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Standardized project management may increase development projects success

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Abstract

Companies frequently opt to implement standardized project management (SPM), which can be defined as a standardized set of project management practices. These companies expect that such an approach will carry significant potential for improving project performance. To investigate this potential, we undertook an exploratory study into the impact of SPM on project performance in development projects in high-velocity industries. Our research started with the qualitative method using case study research to identify the major factors in SPM efforts on the organizational project management level (as opposed to the individual project level). Then, we developed hypotheses based on these factors and performed hypothesis testing to identify factors that impact project success. In addition, we conducted the follow-up interviews to enrich and refine our findings. Three major findings came out of this study. First, the variables of SPM tools, leadership skills, and process showed themselves to be of higher interest to standardization than the other independent variables because they may impact project success; second, these variables of higher interest are typically customized to fit the strategic purpose of the company; and third, companies tend to standardize project management practices only to a certain level.
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1. Introduction

According to multiple empirical studies, a company's effectiveness partly depends on the success of its projects [1,2]. Consequently, many researchers have investigated those factors affecting project success, including product definition, quality of execution, and even project management techniques [2–4]. Common to these studies are that they are done on the individual project level and they tend to see these success factors as fitting all project situations [5]. In addition, the studies are not specifically conducted for projects in high-velocity industries.

Some companies in high-velocity industries have recognized standardized project management (SPM, see Table 1 for acronyms in this paper) as a strategy for managing development projects. For example, Brown and Eisenhardt [6] suggested that critical success factors can hinge on the degree of standardization of project practices. Recently, the Project Management Institute (PMI) issued a new standard, the Organizational Project Management Maturity Model (OPM3) [7], which suggests SPM as a major strategy. These references suggest that SPM may have a significant place in many companies' approach to PM.

Given the significance of SPM in the industry, it comes as a surprise that empirical research on the topic remains sparse, especially on the organizational project

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Table 1
Acronyms used in this paper

Acronyms	
ISO	International Standards Organization
OPM	Organizational Project Management
PM	Project Management
PMBOK	Project Management Body of Knowledge
SWD	Software Development
NPD	New Product Development
OPM3	Organizational Project Management Maturity Model
PMI	Project Management Institute
SPM	Standardized Project Management
WBS	Work Breakdown Structure

management (OPM) level. Prompted by this paucity of research, we designed an exploratory study into SPM. In particular, this study aims to identify and then get a better understanding of the factors that may impact project success and, thus, be of interest in future research related to SPM efforts in development projects in high-velocity industries. Specifically, the goal is to address two research questions: *What are the major factors in SPM efforts on the OPM level?* And, *what SPM factors on the OPM level are of interest because they may impact project success?*

2. Conceptual background

The context of this research is the high-velocity electronics, computer, and software industries. According to Eisenhardt [8], a high-velocity environment abounds with rapid and discontinuous changes in demand, competition, and technology; in addition, that information is often inaccurate, unavailable, and obsolete. Lengnick-Hall and Wolff [9] proposed that in these industries:

- Disequilibrium and perpetual, discontinuous, radical change makes all competitive advantages temporary
- Organization units and actions are loosely coupled, stimulating entrepreneurial behaviors
- Any advantage is temporary, contributing to surprise, flexibility, and unpredictability to a firm's strategic weapons
- Continuous disruption is a nonlinear process, and risk is viewed as a factor to capitalize on
- Destabilizing the current environment is focused in such a way that a succession of fleeting advantages lead to high performance.

In such context, while recognizing Brooks' views [10] of the uniqueness of software development (SWD) projects, in this study, we believe that there are enough similarities between new product development (NPD) and SWD projects, especially in the electronics, computer, and software industries. The similarities are in terms of the level of technological uncertainty, system complexity, and risk involvement, etc. These similarities and a phenomenon that a multitude of project products in the electronics and computer industries include both the NPD (hardware) and SWD (software) components, led us to study such NPD and SWD projects together, called "development projects."

