2001). Similarly, senior executives are unlikely to view project management as a strategic imperative as long as the primary criteria used to judge project success fall within the operational realm (Judgev & Thomas, 2002). Therefore, it is important that organizations assess the success of their projects considering their short-term and long-term objectives (Shenhar et al., 2001). There are two kinds of benefits to the organizations form the IT projects: immediate business profits, such as profitability and market share; and longer term benefits of preparing the organization for future challenges. Indeed, many IT projects are initiated for reasons beyond immediate profit. IT outsourcing organizations, in long run, are planning new generations of products or adding new service lines. They hope to enter new markets, gain

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command of a new technology, and gather substantial reputation. Thus, although an IT project may be considered less successful in a short-term due to the time and cost overruns and even limited business success, it may still be assessed as successful long-term initiative by creating new market or expertise in new technology, and preparing the organizational infrastructure for additional products for the future.

The success rating of a project may also differ according to subjective, individual judgment. Freeman and Beale (1992) pointed out that project success assessment may differ according to the assessor: "success means different things to different people." A project that is perceived as a success by a project manager and team members might be perceived as a failure by the client. On the other hand, a project which is considered to be a success by the client might be considered a failure by top management, if the project outcome does not meet top management specifications, even though it might satisfy the client (Belassi & Tukel, 1996). In this case, both of these parties are evaluating project success differently and thus they value the outcome differently. Indeed, it has been pointed out in the recent project management literature that the viewpoints of the client and the project performing organization on the success of a project are fundamentally different, because the former is focused on the deliverables, and the latter is focused on the means by which the deliverables are created. The points of reference of the client are the features of the product. IT projects are high-tech projects in which most of the technologies employed are new or have been developed prior to project initiation. In such high-tech projects the end-customers have been found ready to accept higher risks, as well as higher prices, in order to gain substantial advantages and unique solutions for their problems (Shenhar et al., 2001). There is no question that the firm managing the project is also primarily

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concerned with the deliverables. However, this organization's success factors tend to focus on whether or not processes, procedures, and tools were in place in order to facilitate the activities that would ultimately result in the final product (Rad & Levin, 2003). A good project success measure must therefore incorporate different views and opinions of different stakeholders. This idea influenced the introduction of multi-dimensional frameworks for the assessment of project success which would reflect different interests and different points of view (Pinto & Martel, 1990; Freeman & Beale, 1992; Cooper & Kleinschmidt, 1987).

Considering all of the above, it seems important to adopt in this study the multidimensional approach to definition of project success proposed by Shenhar et al. (2001) and based on the view of project management as part of the strategic activities of multiple stakeholders, which must be executed with the short- and long-term objectives in mind. The authors suggest that the project success can be viewed as a composite of four dimensions: 1) project efficiency, 2) impact on the customer, 3) business success, and 4) preparing for the future. *Project efficiency* tells us how did the project meet its resource constraints – was it finished on time and within the specified budget? This is the immediate dimension with which project can be assessed. Although success in this dimension may indicate a well-managed, efficient project, it may not suggest that this project will be considered a success in the long run, and benefit the organization later. The dimension of *impact on the customer* relates to addressing the importance placed on customer requirements and on meeting their needs. Meeting performance measures, functional requirements, and technical specifications are all part of this dimension. Direct *business success*, according to Shenhar et al. (2001), is an immediate and direct impact the project

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may have on the organization. *Preparing for the future* is the longest-term dimension, involving questions of how well the project prepares organizational processes and infrastructure for future business opportunities.

All four success measures (project efficiency, impact on the customer, business success, and preparing for the future) have been found to be highly inter-correlated with regard to the assessment of project success by different stakeholders in various industries (Dvir et al., 2003). Moreover, a preliminary explorative study conducted by Shenhar et al. (2001) revealed that in the IT projects, which are characterized by high technological uncertainty, the importance of meeting time and budget constraints was lesser than the importance of creating value for the customer and preparing for the future.

This finding led the authors to suggest that for the IT outsourcing projects, poor performance in the short-term and even limited business success may be compensated by long term benefits coming from attaining customer satisfaction, creating new market or expertise in new technology, and preparing the infrastructure for additional products in the future. The authors however advice the readers to take this initial findings with a caution and call for additional studies to further establish the validity of the multidimensional concept (Shenhar et al., 2001).

In keeping with the above, this research will endeavor to further explore the bases of multidimensional approach to measuring project management success. By applying the proposed four-dimensional measure to the IT project management setting, it will be possible to investigate whether indeed the dimensions of impact on the customer and preparing for the future are more important than the dimensions of project efficiency and business success when it comes to assessing the success of IT projects. Moreover, it will be

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interesting to compare possible variations in assessment of project success by different stakeholders (customer versus project performing organization).

The next section will present the review of the literature regarding project management maturity concept and its effect on project success. Further, the research model and the hypothesis will be presented, which will be then examined through a survey-based study of IT outsourcing projects from IT industry.

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2.2. *Organizational Project Management Maturity*

The concept of process maturity was born in the Total Quality Management movement, where the application of statistical process control (SPT) techniques showed that improving the maturity of any technical process leads to two things: a reduction in the variability inherent in the process, and an improvement in the mean performance of the process (Cooke-Davies & Arzymanow, 2003).

Through the widely adopted Capability Maturity Model for software organizations, developed by the Software Engineering Institute of Carnegie-Mellon University between 1986 and 1993, this concept of process maturity migrated to a measure of "organizational" process maturity. Integral to the model is the concept that organizations advance through a series of five stages to maturity: initial level, repeatable level, defined level, managed level and optimized level. "These five maturity levels define an ordinal scale for measuring the maturity of an organization's software process and for evaluating its software process capability. The levels also help organization prioritize its improvement efforts." (Paulk, Curtis, Chrissis, & Weber, 1993). The "prize" for advancing through thesis stages is an increasing "software process capability", which results in improved software productivity.

Federal government has relied on the Capability Maturity Model (CMM) from the Software Engineering Institute (SEI) to indicate the software engineering process maturity of contracted businesses (Jachimowicz, 2003). Since software is developed through projects, it is natural that the concept of organizational maturity would migrate from software development process to project management, and this has been reflected in an interest in applying the concept of "maturity" to software project management (Peter, 2000). Possibly as result of this a number of project management maturity models

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appeared during the mid-1990s that were more heavily influenced by the thinking of the project management profession (Cooke-Davies & Arzymanow, 2003).

In an era in which managers and customers are looking for some kind of guarantee that business project can produce desired results, process maturity is commonly thought to offer a predictor of capability (Jachimowicz, 2003). Consequently, many project management maturity models have emerged since the mid 90's. A recent estimate suggests, there are over 30 models currently serving the market (Cooke-Davies, Schlichter, & Bredillet, 2001). All of them are expected to continue generating interest and support of practitioners for the foreseeable future, as they represent frameworks for improving organizational ability to manage projects and provide a useful and accessible approach to planning and implementing structured process improvement programs in project management (Jachimowicz, 2003).

Conceptually, most of the models are based on the SEI's Capability Maturity Model. Several of the models have been described in the project management literature. All of them define project management maturity as the level of sophistication of an organization's current project management practices and processes (Kwak & Ibbs, 2000). More specifically, the models utilize the five levels of process maturity described in the CMM to provide a framework for assessing project management process maturity. These five levels are initial process, structured process and standards, organizational standards and institutionalized process, managed process, and optimizing process (Jachimowicz, 2003). The project management maturity levels portray a firm's evolution from immature project management practices to solid practices and the related infrastructure necessary to support projects at an organizational level (Dinsmore, 1998; Kerzner, 2001). Most models

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provide structured objective criteria to be met at each level of maturity. The PMMMs typically are aligned with national project management bodies of knowledge. The questions generally focus on knowledge areas as per the national project management bodies of knowledge, such as *A Guide to the Project management Body of Knowledge (PMBOK Guide)* (PMI Standards Committee, 2000).

However, some have criticized the PMMMs from a practical perspective (Cabanis, 1998; Dinsmore, 1998). Among the most common critiques are:

Models are inflexible when a flexible model is required for managing change and in keeping with quality improvement principles;

Models do not account for a rapid pace of change with which the firms adopt new technology and change processes, practices, and management systems;

The five maturity levels do not offer enough granularity to measure progress over time;

Models are overly disciplinary, impractical, and overwhelming as methodologies;

Models focus on the work processes and some ignore the human resource or organizational aspects.

The PMMMs also have some limitations from a theoretical perspective. First of all, they are based on software maturity models that lack a theoretical basis (Judgev & Thomas, 2002). Moreover, the field of PMMMs is relatively young and lacks empirical support for determining which competencies contribute most to project success (Skulmoski, 2001). In addition, no model has achieved acceptance at a worldwide level.

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Despite these shortcomings, PMMMs have made a significant contribution to the field. The growing emphasis on MMs also reflects an increasing desire to link project success to the corporate organizational processes (Judgev & Thomas, 2002). Besides, project management maturity models provide a systematic means to perform benchmarking. They provide assessment frameworks that enable an organization to compare its project delivery with the best practice or against its competitors or even within an organization among its departments (Pennypacker & Grant, 2003).

Considering all of the above, the major goal undertaken in this thesis research is to investigate whether the recent popular view of organizational project management maturity as a driving factor of project success is well merited. In order to do so, this thesis adopted the PM Solutions Project Management Maturity Model as the basis for the study.

2.3. PM Solutions Project Management Maturity Model

The PM Solutions Project Management Maturity Model is based on a two-dimensional framework. The first dimension reflects the level of maturity. It is based on the structure of the SEI's Capability Maturity Model. The second dimension depicts the key areas of project management addressed. This dimension adopts the structure of the Project Management Institute's nine knowledge areas (PMBOK Guide, 2000).

2.3.1. Project management knowledge areas

The Project Management Body of Knowledge (PMBOK) is a collection of processes and knowledge areas generally accepted as best practice within the project

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management discipline. PMBOK recognises 9 basic knowledge areas typical of almost all projects. The nine knowledge areas are:

Project Integration Management

Project Integration Management includes the processes required to ensure that the various elements of the project are properly coordinated. It involves making tradeoffs among competing objectives and alternatives to meet or exceed customer needs and expectations. This area of knowledge covers project plan development, project plan execution and integrated change control. Project plan development uses the outputs of the other planning processes, including strategic planning, to create a consistent, coherent document that can be used to guide both project execution and project control. Project plan execution is the primary process for carrying out the project plan. In this process, the project manager and the project management team must coordinate and direct the various technical and organizational interfaces that exist in the project. Finally, integrated change control is concerned with influencing the factors that create changes to ensure that changes are agreed upon, and manage the actual changes when and as they occur.

