The notion of project management maturity (PMM) is central to the understanding of project success in general and information systems (IS) projects in particular. Yet, while the professional press assumes for years a positive relationship between PMM level and IS project success, this relationship is still not well understood in the IS literature. Drawing on project management maturity perspective and IS contingency view from Organization Theory, we formulate a model articulating the relationship between PMM levels and IS project success and the moderating role of IS project risk profile. To validate the model we survey 125 IT projects in North America. PLS method will be used and our analysis of the measurement and structural model will be conducted. We theorize that the impact of PMM level on IS project success is moderated by IS project risk profile. The potential implications of these results on research and practice are also discussed.

Keywords: Project management maturity, IS project success, survey
Introduction

Projects are considered to be the vehicles that allow organizations to turn business opportunities into valued business assets, increase revenues, decrease life cycle costs, and use less capital to achieve business goals (Subramanian et al., 2007). Project management (PM) has been an important topic in a variety of disciplines over the last two decades, and specific project management techniques, tools and practices have grown increasingly sophisticated to help increase project success rates (Rivard and Dupre, 2009; Ika, 2009; Jiang et al. 2004). Nonetheless, in the IS literature, despite growing efforts, we still need a better understanding of why so many IS projects fail (Agarwal and Rathod, 2006; Gelbard and Carmeli, 2009; Rivard and Dupre, 2009). One of many examples of IS project failures is of the Canadian Arms Registry, an information system first estimated at "no more than 2 million dollars a year" in 1995, that finally cost close to one billion $ CAD 10 years later (CTV, 2006). The business impact of these problems is significant and often threatens the profitability and even the survival of the firms (Krishnan et al., 1999; Papke-Shields et al., 2009). In such circumstances, it is undisputable that successful IS project delivery is critical to the ability of organizations to achieve corporate goals (Agarwal and Rathod, 2006).

Prior research shows that the management of IS projects is often marked by inadequate planning, a poor grasp of the overall development process, and no clear management framework, even as the focus shifts from a technology perspective to a more process-centric view (Slaughter, 2006). Carefully designed management practices are, therefore, needed to improve these processes and gain better control over uncertain and risky environments. Such practices are now emerging as viable solutions to the IS projects crisis (Canfora et al. 2005). In addressing these concerns, significant efforts have lately focused on designing and improving IS project management processes with the objective of enhancing their capability maturity levels and, therefore, IS project success (Jiang et al. 2004).

The project management community is actively demonstrating substantial interest in the development of viable methods to assess and improve project management maturity (PMM), a persistently discussed topic in project management (Jung and Goldenson, 2009). Project management maturity refers to the level of sophistication of an organization’s current project management practices and processes (Yazici, 2009). Several project management maturity models have been designed to help address organizations’ needs to progressively develop the capabilities needed to deliver consistently successful projects (Papke-Shields et al. 2009). Unquestionably, the most used one is the model developed by the Project Management Institute (PMI, 2000) known as The Project Management Body of Knowledge (PMBOK) which is a collection of processes and knowledge areas generally accepted as best practice within the project management discipline. The foundation for this model is the well-known Capability Maturity Model or CMM originally developed by the Software Engineering Institute (Paulk et al. 1993).

Clearly most projects are conceived with a business perspective in mind, and often with a goal which is focused on better results and organizational performance-more profits, additional growth, and improved market position (Shenhar et al. 2001). Several studies have indicated the impact of effective projects on firms performance (Ika, 2009; Rivard and Dupre, 2009). This study is based on the proposition that projects are part of the strategic management in organizations. Their benefits are multifaceted, and their goals must be set in advance to better help the organization meet its short and long-term objectives (Shenhar et al. 2001).

Prior research has proposed and tested a direct link between the maturity level and project performance from the operational perspective (cost, time and quality) but mixed results were found (Jiang et al, 2004). Drawing on project management maturity perspective and IS contingency view from Organization Theory, we posit and argue that the relationship between PMM level and IS project success is moderated by an important construct suggested by Barki et al. (1993; 2001) - IS project risk profile (project size, project complexity, technological newness, team expertise, organizational environment). This is the objective of this study.

The contribution of this paper is twofold. First, as suggested by Shenhar et al. (2001), IS project success construct is conceptualized and tested as a multidimensional construct which consists of four dimensions (project efficiency, impact on the customer, direct business and organizational success, preparing for the future). This conceptualization and operationalization is a complement of the operational perspective of IS project performance widely used in IS literature (Fisk et al. 2010). Second, this study is perhaps the
first to explicitly integrate putative risk factors - IS project risk profile as a moderator of the relationship between PMM level and IS project success. This conceptualization is needed to explain, in part, the etiology of IS project success from the capability maturity perspective. In this regard, we expect that our findings offer new insights into the management of IS projects.