- Technological uncertainty: This issue is closely related to the degree that the project uses novel versus mature technologies. Projects involving more novel technologies are considered to have a higher technological uncertainty than those with more mature technologies. For example, breakthrough NPD projects that create product platforms based on a new generation of technology are characterized by a higher level of technological uncertainty than derivative NPD projects, whose purpose is to adapt the platform for a certain market niche [11]. Similarly, an SWD project focusing on maintenance, including minor upgrades, has a lower level of technological uncertainty than a breakthrough program. *Since the essence of NPD and SWD projects is innovation advantage*, *a large portion of these projects deal with a medium to high level of technological uncertainty.*
- System complexity: This issue can be conceptualized as a combination of product characteristics, functional mission, and organizational structure. For example, imagine a project with a single component and a single function of a limited scale that is implemented within a functional group, such as the development of a computer hard drive or development of a software translator. In contrast, a complex project would have multiple components and multiple functions and require the involvement of multiple organizations, e.g., development of a new generation of computers or a large software suite. *Many NPD and SWD projects have medium to high levels of system complexity*, *which causes further complexities in their development process* (e.g., complexity of team communication, project structure, and project schedule) *and product* [10].
- Risk involvement: NPD and SWD projects are among the riskiest endeavors for the modern company and those risks tend to hit NPD and SWD projects from many angles. A risky situation may be severe when the firm has limited knowledge and experience with the product and process technologies that they intend to incorporate into the product [11]. In both NPD and SWD projects, the risk level increases if the project involves many personnel, has a high application complexity, involves a high number of technology acquisitions, and lacks of sufficient resources and team expertise. *Generally*, *a significant number of NPD and SWD projects are exposed to medium to high severity of risk.*

2.1. Measures of project success

Project success measures literature in general PM and NPD includes several rigorous empirical studies [12,13]. Its dominant view seems to be a stakeholder approach to project success, wherein each stakeholder group – e.g., customers, senior management, etc. – takes a view of the project success from a different angle. The logic here is that measures of project success need to include the diversity of stakeholder interests.

In the context of high-velocity industries, project success measures literature offers some rigorous empirical research but much more of trade literature. Examples from the rigorous empirical research include measures such as: on time to market (anticipates markets), on target to market (product meet needs of current customers), schedule [6] and schedule, cost, quality; quality of the project management process; customer satisfaction [14]. Trade literature examples point to schedule, budget, customer satisfaction [15], and market share, profitability index, schedule, budget, staffing level [16]. Overall, these measures follow the stakeholder approach. In addition, the measures can be grouped as (a) internal measures (e.g., cost, time, quality) and (b) external measures (benefiting organization, e.g., market share, time to market, profitability index; and benefiting customer, e.g., customer satisfaction).

2.2. Project management factors critical to project success

Critical success factors can be described as characteristics, conditions, or variables that can have a significant impact on the success of the project when properly sustained, maintained, or managed [17]. In our literature search, we did not find any empirical studies about SPM factors on OPM level that are critical to the success of projects in high-velocity industries. However, we did find some studies about SPM factors that are critical to project success on OPM level. The studies of Toney and Powers [18] and Kerzner [1] include samples drawn from high-velocity industries while a study of Sobek et al. [19] collected samples from company in the capability-based industries [9].

According to Toney and Powers [18], standardized process (approaches and procedures) is a success factor. Standardized PM tools and skill sets for project leadership are identified as critical success factors in a case study about Toyota projects by Sobek et al. [19]. Finally, Kerzner [1] claims that standard PM metrics and tools impact standard PM methodology (i.e., process), which then influences project success. Also according to Kerzner [1], organizational culture and information management systems impact project success as well.