Project Scope Management

Project Scope Management includes the processes required to ensure that the project includes all of the work required, and only the work required, to complete the project successfully. It is primarily concerned with defining and controlling what is or is not included in the project. Project scope management processes are initiation, scope planning, scope definition, scope verification scope change control. Initiation is the process of formally authorizing a new project or that an existing project should continue

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into its next phase. This formal initiation links the project to the ongoing work of the performing organisation and it may be brought up by a market demand, business need, customer request, technological advance, legal requirement or a social need. Scope planning is the process of progressively elaborating and documenting the project work.

The scope statement forms the basis for an agreement between the project and the project customer by identifying both the project objectives and the project deliverables. Scope definition involves subdividing the major project deliverables into smaller, more manageable components to improve the accuracy of cost, duration and resource estimates, define a baseline for performance measurement and control, and facilitate clear responsibility assignments. Scope verification is the process of obtaining formal acceptance of the project scope by the customer. It requires reviewing deliverables and work results to ensure that all were completed correctly and satisfactory. Scope change control is concerned with a) influencing the factors that create scope changes to ensure that changes are agreed upon, b) determining that a scope change has occurred and c) managing the actual changes when and if they occur.

Project Time Management

Project Time Management includes the process required to ensure timely completion of the project. The major processes in developing the projec6t time schedule are activity definition, activity sequencing, activity duration estimating, schedule development, schedule control. Activity definition involves identifying and documenting the specific activities that must be performed to produce the deliverables and sub-deliverables identified during scope definition. Activity sequencing involves identifying

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and documenting interactivity and logical relationships that would be the bases for realistic and achievable schedule. Activity duration estimating is the process of taking information on the project scope and resources and then developing durations for input to schedules. The estimates are often progressively elaborated, and the process considers the quality and availability of the input data. Schedule development means determining start and finish dates for project activities. Schedule control is concerned with managing the changes to project schedule when and if they occur.

Project Cost Management

Project Cost Management includes the processes required to ensure that the project is completed within the approved budget. This knowledge area is primarily concerned with the cost of resources needed to complete the project activities. The major processes of project cost management are resource planning, cost estimating, cost budgeting, cost control. Resource planning involves determining what physical resources and what quantities of each should be used and when they would be needed to perform project activities. Cost estimating involves developing an approximation of the costs of the resources needed. In approximating the cost, the estimator considers the causes of variation of the final estimate for purposes of better managing the project. Cost budgeting involves the overall cost estimates to individual activities to establish a cost baseline for measuring project performance. Cost control is concerned with ensuring that any changes to the cost baseline are controlled, agreed, and measured.

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Project Quality Management

Project Quality Management includes the processes required to ensure that the project will satisfy the needs for which it was undertaken. The quality management processes are quality planning, quality assurance, and quality control. PMI's approach to quality is compatible with that of the International Organisation for Standardization (ISO), as detailed in the ISO 9000 and 10000 series of standards and guidelines. Project quality management addresses both the management of the project and the product of the project. Quality planning involves identifying which quality standards are relevant to the project and determining how to satisfy them. Quality assurance is all the planned and systematic activities implemented within the quality system to provide confidence that the project will satisfy the relevant quality standards. It is performed throughput the project. Quality control involves monitoring specific project results to determine if they comply with quality standards, and identifying ways to eliminate causes of unsatisfactory results.

Project Human Resource Management

Project Human Resource Management includes the processes required to make the most effective use of the people involved with the project and is comprised of organizational planning, staff acquisition, team development. Organisational planning involves identifying, documenting, and assigning project roles, responsibilities, and reporting relationships. Staff acquisition is concerned with getting the needed human resources assigned to and working on the project. Team development includes both enhancing the ability of stakeholders to contribute as individuals as well as enhancing the

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ability of the team to function as a team. Development as a team is critical to the project's ability to meet its objectives.

Project Communications Management

Project Communications management includes the processes required to ensure timely and appropriate generation, collection, dissemination, storage, and ultimate disposition of project information. It provides the critical links among people, ideas, and information that are necessary for success. Project communications management takes place through communications planning, information distribution, performance reporting, and administrative closure. Communications planning involves determining the information and communication needs of the stakeholders. While all projects share the need to communicate project information, the information needs and the methods of distribution vary widely. Identifying the information needs of the stakeholders and determining a suitable means of meeting those needs is an important factor for project success. Information distribution involves making needed information available to project stakeholders in a timely manner. It includes implementing the communications management plan, as well as responding to unexpected requests for information. Performance reporting involves collecting and disseminating performance information to provide stakeholders with information about how resources are being used to achieve project objectives. The project or phase, after either achieving its objectives or being terminated for other reasons, require closure. Administrative closure consists of documenting project results to formalize acceptance of the product of the project by the customer.

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Project Risk Management

Project risk is an uncertain event or condition that, if it occurs, has a positive or negative impact on a project objective. Risk Management is the systematic process of identifying, analyzing, and responding to project risk. It includes maximizing the probability and consequences of positive events and minimizing the probability and the consequences of adverse events to project objectives. The major processes of project risk management are risk management planning, risk identification, qualitative risk analysis, quantitative risk analysis, risk response planning, risk monitoring and control. Risk management planning is the process of deciding how to approach and plan the risk management activities for a project. Risk identification involves determining which risks might affect the project and documenting their characteristics. Qualitative risk analysis is the process of assessing the impact and likelihood of identified risks. Quantitative risk analysis, on the other hand, aims to analyse numerically the probability of each risk and its consequence on project objective, as well as the extent of overall project risk. Risk response planning is the process of developing options and determining actions to enhance opportunities and reduce threats to the project's objectives. Risk monitoring and control keeps track of the identified risks, monitors the residual risks and identifies the new risks, ensuring the execution of risk plans, and evaluating their effectiveness in reducing risk.

Project Procurement Management

Project Procurement Management includes the process required to acquire goods and services, to attain project scope, to attain project scope, from outside the performing organization. Project procurement management is comprised of procurement planning,

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solicitation planning, solicitation, source selection, contract administration, and contract closeout. Procurement planning is the process of identifying which project needs cans be best met by procuring products or services outside the project organization. It is usually followed by solicitation planning and solicitation – obtaining responses from prospective sellers on how project needs can be met. Source selection is concerned with receipt of bids or proposals and the application of the evaluation criteria to select a provider. Contract administration is the process of ensuring that the seller's performance meets contractual requirements. Contract closeout is similar to administrative closure in that it involves both product verification and administrative closeout. The contract terms and conditions may prescribe specific procedures for contract closeout.

All of the processes in the nine project management knowledge areas interact with each other. Each process generally occurs at least once in every project. Although the processes are presented here as discrete components with well-defined interfaces, in practice they may significantly overlap.

All of nine knowledge areas are further decomposed into components that are mapped to the five maturity levels, yielding a total of 42 key components that enable a more rigorous and specific determination of project management maturity. The structure of this two dimensional framework is presented in Figure 1 (The PM Solutions Project Management Maturity Model).

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Levels of Project Management Maturity	Level 1 Initial Process	Level 2 Structured Process and Standards	Level 3 Organizational Standards and Institutionalized Process	Level 4 Managed Process	Level 5 Optimized Process
Project Integration Management	No established practices, standards, or Project Office. Work performed in ad hoc fashion.	Basic, documented processes for project planning and reporting. Management only involved on high-visibility projects.	Project integration efforts institutionalized with procedures and standards. Project Office beginning to integrate project data.	Processes/standards utilized by all projects and integrated with other corporate processes/systems. Decisions based on performance metrics.	Project integration improvement procedures utilized. Lessons learned regularly examined and used to improve documented processes.
Project Scope Management	General statement of business requirements. Little/no scope management or documentation. Management aware of key milestones only.	Basic scope management process in place. Scope management techniques regularly applied on larger, more visible projects.	Full project management process documented and utilized by most projects. Stakeholders actively participating in scope decisions.	Project management processes used on all projects. Projects managed and evaluated in light of other projects.	Effectiveness and efficiency metrics drive project scope decisions by appropriate levels of management. Focus on high utilization of value.
Project Time Management	No established planning or scheduling standards. Lack of documentation makes it difficult to achieve repeatable project success.	Basic processes exist but not required for planning and scheduling. Standard scheduling approaches utilized for large, visible projects.	Time management processes documented and utilized by most projects. Organization wide integration includes inter-project dependencies.	Time management utilizes historical data to forecast future performance. Management decisions based on efficiency and effectiveness metrics.	Improvement procedures utilized for time management processes. Lessons learned are examined and used to improve documented processes.
Project Cost Management	No established practices or standards. Cost process documentation is ad hoc and individual project teams follow informal practices.	Processes exist for cost estimating, reporting, and performance measurement. Cost management processes are used for large, visible projects.	Cost processes are organizational standard and utilized by most projects. Costs are fully integrated into project office resource library.	Cost planning and tracking integrated with Project Office, financial, and human resources systems. Standards ties to corporate processes.	Lessons learned improve documented processes. Management actively uses efficiency and effectiveness metrics for decision-making.
Project Quality Management	No established project quality practices or standards. Management is considering how they should define "quality."	Basic organizational project quality policy has been adopted. Management encourages quality policy application on large, visible projects.	Quality process is well documented and an organizational standard. Management involved in quality oversight for most projects.	All projects required to use quality planning standard processes. The Project Office coordinates quality standards and assurance.	The quality process includes guidelines for feeding improvements back into the process. Metrics are key to product quality decisions.
Project Human Resource Management	No repeatable process applied to planning and staffing projects. Project teams are ad hoc. Human resource time and cost is not measured.	Repeatable process in place that defines how to plan and manage the human resources. Resource tracking for highly visible projects only.	Most projects follow established resource management process. Professional development program establishes project management career path.	Resource forecasts used for project planning and prioritization. Project team performance measured and integrated with career development.	Process engages teams to document project lessons learned. Improvements are incorporated into human resources management process.
Project Communications Management	There is an ad hoc communications process in place whereby projects are expected to provide informal status to management.	Basic process is established. Large, highly visible projects follow the process and provide progress reporting for triple constraints.	Active involvement by management for project performance reviews. Most projects are executing a formal project communications plan.	Communications management plan is required for all projects. Communications plans are integrated into corporate communications structure.	An improvement process is in place to continuously improve project communications management. Lessons learned are captured and incorporated.
Project Risk Management	No established practices or standards in place. Documentation is minimal and results are not shared. Risk response is reactive.	Processes are documented and utilized for large projects. Management consistently involved with risks on large, visible projects.	Risk management processes are utilized for most projects. Metrics are used to support risk decisions at the project and the program levels.	Management is actively engaged in organization-wide risk management. Risk systems are fully integrated with time, cost, and resource systems.	Improvement processes are utilized to ensure projects are continually measured and managed against value-based performance metrics.
Project Procurement/ Vendor Management	No project procurement process in place. Methods are ad hoc. Contracts managed at a final delivery level.	Basic process documented for procurement of goods and services. Procurement process mostly utilized by large or highly visible projects.	Process an organizational standard and used by most projects. Project team and purchasing department integrated in the procurement process.	Make/buy decisions are made with an organizational perspective. Vendor is integrated into the organization's project management mechanisms.	Procurement process reviewed periodically. On-going process improvements focus on procurement efficiency and effective metrics.