The remainder of the paper is organized as follows: first we present the theoretical foundation and hypotheses. Next, we discuss our research methodology. We conclude with a discussion of the implications for practice and research and expected contributions.

Theory and hypothesis development

The basic criteria of cost, time and quality, the so-called “iron triangle,” are the traditional project success criteria (Atkinson, 1999). This conceptualization alone may be misleading, since it may count as successful those projects that meet time and budget constraints yet do not meet customer needs and requirements (Malach-Pines et al., 2009). There are many cases in which projects are executed as planned, on time and on budget, and achieve the planned performance goals, but turn out to be complete failures because they did not produce actual benefits to the customer or adequate revenue and profit for the performing organization (Dvir et al., 2006). On the other hand, quite often what seemed to be a troubled project, with extensive delays and overruns, later turned out to be a great project success (Cooke-Davies, 2002; Shenhar et. 2001). Given the growing agreement among project management researchers that there is more to project success than meeting time and budget targets, this study adopts the conceptualisation of project success as proposed by Shenhar et al. (2001). Project success is 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 the project met its resource constraints – was it finished on time and within the specified budget? The impact on the customer dimension refers to 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 represents an immediate and direct impact that the project can have on the organization. Preparing for the future refers to how well the project prepares organizational processes and infrastructure for future business opportunities. In today’s rapidly changing business environment, all projects have to be managed strategically in order to create economic value and competitive advantage. Therefore, it is important for organizations to assess the success of their IS projects by considering their short-term and long-term objectives (Shenhar et al. 2001). This includes immediate business profits, such as profitability and market share, as well as the longer-term benefits that will prepare the organization to meet future challenges. Although a project may be considered less successful in the short term due to time and cost overruns and even limited business success, it may still be seen as a successful long-term initiative if it creates a new market or expertise in new technology, and prepares the organizational infrastructure for additional products for the future.

Project management maturity (PMMs) refers to the level of sophistication of an organization’s current project management practices and processes (Yazıcı, 2009). Traditionally, PMMs models (see Figure 1) consist of five levels and portray a firm’s evolution from immature project management practices to solid and optimized practices and the related infrastructure required to support projects at an organizational level (Kerzner, 2001; Yazıcı, 2009). More specifically, PMMs utilize the five levels of process maturity described in CMM (Paulk et al. 1993) to provide a framework for assessing project management process maturity. These five levels are: initial, repeatable, defined, managed and, optimize level (Papke-Shields et al. 2009). These five maturity levels define an ordinal scale for measuring the maturity of an organization’s PM processes and for evaluating its PM capabilities. The “prize” for advancing through these stages is an increasing project management process capability which results in improved IS project success.

Typically PMMs are aligned with the Project Management Body of Knowledge-PMBOK Guide (PMI, 2000). Although the processes are presented as discrete components with well-defined interfaces, in practice they may significantly overlap. All of the nine knowledge areas are further decomposed into components that are mapped to the five maturity levels, yielding a key components that enable a more rigorous and specific determination of project management maturity.
Drawing on project management literature, a number of studies have indicated the benefits of structured processes, and their effect on project success (Gibson et al., 2006; Subramanian et al., 2007). Subramanian et al. (2007) found that the presence of a defined, managed, measured, and continuously improved new product development process is positively correlated with project success. Jung and Goldenson (2009) found that a structured, formal development process helps reduce development cycle time. Lu et al. (2008) analyzed the relationship between maturity factors and project success. Their results indicate that close connections between project performance and maturity factors affect project performance to a certain extent. On the other hand, prior research reports mixed results of this effect (Jiang et al. 2004). An organization certified at a certain PMM level does not guarantee IS project success, rather the certification facilitates or enables it to effectively drive IS project success taking into account, among others, IS project risk profile (Barki et al. 2001; Bahli and Rivard, 2003, 2005).

In this study, we posit and argue that the effect of PMM level on IS project success is not necessarily a direct effect. This conceptualization originates from the foundation of CMM framework but never was tested in IS project context. While project management maturity nine knowledge areas might facilitate IS project success, they are constrained by the project size, project complexity, team expertise, technological newness and, organizational environment. Therefore, we conceive of IS project risk profile as a moderator that affect the relationship between PMM level and IS project success. The impact that a predictor variable has on a criterion variable is dependent on the level of a third variable, termed here as a moderator. The fit between the predictor and the moderator is the primary determinant of the criterion variable (Venkatraman, 1989 p. 424). More concretely, the predictor variable is PMM level, the moderator variable is IS project risk profile and the criterion variable is IS project success.