Our next step was to generally look at other literature regarding PM factors critical to project success (not specific to SPM). In the area of high-velocity industries, Brown and Eisenhardt [6] demonstrate that process, communication, and interpersonal relationships (trust, respect, etc.) impact project success. Other researchers found success factors such as PM process [14,20], project organization [14,21], tools [20], metrics [14], and culture [21]. We can conclude that this literature points up three ideas. First, in most cases, critical factors are correlated to a construct of an aggregate measure of project success. Second, a great deal of the research exhibits a focus on a single PM area, e.g. project timeliness while some of reviewed articles attempt to investigate multiple PM areas. Third, all this research is directed at the individual project level.

3. Research method

3.1. Research process

The research approach is summarized in Fig. 1. Basically, this is an empirical study that combines qualitative and quantitative methods. According to Eisenhardt [22], the case study research is necessary *"at times when little is known about a phenomenon, current perspectives seem inadequate because there have little empirical substantiation."* In our case, such phenomenon is *SPM on OPM in high-velocity industries*. Hence, we believe that it is appropriate to use a case-study research methodology as the first step to develop SPM constructs drawn from real-life context, and use its results for subsequent steps of developing and testing hypotheses for the quantitative study (research step 2). To ensure the validity of our findings and to enrich and refine them, we implement research step 3, the follow-up case interviews, which is again of qualitative nature. We believe that this research process is very appropriate in searching for answers to our research questions and environments in which we undertake our study. Details are as follows.

In research step 1, we used multiple methods such as semi-structured interviews with 12 project managers (six organizations), review of related SPM documents, and observations. We started informally with open-ended questions, asking them to tell stories of SPM initiatives. Then, we asked them to describe their experiences in SPM efforts and identify variables that make SPM efforts successful. After finalizing individual interviews, we performed content analysis and a cross-case analysis, forming ideas, concepts, and insights of the inner workings of SPM initiatives. As is suggested by Eisenhardt [22], literature review was also performed as part of this case study research (shown earlier in sections: Measures *of Project Success* and *Project Management Factors Critical to Project Success*). The purpose of the literature review was to build internal validity, raise theoretical level, and sharpen construct definitions [22,23]. The col-

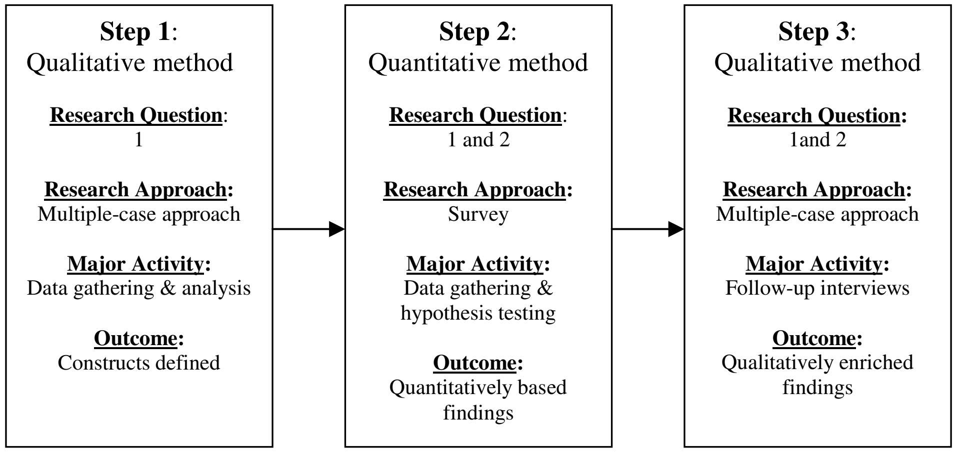

Fig. 1. The three-step approach for this research.

lected data were used to develop seven hypotheses and a questionnaire for the research step two (qualitative research). These seven hypotheses were developed based on seven SPM factors: process, organization, information management systems, tools, metrics, project culture, and leadership, found from case study research. After being tested by five PM practitioners for clarity and to ensure construct validity, the questionnaire was administered to project participants in various PM workshops. Such collected data were used for testing our hypotheses (see the next section for measures, sample, and data analysis methods).