Figure 1 *PM Solutions Project Management Maturity Model*

2.4. *Levels of Maturity*

Level 1: Initial Process

Although there is recognition that there are project management processes, there are no established practices or standards, and individual project managers are not held to specific accountability by any process standards. Documentation is loose and ad hoc. Management understands the definition of a project, that there are accepted processes, and is aware of the need for project management. Metrics are informally collected on an ad hoc basis (Crawford, 2002; Pennypacker, 2001). At this level, an organization is unaware of the value of using projects to deliver business benefits, and has no structured approach to project management (Hillson, 2003). Management processes are repetitive and reactive, with little or no attempt to learn from the past or to prepare for future threats or uncertainties. Rather, the project managers concentrate on management of individual projects and team efforts in order to achieve predefined project goals with predetermined constraints to time and resources (Andersen & Jessen, 2003).

Level 2: Structured Process and Standards

Many project management processes exist in the organization, but they are not considered an organizational standard. Documentation exists on these basic processes. Management supports the implementation of project management, but there is neither consistent understanding and involvement, nor organizational mandate to comply for all projects. Functional management is involved in project management of larger, more visible

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projects, and these are typically executed in a systematic fashion. There are basic metrics to track project cost, schedule, and technical performance, although data may be collected/ correlated manually. Information available for managing the project is often a mix between summary level data and detailed level data (Crawford, 2002). Although aware of the potential benefits of a structured approach to managing projects, an organization at level 2 has not efficiently implemented project management processes and is not gaining the full benefits (Hillson, 2003).

Level 3: Organizational Standards and Institutionalized Process

All project management processes are in place and established as organizational standards. These processes involve the clients as active and integral members of the project team. Nearly all projects use these processes with minimal exception – management has institutionalized the processes and standards with formal documentation existing on all processes and standards. Management is regularly involved in input and approval of key decisions and documents and in key project issues. The project management processes are typically automated. Each project is evaluated and managed in light of other projects (Crawford, 2002; Pennypacker, 2001). At this level, project management is implemented across all aspects of the business. Generic project management processes are formalized and widespread, and the benefits are understood at all levels of the organization, although they may not be fully achieved in all cases (Hillson, 2003).

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Level 4: Managed Process

Projects are managed with consideration to how the project performed in the past and what is expected for the future. Management uses efficiency and effectiveness metrics to make decisions regarding the project and understands the impacts on other projects (Crawford, 2002). All projects, changes, and issues are evaluated based upon metrics from cost estimates, baseline estimates and earned value calculations. Project information is integrated with other corporate systems to optimize business decisions. Processes and standards are documented and in place to support the practice of using such metrics to make project decisions. Management clearly understands its role in project management process and executes it well, managing at the right level, and clearly differentiating management styles and project management requirements for different sizes/complexities of projects. Project management processes, standards, and supporting systems are integrated with other processes and systems (Pennypacker, 2001).

Level 5: Optimizing Process

The organization has a fully project-based culture, with a best-practice approach to project management in all aspects of the business (Hillson, 2003). Processes are in place and actively used to improve project management activities. Lessons learned are regularly examined and used to improve project management processes, standards, and documentation. Management and the organization are focused not only on effectively managing projects but also on continuous improvement. The metrics collected during project execution are used not only to understand the performance of the project but also for making organizational

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management decisions for the future" (Crawford, 2002). An organization has extended its focus from study of a single project to the way the projects are used to achieve its goals. The projects are seen as far more than solving of technical problems; they are also venues for mastering business and change (Andersen & Jessen, 2003).

Thus according to the model, an organization may have a certain level (from 1 to 5) that reflects its attributes with regard to the different project management knowledge areas described it PMBOK (Jachimowicz, 2003). For example, an organization at level 1 in project quality management recognizes the need for quality management, but has no established practices and standards. At level 2, a basic organizational policy has been adopted and management encourages its use on specific projects. At level 3, the quality process is well documented and has become an organizational standard applied to almost all projects.

The PM Solutions Project Management Maturity Model was preferred to other existing maturity models for a few reasons. First, this model has received considerable acceptance as a standard for process modeling and assessment of organizational maturity in several process areas (Crawford, 2002) because the practitioners already involved in a process improvement initiative based on the CMM find PM Solutions' model an easier organizational sell. Moreover, this model resonates more deeply for the project management community because of its ties to the PMBOK Guide (Jachimowicz, 2003). Finally, this model allows for investigation of project management processes not only on corporate but also on departmental level (Kwak & Ibbs, 2000).

In the following section, the existing academic literature linking project management maturity to ultimate project success will be reviewed and conceptual model will be developed

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that suggests a positive relationship between the level of organizational project management maturity and the four dimensions of project management success.

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3. Hypothesis and Conceptual Framework

3.1. Hypothesis

Given the adopted in this research conceptualization of project success as four-dimensional variable, it is important to investigate how the organizational project management maturity is affecting the companies' project success as measured through 1) project efficiency, 2) impact on the customer, 3) business success and 4) preparing for the future.

PMMM, Level 1 and Dimensions of Project Success

At organizational PMMM Level 1, it is expected that there are no formal procedures or plans to execute a project. The project activities are poorly defined and cost estimates are inferior. PM-related data collection and analysis are not conducted in a systematic manner. Processes are unpredictable and poorly controlled. There are no formal steps or formal guidelines to ensure PM process and practices. As a result, utilization of PM tools and techniques is inconsistent and applied irregularly, if at all, even though individual project managers may be very competent (Kwak & Ibbs, 2000). The perception of project management is mainly operational, and project managers are primarily focused on "getting the job done", while often neglecting the long-term benefits of their project activity. As a result, many projects, even when completed on time and within budget, are achieving very moderate business results (Shenhar, 2003).

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To summarize, at Level 1 projects are often delivered through the personal heroics and effort of the project manager and his/her team. They tend to be delivered in spite of the organisation rather than because of it (Haughey, 2005). Therefore it is commonly assumed that at this level of project management maturity organizations will not be able to achieve a sustainable project success on neither of the fore dimension.

PMMM, Level 2 and Dimensions of Project Success

As it was mentioned before, at this maturity level, informal and incomplete processes used to manage the project. Some of PM problems are identified, but these problems are not documented or corrected. PM-related data collection and analyses are informally conducted but not documented. PM processes are partially recognized and controlled by project managers. Nevertheless, planning and management of projects depend largely on individuals (Shenhar, 2003).

The organization at level 2 understands the project's basic commitments. This organization possesses strength in doing similar and repeatable work. Anybody can deliver here not just heroes, because there is an agreed methodology to be followed that helps repeat earlier successes from similar projects (Haughey, 2005). However, when organization is presented with new or unfamiliar projects, it confronts major chaos in managing and controlling the project (Shenhar, 2003).

Metrics used to evaluate projects at this maturity level causes sub-optimization due to myth of certainty. Relying on triple constraints (cost, time, quality) causes project manager to chase after wrong goal. Something is delivered by the deadline, but not really what the

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customer wants. Lower customer acceptance leads to lower market sales and organization profit. However, since something was delivered somewhere near the budget, the project is considered a success, even though the project outcome is failure. Something is delivered by the deadline, but the technology may have changed and the market may have moved on (Graham & Cohen, 2001).

Overall, PMMM Level 2 project success is often evaluated through criteria that emphasize the effectiveness in the management of single projects and thus the fact that projects do have connections to organizations' strategy and other projects as well is neglected (Dietrich & Lehtonen, 2005). This leads to conclude that as organization moves from Level 1 to Level 2 project management maturity, the efficiency dimension of project success will be affected positively, but not the other three remaining success components.

PMMM, Level 3 and Dimensions of Project Success

As organization moves to Level 3, PM processes become more robust and demonstrate both systematic planning and control characteristics. Most of the problems regarding PM are identified and informally documented for project control purposes. PM-related data are collected across the organization for project planning and control. Various types of analyzed trend data are shared by the project team to help it work together as an integrated unit throughout the duration of the project (Shenhar, 2003). Most importantly, the involvement of the customer follow-up team and project control are recognized as very important factors in the success of all types of projects (Dvir et al., 1998).

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Customer satisfaction means that the project is only successful to the extent that it satisfies the needs of its intended user. Project managers must now devote additional time and attention to maintaining close ties with and satisfying the demands of external clients (Pinto, 1998). In support of this view Dvir et al. (1998) have found that "benefits to the customer" is by far the most important success dimension. This only stresses the contribution of complete and accurate capture of end-user requirements to successful project completion. At Level 2, end-user involvement starts at the first stage of the project and continue until its successful end (Dvir et al., 2003).

PMMM, Level 4 and Dimensions of Project Success

At PMMM Level 3, PM processes are formal, with information and processes are being documented. Organization can plan, manage, integrate, and control multiple projects efficiently. PM processes data are standardized, collected, and stored in a database to evaluate and analyze the process effectively. Also, collected data are used to anticipate and prevent adverse productivity and quality impacts. Is allows an organization to establish a foundation for fact-based decision-making (Shenhar, 2003).

In addition to effectively conducting multiple project planning and control, the organization exhibits a strong sense of team work within each project and across projects. PM training is fully planed and is provided to the entire organization. Integrated PM processes are fully implemented at this level (Shenhar, 2003). This is not only about delivering projects but also realising benefits. This involves knowing what benefits are expected and when the project has delivered them (Haughey, 2005).

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The organizations that succeed best in managing strategic initiatives in a multi-project environment have a common project management process or project model and they also use it in as many projects as possible. These organizations review the objectives of their ongoing projects in linkage with strategy formulation (Dietrich & Lehtonen, 2005).