Stemming from organization theory, traditional IS literature contains a series of studies which aim to explain risk profile or factors that predict levels of risk in IS development projects (Barki et al. 1993; 2001; Wallace et al., 2004). The aim of this literature is to assess factors that may influence project failure and, then, either compensate or inhibit their impact through a series of contingencies. We adopted the conceptualization and operationalization of risk profile suggested by Barki et al. (1993, 2001). Accordingly, five dimensions were identified (project size, technological newness, team expertise, project complexity, and organizational environment). During the lifetime development span of an IS project, these factors may influence the outcome of an IS project (Barki et al. 2001). Using a contingency
perspective, Barki et al., (1993, 2001) have suggested that increased levels of fit between IS project risk profile (project size, technological newness, project complexity, team expertise, organizational environment) and the associated management profile have a positive effect on software project performance. In this study, we hypothesize that the interactions of IS project profile and PMM level impacts IS project success. We therefore hypothesize that:

- **H1**: Project size moderates the effect of project management maturity level on IS project success
- **H2**: Project complexity moderates the effect of project management maturity level on IS project success
- **H3**: Team expertise moderates the effect of project management maturity level on IS project success
- **H4**: Technological newness moderates the effect of project management maturity level on IS project success
- **H5**: Organizational support moderates the effect of project management maturity level on IS project success

![Figure 2. Proposed Research Model](image-url)
Research Design & Method

Instrument development and data collection

To validate the hypothesized model we conducted a survey on the impact of project management maturity level on IS project success. The survey examined the level of IS project success, the PMM level of each surveyed organization and the IS project risk profile as a moderator variable. The unit of analysis is the IS project. We operationalize model constructs by adapting existing scales where possible (Table 1). We followed the scale development procedures suggested by DeVellis (2003). The measures used were refined via a card-sorting procedure (Moore and Benbasat 1991) performed by ten experienced IT researchers and professionals who are familiar with the topic of project management maturity. Each measure was placed on a card. Each judge was given all the cards as well as a brief description of each of dimension. Then we asked each judge to map each card into the appropriate dimension. To assess the reliability of the judges' sorting, the level of agreement of each pair of judges was assessed with Cohen's Kappa (Cohen 1960). All levels of agreement were found to be high 0.71 where the threshold was 0.65.

Before collecting the data, the instrument was pre-tested with the same ten individuals who performed the card sorting procedure. The survey instrument was modified in accordance with their recommendations. Project management maturity level was evaluated using a scale from 1 to 5 as well as a reflective construct of nine dimensions, illustrating the five PMM levels of the organization's capabilities in managing the nine major PM knowledge areas (Crawford, 2002; Yazici, 2009). IS Project success was measured along four dimensions: project efficiency, impact on the customer, business success, and preparing for the future (Shenhar et al. 2001). IS Project risk profile was measured along five dimensions: project size, project complexity, team expertise, technological newness, organizational support (Barki et al. 2001).

The data was collected from IS project managers from North American organizations which are already certified from the PMI. Respondents were asked to assess a recent and significant IS development project implemented in the last two years. These constraints were used for temporal stability and in order to avoid response bias as suggested by Huber (1981). The survey research method was adopted to collect the data and test the research model. Out of the 800 questionnaires distributed to IS project managers, 136 were received. Of these, 11 were missing responses to two or more of the items for one or more constructs. These cases were removed leaving 125 usable responses (for a net response rate of 16 percent). This response rate is consistent with the typical response rate (10 to 20 percent) for surveys of PMI members (Stefanou, 2003). Despite this, we tested for the possibility of response bias.

Non-response bias was assessed using t-tests between early respondents' and late respondents' answers (83 respondents within the first 3 weeks and 42 questionnaires received after the 3-week period). T-tests were used to compare the assets, number of employees, annual sales and industry sector of operation of participating and non-participating firms. No significant difference was found (p<.0731). Furthermore, we examined the common method bias (CMB) using Harman's one-factor test. Harman's single-factor test is arguably the most widely known approach for assessing CMB in a single-method research design (Podsakoff et al. 2003). Typically, in this single-factor test, all of the items in a study are subject to exploratory factor analysis (EFA). Then, CMB is assumed to exist if a single factor emerges from unrotated factor solutions, or a first factor explains the majority of the variance in the variables. These tests found no significant biases in our dataset that would have been due to the survey methodology.
### Table 1. A Sample Table