In research step 3, we conducted multiple follow-up interviews with five individuals from five companies in our sample. We selected these companies because they had a solid SPM level. The purpose was to add richness to the interpretations of the data analysis results – in other words to verify and enrich findings of hypotheses testing and learn more about the research results.

3.2. Measures

Our questionnaire included these measures:

(1) One dependent variable – the degree of project success operationalized as a multi-item construct aggregating four criteria: the degree to which the projects accomplished their schedule, cost, quality, and customer satisfaction goals; as perceived by respondents on a 5-point Likert scale (5 being the highest degree, 1 being the lowest degree). Here is an example of a question measuring project success on cost: "Please indicate to what degree these projects met the following goals" and its format.

	Very low 1	2	3	4	Very high 5
Cost goals	☐	☐	☐	☐	☐

In the sample question, "these projects" refers to the frame of reference: recently completed projects in which the participants were involved. Similar questions were asked about schedule, quality, and customer satisfaction goals. Note that there are several reasons we have chosen these goals. First, most of our respondents did have limited information about strategic goals mentioned in the earlier literature review section on project success. Rather, they had knowledge about the "internal view" goals such as schedule, cost, and quality, as well as customer satisfaction (the only goal from the "external view"). Second, project success measures similar to ours have been extensively used in some rigorous PM research on NPD projects some of which are from high velocity industries [24]. Finally, respondents had limited time in which to complete this survey; therefore our need to limit the size of the questionnaire.

(2) Seven independent variables – on OPM level: standardized PM process (Hypothesis 1, referred to as H1), organization (H2), information management systems (H3), tools (H4), metrics (H5), project culture (H6) and leadership (H7).

To illustrate the measuring process, here is an example using the first factor, the PM process. In order to measure the degree of PM process standardization, we defined "standardized" according to Stevenson [25]: the degree of uniformity or consistency applied in implementing PM process. Thus, the highest degree of uniformity (i.e., standardization) is when the PM process is implemented by all project managers in the same way. In contrast, when the PM process is inconsistently used and not shared by all project managers, we considered it to have the lowest degree of uniformity/standardization.

To capture the numerical responses of our respondents as to the degree of PM process standardization, we again used a 5-point Likert scale (5 being the highest degree of standardization, 1 being the lowest degree of standardization). And we asked questions like the following: "To what degree is your OPM process shared and consistent across projects?"

Very low				Very high
1	2	3	4	5
☐	☐	☐	☐	☐

Using the same format, we asked questions about the degree of standardization of PM tools, PM metrics, project culture, and leadership skills. Similar questions were used to measure the degree of standardization of project organization and information management systems. For example, "To what degree does your organization use managerial mechanisms (e.g., a project management office or project approval committee) to ensure consistent practices in synchronizing and aligning all projects with the business strategy?"

Very low				Very high
1	2	3	4	5
☐	☐	☐	☐	☐

One question was used for each variable. Such single-item constructs are generally less effective than multi-item constructs. However, from the reliability test of our questionnaire, we found that Cronbach's alphas were higher than the threshold value −0.7, as recommended by Nunnally [26]. This indicates that our questionnaire is reliable.

(3) Demographic information: Here, we focused on the type of organization, the type of project, the size of the project, and the PM experience of the respondents (number of years).

3.3. Sample

A final qualifying sample included 55 project participants (project directors, project managers, and team members) from development projects in high-velocity industries. Of the business units, 31 were in computer/software industries; 24 were in electronics industries. As for the size of the project budget, 37% of the projects had a budget greater than \$5 million, while 28% had a budget larger than \$500,000 but smaller than \$5 million, and 35% had a budget less than \$500,000.