The project management success criteria of time, cost and performance are subordinate to the higher product success objectives of goal and purpose (Baccarini, 1999). Consequently, "this explains why projects, which ought to be considered a disaster in project management terms, are perceived as success simply because the higher-level objective was met" (de Wit, 1988). Project management processes address business aspects of the project, and dealing with just execution and meeting short-term goals no more suffice. In fact, senior managers are beginning to demand that the investment in PM tools, systems, and practices be justified financially. Thus, at this stage financial/business benefits need to occur from investing in organizational project management maturity (Kwak & Ibbs, 2000).

PMMM, Level 5 and Dimensions of Project Success

At Level 5, companies continuously improve their PM processes using, for instance, formal lessons-learned programs. Problems associated with applying PM are fully understood and addressed on an ongoing basis to ensure project success. PM data are collected automatically to identify the weakest process elements. These data are then rigorously analyzed and evaluated to select and improve the PM processes. Innovative ideas are also vigorously pursued, tested, and organized to improve processes. (Shenhar, 2003).

At this stage, the organization is concerned with whether they are doing the right projects and how via those projects they can deliver the business strategy and add value

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(Haughey, 2005). Projects and project management serve as primary capabilities of an organization to respond to change and thereby maintain a competitive edge. Projects may be considered as building blocks in the design and execution of future strategies of the organization. Organizations need to ensure better linkage between the current efforts conducted by projects and the intended strategic aims of the organization. The managerial focus of firms needs to shift towards the simultaneous management of the whole collection of projects as one large entity, and towards the effective linking of this set of projects to the ultimate business purpose (Dietrich & Lehtonen, 2005).

In order to increase shareholder value, project costs are viewed as investments made now to increase organizational value in the future (Graham & Cohen, 2001). Project managers use shareholder value as the system objective to set priorities and make decisions to guide project midcourse corrections. There is a strategic alignment between project management processes and organizational strategy. Even if the project itself does not show a sufficient economic return, it may still be included in the portfolio because it enables other projects to be done that will provide a sufficient return. Projects with sufficient returns on investment must be also aligned with the strategy so that they do not cancel their short-tem gain with longer term damage to competitive advantage (Graham & Cohen, 2001).

Given all of the above, the following four specific hypotheses can be formulated that reflect the positive relationship between organizational project management maturity and its project success dimensions:

Hypothesis 1a: Organizational Project Management Maturity Level is positively related to project efficiency.

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Hypothesis 1b: Organizational Project Management Maturity Level is positively related to project impact to the customer.

Hypothesis 1c: Organizational Project Management Maturity Level is positively related to project's preparing for the future.

Hypothesis 1d: Organizational Project Management Maturity Level is positively related to direct business and organizational success.

This hypothesis is graphically reflected in Figure 2 below and will be investigated using survey-based quantitative research methodology.

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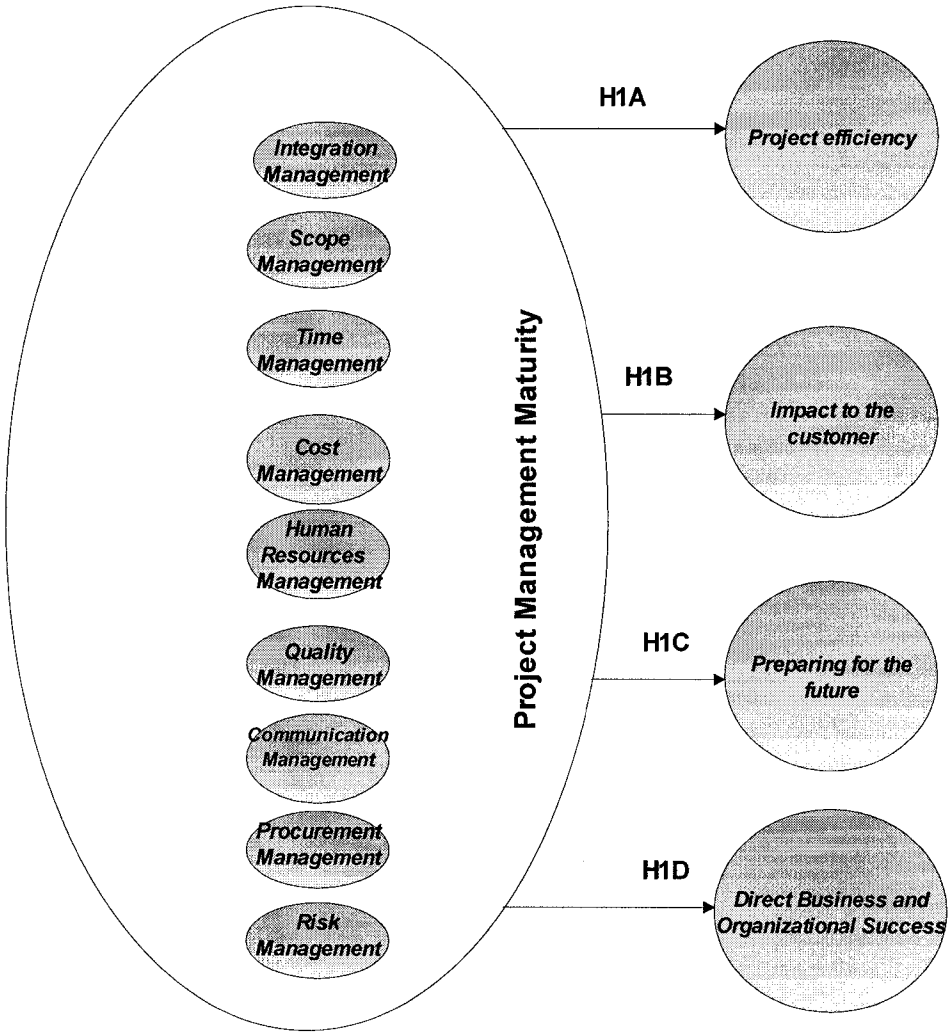

Figure 2 Research Model

3.2. Conceptual Framework

The main objective of this thesis is to test whether project management maturity has any impact on project success. Before doing so, we will start looking at the factorial validity of these two constructs. This step will allow us to test whether each of these two "concepts" (latent variables) can be characterized as a first order or a second order model. A second order model is the case where the dependent constructs (9 in the case of project management maturity and 4 in the case of project success) can be explained by the same latent variable

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(project management maturity and project success). A first order model is the case where we can not get a second order model with a reasonable fit.

In the second step we will test hypothesis 1a, 1b, 1c and 1d and the general hypothesis that project management maturity has (or not) an impact on project success.

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4. Research methodology

We will use a structural equation modeling (SEM) framework to test our hypothesis. It is recommended to use a two step analysis (Anderson and Gerbin, 1987).

In this approach a measurement model is first analyzed. A measurement model does not contain any causal relationships and all the factors of the model are allowed to correlate with each other. This method also helps eliminate some factors that are highly correlated with the others. Once a good fit is obtained, one can analyze the hypothesized causal relationships. The measurement model is also very useful when analyzing scores reliability, convergent validity and discriminant validity, as we will see below.

4.1. Data collection and research sample

To collect the data to test hypothesis, a survey research methodology was adopted. The WEB – based survey was distributed to the members of the Montreal Project Management Institute chapter in addition to the paper-based questionnaire distributed to the Project Management Institute members. In total, the questionnaires were distributed electronically and in hard copies to 800 respondents and 125 responses were received. Out of 125, 109 responses were completed and analysed.

The research is based on the analysis of the correlation between the levels of the Project Management Maturity in the organization and the success of the project as perceived by the three main stakeholders (customer, project manager, and contractor). The data for the analysis is drawn from a survey of IT – related projects in telecommunication industry.

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The customer is intended to be represented by personnel who is using the end product of the project (i .e. system or tool) and participated in defining the functional requirements. The contractor is the commercial firm or a government R&D facility that has been awarded the contract for carrying out the project that will develop and produce the product, which will fulfill the end-user need. The project manager is an employee of the contractor who has full responsibility for successful execution of the project [Dvir et al, 1997]. The questionnaires suggested describing success of the project, which was performed not more than 3 years ago. The respondents were asked to self-report on the PM practices and perceived success of the project. Questioner asks whether respondent is the customer, the project manager or contractor (line manager).

The questions solicited subjective evaluations on a seven-point scale (for questioner see Appendix No 1).

4.2. Research variables and Measures

The variables which were used in the study fall into two constructs: *Project Management Process Maturity* and *Project Success*, and were adopted from the previous research.

Project success was measured along three criteria that were applied and validated in research of Shenhar, Dvir and Levy [1997]. These criteria are:

(1) Meeting planning goals (success at the project manager level)

(2) End-user benefits (success from the end-user point of view)

(3)Contractor benefits (success at the contractor's level, and includes their last two criteria: commercial success of the project and potential for future revenues)

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Items below were measured on the scale from 1 to 7.

Meeting Planning Goals (Project efficiency) was assessed via three measurements:

(1) Meeting schedule goals as described in the initial project plan

(2) Meeting budget goals as described in the initial specifications

(3) Meeting the functional goals as described in the initial specifications

Impact on the customer was measured via five measurements.

(1) Satisfying customer operational need.

(2) Project end product delivered to the customer in time

(3) Project end product has significant usable life expectancy

(4) Customer capabilities significantly improved

(5) The customer is using the end product

Contractor benefit was measured via *Project Business success* and *Preparing to the future* constructs:

Business Success was measured via two measurements:

(1) Commercial success (profit exceeded plans or profit from similar projects)

(2) Creating a large market share (new market penetration)

Preparing for the future was measured via six measurements:

(1) Creating a new market

(2) Creating a new product line

(3) Developing a new technology

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(4) Developing new knowledge and expertise

(5) Created positive reputation

(6) Responded to business or competitive threat

Overall success measure: in addition to the three sets of success measures described above, the questionnaire included an item dealing with overall success of the project. The *overall success* will be measured on a 1–5 scale, where 1 represents a complete failure and 5 represents full success.

Project Management Maturity was evaluated via organization's capabilities in managing the major Project Management knowledge areas: Project Integration Management, Project Scope Management, Project Time Management, Project Quality Management, Project Human Resources Management, Project Communication Management, Project Risk Management, and Project Procurement Management. PMMM [Crawford, 2002] was be used for this assessment.

The Figure No 2 above demonstrates the relationships between the two research constructs. They are described in the sections below.