<table>
<thead>
<tr>
<th>Construct</th>
<th>Dimensions</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IS Project Success</strong></td>
<td>Efficiency</td>
<td>Shenhar et al. (2001)</td>
</tr>
<tr>
<td></td>
<td>Impact on the customer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Business Success</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preparing for the Future</td>
<td></td>
</tr>
<tr>
<td><strong>Project Management Maturity</strong></td>
<td>Project Integration Management</td>
<td>Refined Measures of PMI (2000)</td>
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<tr>
<td></td>
<td>Project Time Management</td>
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<td></td>
<td>Project Cost Management</td>
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<td>Project Quality Management</td>
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<td>Project HR Management</td>
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<td></td>
<td>Project Communications Management</td>
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<td>Project Risk Management</td>
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<tr>
<td></td>
<td>Project Procurement</td>
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</tr>
<tr>
<td><strong>IS Project Risk Profile</strong></td>
<td>Project Size</td>
<td>Barki et al. (2001)</td>
</tr>
<tr>
<td></td>
<td>Project Complexity</td>
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<tr>
<td></td>
<td>Technological Newness</td>
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<td></td>
<td>Team Expertise</td>
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<td></td>
<td>Organizational Environment</td>
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</tbody>
</table>

### Some Descriptive Statistics

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<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Male IT Project Managers</td>
<td>82.80 %</td>
</tr>
<tr>
<td>Female IT Project Managers</td>
<td>17.20 %</td>
</tr>
<tr>
<td>Systems integration projects</td>
<td>43 %</td>
</tr>
<tr>
<td>Network management projects</td>
<td>28 %</td>
</tr>
<tr>
<td>Security management represents</td>
<td>26 %</td>
</tr>
<tr>
<td>Project budget &gt; 1 million US$</td>
<td>47 %</td>
</tr>
<tr>
<td>500 000 &lt; Project budget &lt; 1 million</td>
<td>20 %</td>
</tr>
<tr>
<td>100 000 &lt; Project budget &lt; 500 000</td>
<td>29 %</td>
</tr>
</tbody>
</table>

### Assessment of the Measurement and Structural Model

The data was screened for missing values, flat lining and outliers and removed where necessary. Data was checked for normality, multicollinearity, and homoscedasticity using SPSS 17. Overall, of 136 cases, 125 were used for final analysis. The measurement and structural model will be assessed using the partial least squares (PLS) technique, and specifically PLS-Graph version 3.0, build 1130 to examine internal consistency reliability, convergent and discriminant validity (Chin and Frye, 2001). To assess convergent validity, we will assess (α) individual item reliability and (e) construct reliability. To assess the discriminant validity, we will examine whether the square root of the average variance extracted (AVE) score of each construct is greater than its correlations with the other latent constructs. With a satisfactory measurement model in place, we will evaluate our hypotheses using the structural model. We intend to run the PLS model without the moderating role of IS project risk profile and then with it included. That is the impact PMM level (scaled from 1 to 5) on IS project success as a composite construct as suggested by Barki et al. (2001) and then integrate the five moderating variable of IS project risk profile. Furthermore, in order to get a thorough treatment of IS project etiology, we will test the moderating role of each
dimension of IS project profile on the impact of each of the nine PMM knowledge areas on each of the four dimensions of IS project success to identify any differential impact on IS project success at the second-order factor level of our model. Some preliminary results and highlights of the developed instrument will be presented at the conference.

**Practical Implications and Expected Contributions**

This research has important practical implications. We demonstrate that IS project success can be seen as a multidimensional construct, as suggested by Shenhar et al. (2001). This conceptualization is supported by a growing agreement in the literature that overall IS project success should be measured by efficiency, business success, impact on the customer and preparing for the future – which cannot be measured until after the project is complete – and project efficiency – which can be measured during the life of the project (Cooke-Davies, 2002; Dvir et al. 2006; Shenhar et al. 2001). This study contribute to the practice of IS project management by stressing the importance of adopting a strategic view of IS project success. This study does not diminish the importance of the operational perspective widely used in practice (cost, time and quality, the so-called “iron triangle,”) but rather complement it. Second, this study is perhaps the first to explicitly integrate IS project risk profile as a moderator construct of the relationship between PMM level and IS project success. Depending on IS project risk profile, organizations placed farther along the 5-level continuum of the project management maturity scale may be able to achieve higher rates of IS project success. In this regard, we expect that our findings offer new insights into the management of IS projects.

For information systems practice, our study quantifies the benefits of project management maturity from a strategic perspective of IS project success. Organizations and IS project managers maybe reluctant to invest in PMM practices without knowledge of the return on that investment. For IS project managers, our study a methodology for assessing IS project risk profile and its moderating impact on IS project success. These expected contributions provide insights for planning projects and assessing the likelihood of IS project success.

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**References**