Project Management Process Maturity

Construct	**Item**	**Measure**
Overall Project Management Maturity	PMMM level	Please rate your organization's overall PM maturity

Variable	**Item**	**Measure**
Integration Management	Int1	Project Plan Development
	Int2	Project Plan Execution

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	Int3	Change Control
	Int4	Project Information Systems
	Int5	Project Office
Scope Management	Scp1	Requirements Definition – Business
	Scp2	Requirements Definition-Technical
	Scp3	Deliverables Identification
	Scp4	Definition
	Scp5	WBS
	Scp6	Change Control
Time Management	Time1	Activity Definition
	Time2	Activity Sequencing
	Time3	Schedule Development
	Tiime4	Schedule Control
	Time5	Schedule Integration
Cost Management	Cost1	Resource Planning
	Cost2	Estimating
	Cost3	Budgeting
	Cost4	Performance Management
	Cost5	Cost Control
Quality Management	Qlt1	Planning
	Qlt2	Assurance
	Qlt3	Control
	Qlt4	Management Oversight
HR Management	HR1	Organization Planning
	HR2	Staff Acquisition
	HR3	Team Development
	HR4	Professional Development
Communication Management	Com1	Communication Planning
	Com2	Information Distribution
	Com3	Performance Reporting
	Com4	Issues Tracking and Management
Risk Management	Risk1	Identification
	Risk2	Quantification
	Risk3	Response Development
	Risk4	Control
	Risk5	Documentation
Procurement Management	Prc1	Procurement Planning
	Prc2	Requisition
	Prc3	Solicitation/Source Control
	Prc4	Contract Management /Closure

Table 1 *Measure of Project Management Maturity*

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Measure of Project Success

Variable	Item	Measure
Project Efficiency	Prf1	Meeting Planning Goals
	Prf2	Meeting Budget Goals
	Prf3	Meeting Project Functional Goals
Impact to the Customer	ICust1	Were Customer Operation Needs Satisfied?
	ICust2	Was the Customer End Product Delivered in Customer in Time?
	ICust3	Is the Project End Product Has Significant Life Expectancy?
	ICust4	Were the Customer Capabilities Improved Significantly?
	ICust5	Is Customer Using the End Product?
Project Business Success	Bsuc1	Did the Project Have Commercial Success?
	BSuc2	Was a Large Market Share Created?
Preparation to the Future	PFut1	Was a New Market Created as a result of a Project Completion?
	PFut2	Was a New Product Line created as a result of Project Completion?
	PFut3	Was Any New Technology Developed as a Result of Project Completion?
	PFut4	Were New Knowledge and Expertise Developed as a Result of Project Completion?
	PFut5	Was a Position Reputation of Your Organization/Department Created?

Table 2 *Measure of Project Success*

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4.3. Data Description (descriptive statistics)

Position

VP or Director – Level Business Manager	7
Project/Program Office Manager	65
Director, Project/Program Manager	35
CEO	2

Domain of the project research

Desktop management	12
Disaster Recovery	2
Hardware maintenance	4
Network Management	28
Operation of application	3
Operation of operating system	1
Printer operation	1
Security Management	3
System Integration	43
Training	3
Other	8

Department/division

IT	66
New Product Development	26
Other	16

Project budget

> 1,000,000	47
500,000 - 1,000,000	20
100,000 - 500,000	19
50,000 - 100,000	10
10,000 - 50,000	7
5,000 - 10,000	2
5,000 <	1

Table 3 *Descriptive statistics*

Data screening shows there was almost no missing data. Also, since all variables are measured on a scale 1 to 7, the issue of outliers is not relevant.

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4.4. Reliability assessment

A first step in the SEM approach is the analysis of whether data are measuring what they are supposed to measure; this is reliability assessment. This assessment can be done using the reliability Cronbach' alpha. A higher value indicates that the measurable variables are measuring what they are supposed to measure. Table 4 and Table 5 give such values for the project management maturity factors and for the project success factors. All values are high indicating good scores reliability.

Factors for project management maturity	**Cronbach Alpha**
Integration Mgt	0.896
Scope Mgt	0.894
Time Mgt	0.906
Cost Mgt	0.904
Quality Mgt	0.909
HR Mgt	0.832
Communication Mgt	0.865
Risk Mgt	0.901
Procurement Mgt	0.904

Table 4 *Cronbach' alpha for project management maturity factors*

Factor(Project Success)	**Cronbach Alpha**
Project efficiency	0.866
Impact to the customer	0.885
Project Business Success	0.84
Preparation to the future	0.878

Table 5 *Cronbach' alpha for project success factors*

A complimentary method for assessing scores reliability is through the measurement models (see below).

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4.5. Data parceling

Raw data may be subject to many errors such as omissions. Such errors may induce "noises" in the data. To alleviate the effect of such errors, data parceling is used.

It consists in aggregating measurable items to create item parcels that are used as indicators (Bagozzi&Edwards, 1998; Bagozzi&Heatherton, 1994). Although, some information may be lost through this method, the method is widely used in the literature and because of its advantages such as the stable and the reliable estimates that it induces (Landis et al 200).

We will use correlation analysis to perform data parceling: Items that are highly correlated will be replaced by their average. Table 6 and Table 7 give the new items that will be used for SEM analysis.

Factors for project management maturity	**Initial variables**	**Aggregated variables**
Integration management	Int1 Int2 Int5	AInt1
	Int3 Int4	Ant2
Scope management	Scp1 Scp2 Scp3	AScp1
	Scp4 Scp5 Scp6	AScp3
Time management	Time1 Time2 Time3 Time5	ATime2
	Time4	Time4
Cost Management	Cost1 Cost2	ACost1
	Cost3	Acost3

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	Cost4 Cost5	
Quality management	Qlt1 Qlt2 Qlt3	AQlt1
	Qlt4	Qlt4
HR management	HR1 HR2 HR3	AHR1
	HR4	HR4
Communication management	Com1 Com3 Com4	ACom1
	Com2	Com2
Risk management	Risk1 Risk2 Risk3 Risk4	ARisk1
	Risk5	Risk5
Procurement management	Prc2	Prc2
	Prc1 Prc3 Prc4	APrc3

Table 6 *Data averaging for project management maturity*

Factors for project success	**Initial variables**	**Aggregated variables**
Project efficiency	Prf1	Prf1
	Prf2	Prf2
	Prf3	Prf3
Impact to the customer	ICust1 ICust2	AICust1
	ICust3 ICust4 ICust5	AICust3

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Project Business Success	Bsuc1	Bsuc1
	Bsuc2	Bsuc2
Preparation to the future	PFut1	APFut1
	PFut2	
	PFut3	Acost3
	PFut4	PFut4
	PFut5	PFut5

Table 7 *Data averaging for project success*

4.6. Software used and SEM analysis

Structural Equation Modeling is a statistical methodology for the analysis of hypothesized multivariate causal relationships between variables. The causal processes under study are represented by a series of regressions. The hypothesized model is then tested statistically to assess the extent to which it is can be consistent with the data. Good fits of the model indicate that the hypothesized model and causal relationships are plausible. SEM analyses are suited for research models that deal with both measurable and non measurable (latent) variables. Analyses were performed using EQS for Windows 5.7 (Bentler and Wu 1998).

SEM is chosen to analyse the data of the current research, as the Management Maturity Model (PMMM) intends to capture the multi-facets of project management maturity (PMM). Each facet or factor of PMMM is characterized by a set of measurable variables. Structural Equation Model suggests that such factors are one-dimensional and they and current research obtained the reasonable model fits with first order factors representations.

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4.7. Factorial validity for project management maturity

As stated above, we will test whether project management maturity is a second order model.

This is equivalent to assessing model fits for the hypothesized second order model presented in Figure 3. The analysis of the measurement model gives the following correlations matrix (table 8)

	Integration Mgt	Scope Mgt	Time Mgt	Cost Mgt	Quality Mgt	HR Mgt	Com/n Mgt	Risk Mgt	Proc/t Mgt
Integration Mgt	1								
Scope Mgt	0.852	1							
Time Mgt	0.786	0.971	1						
Cost Mgt	0.682	0.893	0.863	1					
Quality Mgt	0.739	0.789	0.768	0.937	1				
HR Mgt	0.707	0.899	0.807	0.979	0.922	1			
Com/n Mgt	0.659	0.787	0.703	0.833	0.802	0.992	1		
Risk Mgt	0.633	0.799	0.859	0.955	0.959	0.962	0.833	1	
Proc/t Mgt	0.636	0.765	0.658	0.8	0.793	0.846	0.769	0.864	1

Table 8 *Correlations matrix for the factors of project management maturity*

Table 8 shows that some factors are highly correlated with each other. The high correlations are indications of poor discriminant validity. Therefore we eliminate factors that are causing such high correlations with several other factors. By doing so, we are not loosing information since two highly correlated factors convey the same information. We keep the following factors: Integration, scope, cost, communication and procurement management. The new correlation matrix (Table 9) indicates reasonable correlations between the factors.

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	Integration Mgt	Scope Mgt	Cost Mgt	Com/n Mgt	Proc/t Mgt
Integration Mgt	1				
Scope Mgt	0.876	1			
Cost Mgt	0.691	0.894	1		
Com/n Mgt	0.661	0.775	0.807	1	
Proc/t Mgt	0.645	0.77	0.796	0.728	1

Table 9 *Correlations matrix for the factors of project management maturity*

The second step in the SEM approach is the analysis of the structural model (second order model). Figure 4 gives the results of the analysis.

Model fits are assessed using different indices as recommended in the literature (Hu and Bentler 1998). The indices used are the root mean square error of approximation (RMSEA) and the comparative fit index (CFI). Kline, 2005 gives some guidelines about the ranges for reasonable fits. RSMEA between 0.05 and 0.08 suggests a reasonable error of approximation. A CFI value larger than 0.9 may indicate a reasonably good fit. Both conditions hold in the case of the second order model for project management maturity.

All scores loadings in Figure 4 are statistically significant suggesting good scores reliability.

Loadings of the latent variable maturity (project management maturity) are also statistically significant indicating that this variable can indeed be seen as a second order model.

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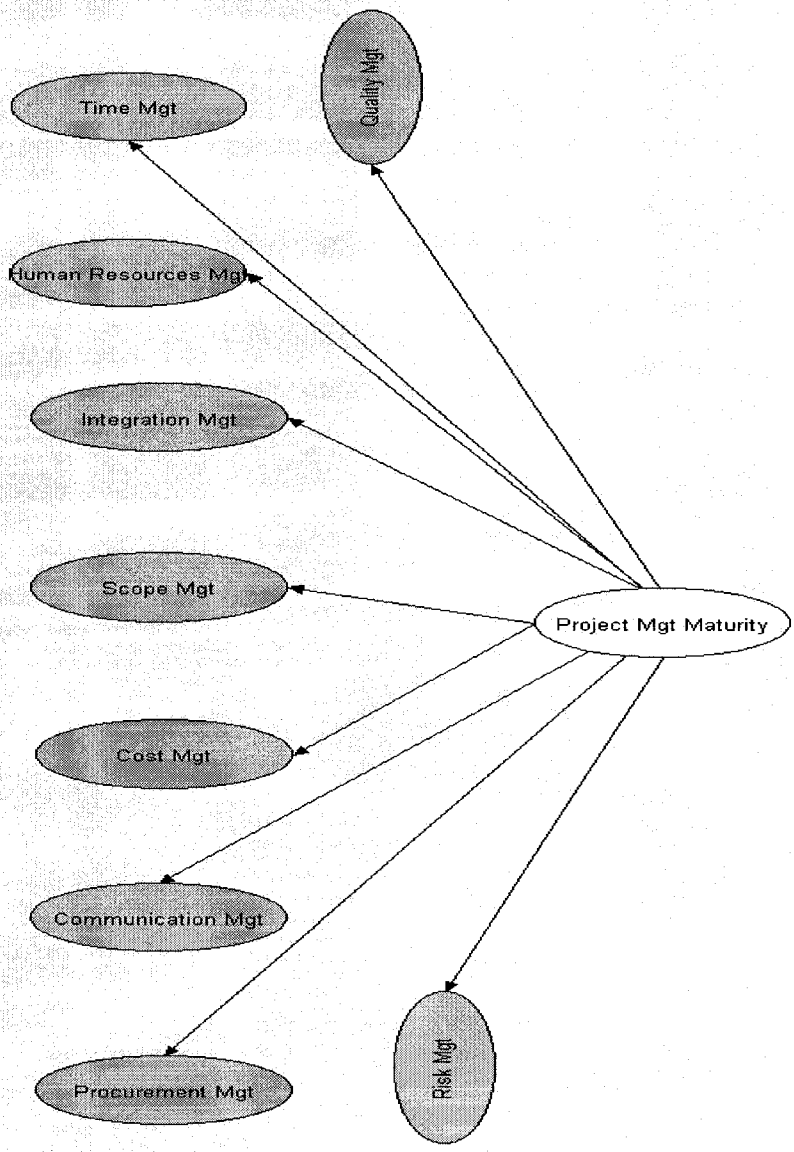

Figure 3 *A second order model for project management maturity*

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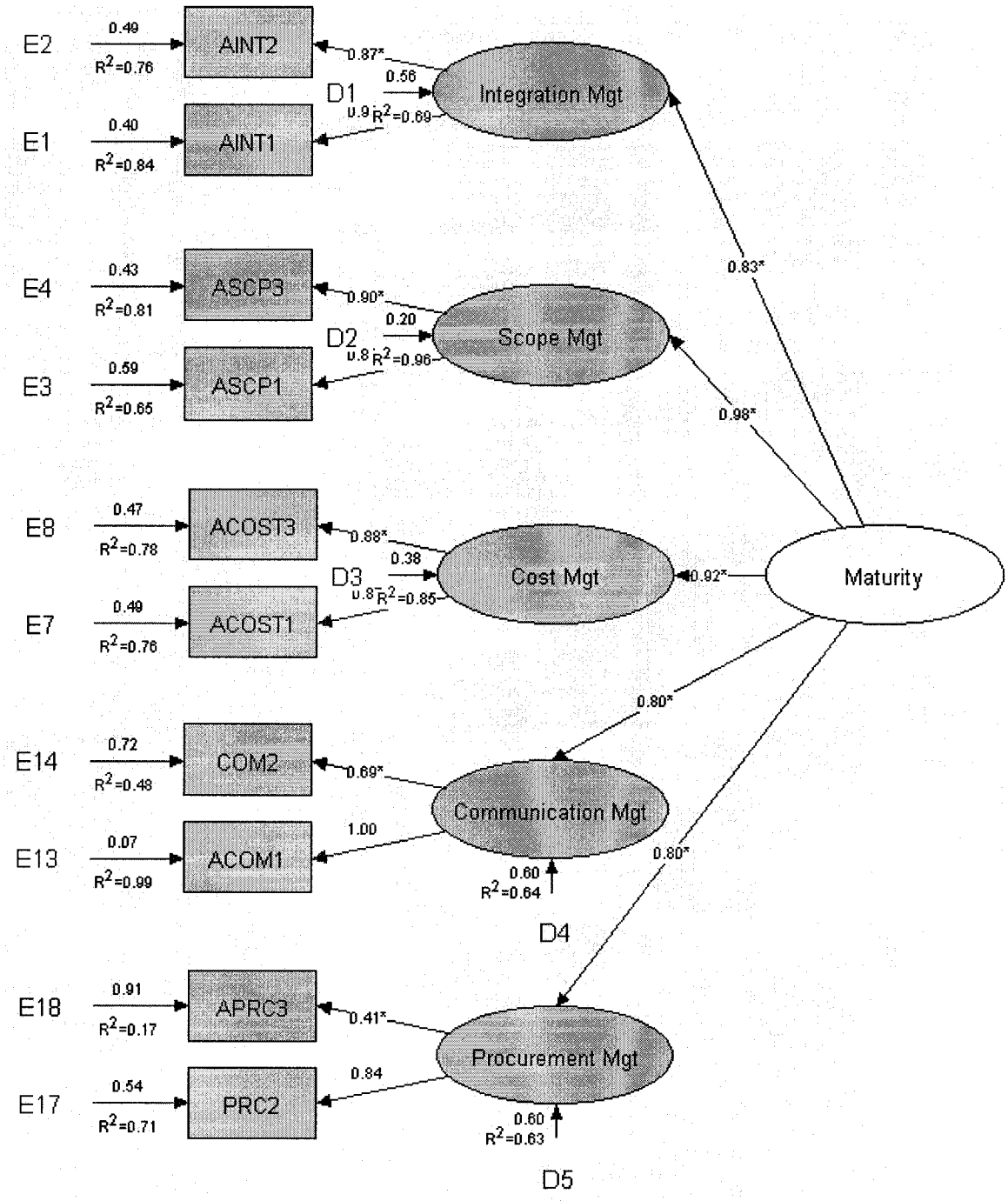

Figure 4 *A second order model for project management maturity*
CFI=0.97, RMSEA=0.08, Chi-sq=49.31, p-val=0.01

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4.8. Factorial validity for project success:

We use the same approach as above to test whether project management maturity is a second order model.

This is equivalent to assessing model fits for the hypothesized second order model presented in Figure 5 The analysis of the measurement model gives the following correlations matrix (Table 10)

	Project Efficiency	Impact to Customer	Business Success	Preparation for Future
Project Efficiency	1			
Impact to Customer	0.911	1		
Business Success	0.783	0.807	1	
Preparation Future	0.893	0.848	0.951	1

Table 10 *Correlation matrix for project success*

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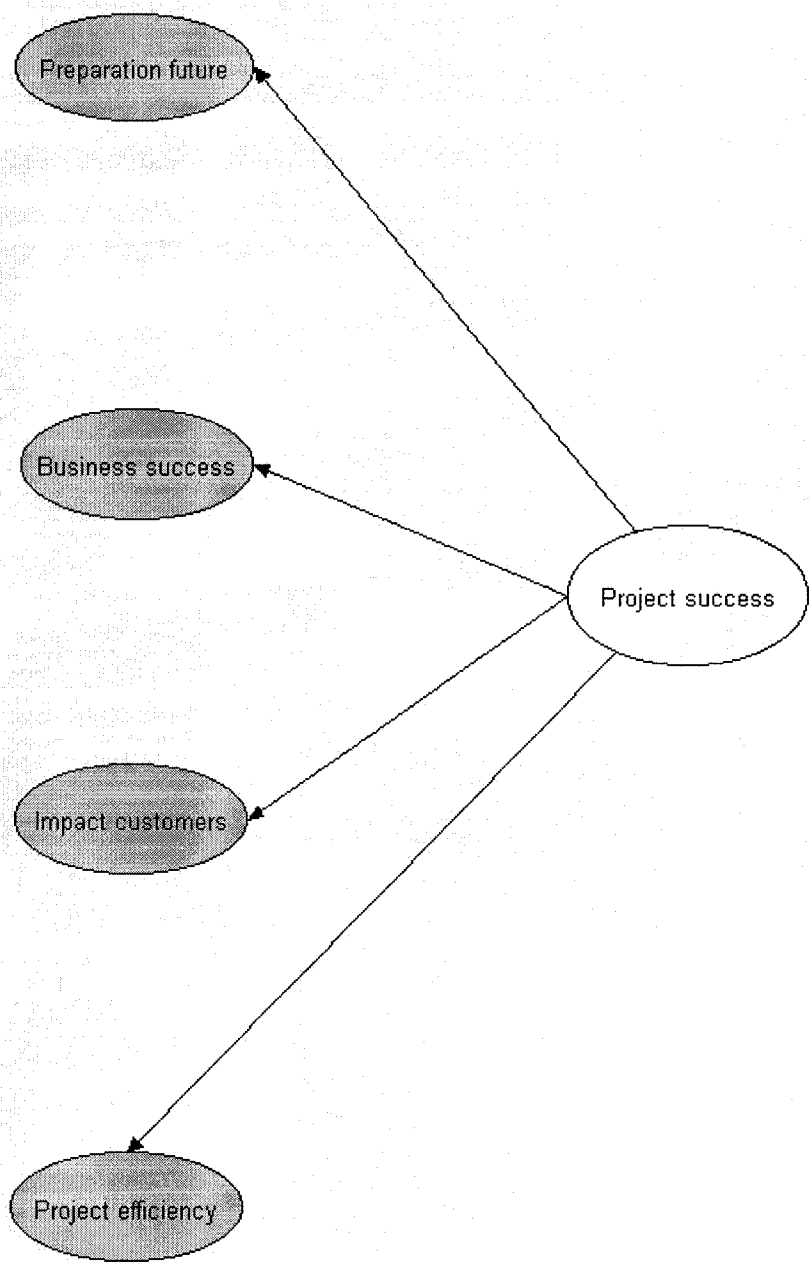

Figure 5 *A second order for project success*

Table 10 shows that some factors are highly correlated with each other. The high correlations are indications of poor discriminant validity. Therefore we eliminate factors that

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are causing such high correlations. We keep the following factors: Business success and project efficiency. The new correlation matrix (Table 11) indicates reasonable correlations between the factors.

	Project Efficiency	Business Success
Project Efficiency	1	
Business Success	0.75	1

Table 11 *Correlation matrix for project success factors.*

As before, the second step in the SEM approach is the analysis of the structural model (second order model). Figure 6 gives the results of the analysis.

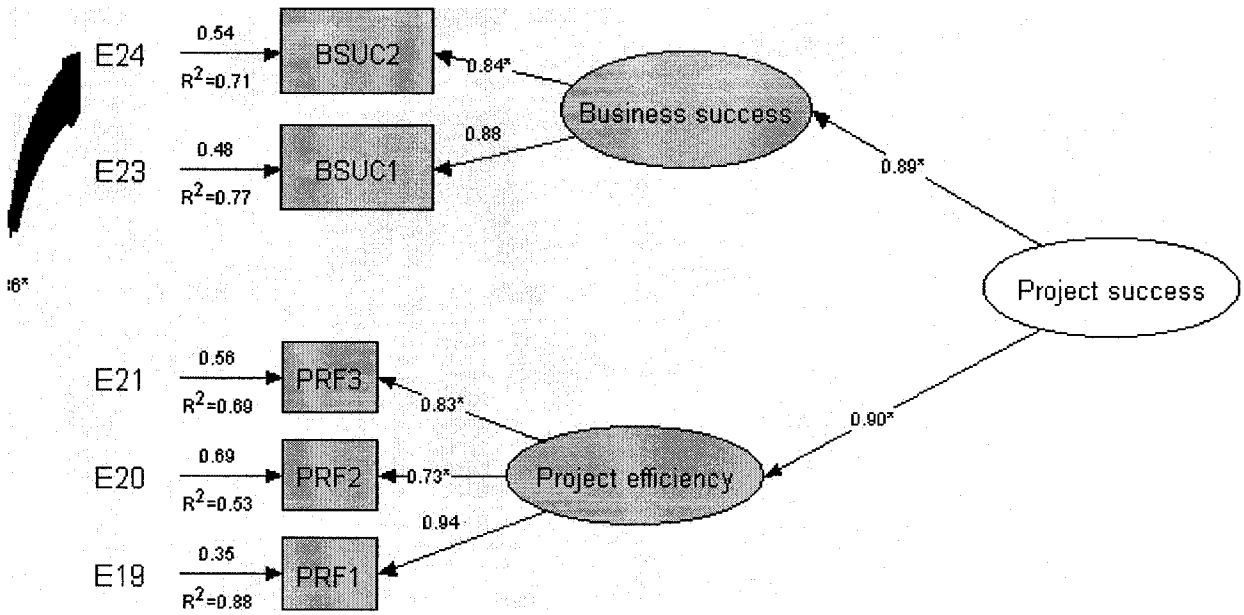

Figure 6 *A second order model for project success*
CFI=0.99, RMSEA=0.01

All scores loadings in Figure 6 are statistically significant suggesting good scores reliability.

Loadings of the latent variable maturity (project success) are also statistically significant indicating that this variable can indeed be seen as a second order model.

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4.9. Findings

Project management maturity is positively related to project efficiency (H1d)

Since impact to customers and preparation for future were eliminated above, we are left with two hypotheses to be tested H1a and H1d.

Hypothesis 1d is tested using the SEM approach. The results of the structural model are summarized in Figure 7.

Results of the model show reasonable model fits. The loading coefficient from project management maturity onto business success is statistically significant and positive indicating indeed that the two are positively related.

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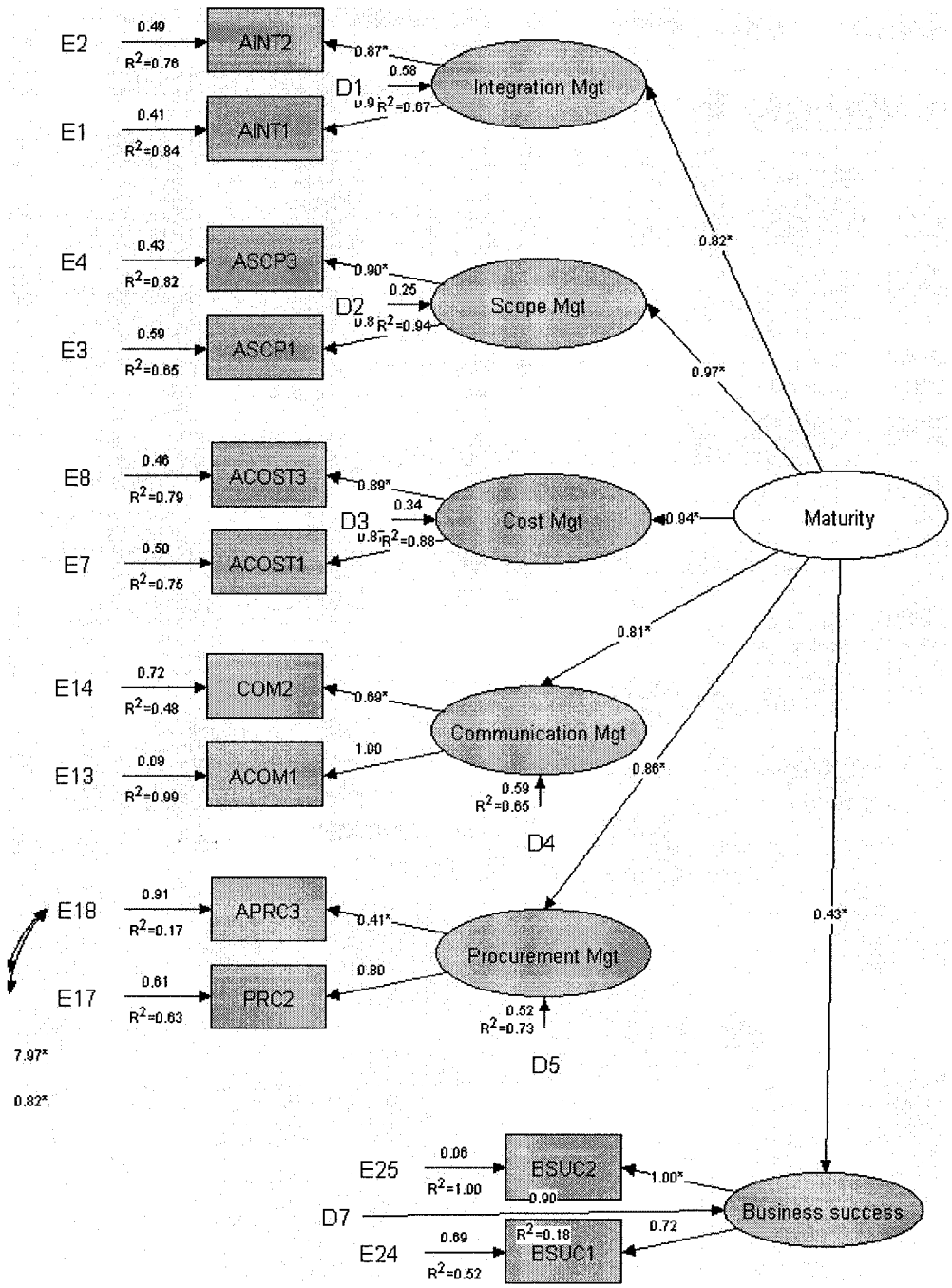

Figure 7 *Project management maturity positively related to project business success*
CFI=0.94, RMSEA=0.1

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Project management maturity is positively related to project efficiency (H1a)

Hypothesis 1a is tested using the SEM approach. The results of the structural model are summarized in Figure 8.

Results of the model show reasonable model fits. The loading coefficient from project management maturity onto project efficiency is statistically significant and positive indicating indeed that the two are positively related.

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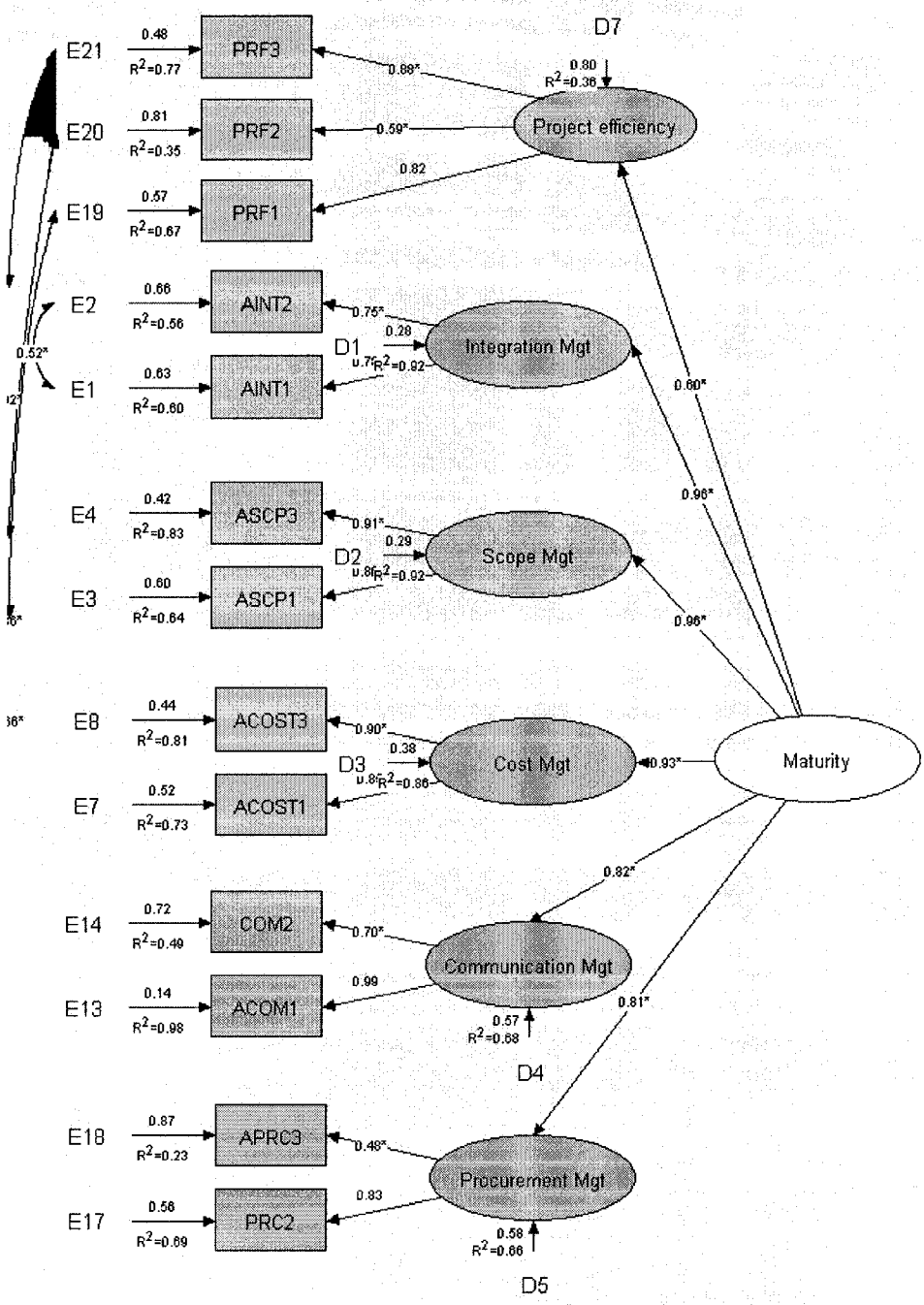

Figure 8 *Project management maturity positively related to project efficiency*
CFI=0.92, RMSEA=0.1

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5. Discussion

This section of the paper will first present a brief summary of research findings and will highlight the apparent existence of positive relationship between the constructs of project management maturity and project success. Then, implications for research and practice of IT project management will be discussed. Finally, the section will address the limitations of the study and present suggestions for further research.

5.1. Summary of Research Findings

Project management, though very popular in different industries, is gaining more popularity in the IT sector. Different new techniques, with different degrees of sophistication, are devised. One of the main implications of mastering project management techniques in the IT sector is the shift to a project oriented approach towards their operations (Kwak & Ibbs, 2000). This approach is supported by the benefits a company can achieve through the realization of successful projects. Indeed, the company running good projects is likely to increase revenues, to decrease life cycle costs and to reduce financing and capital costs (Lavingia, 2001). Therefore, project management is becoming a true competitive advantage strategy.

Developing projects management techniques that help bring value to the organization is a continual process of improvement. Many research models try to capture the learning effect of developing and improving project management techniques. Among such models, project maturity models (PMMs) are well documented in the literature (Pennypacker&Grant,

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2003). PMMMs models are presented by many industry experts as successful tools that the company can use to achieve sustainable project management successes. However, and to our best knowledge, such a claim has not yet been supported by any empirical work. This thesis examined the link between organizational project management maturity and project success in an empirical framework.

PM Solutions Management Maturity Model was used to measure the degree of maturity or sophistication in the techniques and practices of project management within a corporate environment. The model presents project management maturity as a nine construct concept. The model along with other project maturity management models is based on SEI's Capability Maturity Model. The latter is well documented in the literature. On the contrary, project success is not defined in the literature in a coherent way. After conducting a thorough literature research, we have proposed a five construct model that captures many of the project success facets discussed in the literature.

Our initial task was to test whether both models are effectively supported by our data. Project management maturity was analyzed using structural equation modeling (SEM). Our first result was that project maturity could be represented by a second order. This is an indication that indeed, the model PMMM is empirically tested. However, not all the constructs of the proposed model were retained. Indeed, some of the nine factors were highly correlated indicating they were measuring the same "concept". High correlations may be due mainly to the fact that certain factors such as costs management and quality management are likely to be correlated in many corporate and project environments.

Our next task was to test that the construct model we proposed for projects success is confirmed by the data. The SEM approach used shows that indeed, project success can be

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seen as a second order concept. However, only business success and project efficiency were retained as explanatory factors for project success. This is not to say that the other factors (preparation for the future and impact for the customers) were irrelevant since in fact they were highly correlated with the factors retained. Indeed, it seems logical to assume that if a customer is satisfied with project deliverables this results in direct increase of profits and business success for a performing organization.

Our third research objective was to test the relationship between organizational project management maturity and project success. We achieved this objective in two ways. First, we tested the links between project management maturity as a second order concept and business success and project efficiency. Both relationships were statistically significant and the causal coefficients were positive, indicating there is a positive causal relationship between project management maturity and those factors. Second, we investigated the relationship between project maturity as a second order concept and project success as a second order model. The relationship was positive indicating a causal relationship.

5.2. Implications for Research

To our best knowledge, this thesis is the first empirical study that tries to link the degree of project management maturity to project success. In that sense, it brings a significant contribution to the literature in this field. Findings of this study show that project management maturity has a positive causal relationship with project success. In an era where companies are adopting a project oriented approach even to their operations, this study suggests that investments in the improvement of the degree of project management maturity maturity are essential for the value creation at the corporate level.

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Another contribution is the proposal and assessment of a model for project success. Indeed and as previously stated, there is no "universal" definition of project success in the literature. The thesis suggests that project success can be seen as a second order concept and that business success and project efficiency are the main factors components of such a concept.

The latter finding, in fact, re-opens the discussion among researcher regarding the crucial dimensions of the project success. On one hand, the study results support a growing agreement that overall project success should be measured by both – project business success, which can not be measured until after the project is complete, and project efficiency (performance), which can be measured during the life of the project (Cooke-Davies, 2002; Shenhar, Dvir, Levy, & Maltz, 2001). On the other hand, we did not find support for separating the measure of benefits to the organization on immediate business profits and longer term benefits of preparing the organization for future challenges. These two dimensions were indeed highly correlated, although this finding could be explained by the nature of research sample, which was comprised in large part of project managers may have lesser understanding and visibility of companies strategic objectives that a CIO or a program manager would have. Finally, although there are various points of view on the project success they may be not all that different. Our empirical findings support the existing in project management community opinion that efficient project management leads to a satisfied customer, which positively reflects on the company's business success.

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5.3. *Implications for Practice*

As high project failure rates persist in IT outsourcing and other industries, the search for the factors and determinants of project success remains the most relevant. These research findings contribute to the practice of project management by stressing the importance of formal, managed and integrated organisation-wide approach to project management. By examining one of the many circulating in the industry project management maturity models (PM Solutions Project Management Maturity Model), we found support for these models growing popularity and shared among many practitioners assumption that organizational project management leads to sustainable project management success. Indeed, this research findings show that organizations places farther along the 5-level continuum of project management maturity are able to achieve higher rates of project success. The latter finding could result in several constructive prescriptions to the organizations that choose to "projectize" their IT practices and operations.

The first step towards improvement would be for the organisations to undergo project management maturity assessments. Such exercise although somewhat costly and lengthy, would help organizations identify what needs to be improved and develop a read-map to reach higher degree of project management maturity levels.

As more and more organizations embark on the ladder of project management maturity, they recognize the need for standardizes and analytical approach for project management processes. In view of our findings, it could be recommended that the organizations implemented initiatives that included project offices, project management methodologies, project management software, and project management training. The organizations that succeed best in managing strategic initiatives in a multi-project

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environment have a common project management process or project model and they also use it in as many projects as possible. These organizations review the objectives of their ongoing projects in linkage with strategy formulation (Dietrich & Lehtonen, 2005). More importantly, industry leading organisations seem to strategically rely on multiple coordinated project management improvement initiatives through Project Management Office (PMO), rather than on just one or two separate projects. A recent PMI Research Conference described the PMO as "an organizational entity with full time personnel to provide and support managerial, administrative, training, consulting and technical services for a project driven organization." Surprisingly however, only 37% of average companies recognize the value of a PMO, according to Hackett Group's World-Class IT Research Report research (reported May 21, 2003, CIO Magazine.) This despite the fact that, according to an AMR Research Report, leading enterprises used PMOs to cut IT costs by 2% to 5%, improve productivity 25% to 50%, and shift 10% to 15% of the IT budget into more strategic projects. (Eric Austvold, The AMR Research Report, "What it Takes to Be a Leader in IT Portfolio Management", July 21, 2003.) We believe the positive relationship between degree of project management maturity and project success found in this study supports the commencement of the industry move toward setting up IT PMOs.

Finally, another important practical implication of this research is in that it demonstrates to the "projectized" organizations and their executives the necessity of developing company-wide project success measures based not only of 'Iron Triangle' principle but also considering the extent to which the initial business goals of projects were achieved. The project management success criteria of time, cost and performance must be complemented by overall project goals and objectives (Baccarini, 1999).

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5.4. Limitations of the Study and future research

The study was based on data from local companies. Although in today's global economy, one can think of the sample of companies surveyed as a representative sample of the IT industry, an interesting further research would be whether our results could be confirmed in a more international framework, whereby the companies surveyed present a more international pooling.

Another important research issue could be a thorough analysis of the structure of the project success concept. Our findings suggest that business success and project efficiency are the factors that form the two facets of project the management concept. However, it is natural to think of preparation for the future as the main characteristic of project success in "futuristic" industry such as the military and defence. In such industries, it would be interesting to assess whether our findings still hold.

Our study though was not intended to be dynamic, would be more substantiated if extended in a dynamic framework to take into account the learning effect of companies and how the change in project management maturity and not the project management maturity is affecting project success

A last but not least continuation of the research methodology and questions tackled in this thesis is the investigation of whether the findings of our study hold in other industries other than the IT sector.

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6. Conclusion

What does project success mean? And most importantly, how does an organization ensure sustainable success of its projects? In an era when projects have become increasingly common in organizations, these questions are more relevant than ever (Shenhar et al., 2001). In today's business environment, the question of project success is strongly linked to an organization's effectiveness and maturity of its overall project management practices. Consequently, drawing on project management maturity models and the existing research into a construct of project success, this thesis undertook an investigation into the nature of the project success, its dimensions and driving factors. Project management practitioners have already long recognized the importance of coherent organizational project management practices to the sustained project success rates. This is evident through the proliferation of various Project Management Maturity Models in the IT Industry as well as in many others. Unfortunately, the theory has not caught up with the practice yet, as to this date there has been not empirical study investigating and demonstrating the relationship between organizational degree of project management maturity and project success. Our study therefore was undertaken with the goal to address this limitation.

The quantitative survey among over 100 IT industry Project Management Professionals revealed the existence of a strong positive relationship between degree of project management maturity and project success. The sustained IT project management success appears to be attained by developing standard organizational project management practices, tools and techniques; in other words by increasing organizational project management maturity.

Finally, this research explores and highlights the relevance of different project success dimensions proposed in the theoretical literature. A general agreement on the composites of

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the construct of project success is critical to further research into its driving factors. This study finds that out of four commonly named dimensions of project success - project efficiency, business benefits, preparing for future and impact to the customer – the first two are the most relevant. Overall, this thesis helps to breach the existing gap between project management theory and practice.

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