3.4. Data analysis

To test each of the seven hypotheses, we used the same statistical plan: two methods of bivariate data analysis along with one multivariate method. The bivariate methods were Pearson product-moment correlation between each independent and dependent variable, and *t*-test, which assesses the significant difference in means between the top group and the bottom group of cases in terms of project success. First, we divided all our data points for project success (dependent variable) into the low group (average score 1–2.33 on the Likert scale), the middle group (average score 2.34–3.66), and top group (average score 3.67–5). Then for each group, we calculated the mean value of standardization of the seven independent variables.

The assumption here is that the top group with the highest project success will have the highest degree of SPM factors. If so, the *t*-test will indicate significant differences between the top group and the bottom group for each independent variable, proving our hypotheses. Stepwise multiple regression analysis was used in order to validate the previous bivariate analyses. Several regression runs were performed, eliminating the correlation effects between the independent variables.

4. Research results

4.1. Case study findings

After finishing interviews, document reviews, and observation in the research step 1 (see Fig. 1), the content analysis pointed to the following SPM factors on OPM level critical to success in high-velocity industries projects under seven major headings – *standardized PM process*, *organization*, *information management systems*, *tools*, *metrics*, *project culture and leadership*.

Table 2
Factors affecting the success of development projects

Factor critical to project success	Publications that identified the factor as critical
PM process	*Zmud* [20][a]; *Deephouse et al.* [21]; *Brown and Eisenhardt* [6]; Sobek et al. [19]; Davidson et al. [27]; Cooper [2]; *Hartman and Ashrafi* [14]
Project organization	Larson and Gobeli [28]; *Deephouse et al.* [21]; Davidson et al. [27]; Cooper [2]; *Hartman and Ashrafi* [14]; Shenhar et al. [13]
Information management system	Davidson et al. [27]
PM tools	*Zmud* [20]; Might and Fisher [3]; Sobek et al. [19]
PM metrics	Davidson et al. [27]; *Hartman and Ashrafi* [14]
Project culture	*Deephouse et al.* [21]; Sobek et al. [19]; Davidson et al. [27]
Project leadership	Sobek et al. [19]; Davidson et al. [27]

[a] Note: Italicized are sources relating to high velocity industries. Other sources are from other industries.

As already mentioned, literature review was performed as part of this case study research [22], and directly-related (references relating to high velocity industries) and indirectly-related references (references from other industries) are included into Table 2.

In particular, the first step indicated that:

- SPM factors on OPM level may have a positive correlation with project success. In other words, increasing standardization degree of the factors may lead to increased project success.
- Some interviewees believe that there is an inflection point in this standardization increase. Specifically, increasing the degree of standardization of the factors to a certain point may lead to the increase in project success. Increasing the degree of standardization of the factors beyond that point tends to lower project success. Where this inflection point exactly is appears to be company-specific, meaning that it varies from company to company.

To verify these findings from research step 1, we chose a simple design for next two research steps (Fig. 1). In research step 2 we formulated hypotheses to test our first findings – SPM factors on OPM level may have a positive correlation with project success (next section). In research step 3, we conducted follow-up interviews to learn more about our findings and second finding from research step 1 – the inflection point.

Why did we choose this research design? This is an exploratory study trying to develop an understanding of basic correlations such as what SPM factors may help improve project success. Adding to this is the number of data points that is limited and relatively simple (single-item constructs). Given such intent and data set we thought that simple correlation coefficients and linear regression would be a right choice of testing tools. When it comes to the inflection point and its location, which is subjective in nature, we believe that a qualitative method of follow-up interviews is appropriate.

4.2. Hypothesized factors critical to project success in SPM

In research step 2, the seven SPM factors were used in formulating hypotheses and developing questionnaire to collect data for hypotheses testing. By using the interviewees' justification for why these SPM factors impact project success on the OPM level and acknowledging the findings from the literature focused on individual project success, we hypothesize that project success in SPM on the OPM level in high-velocity industries likely depends on standardization of the PM factors affecting project success. In particular, project success likely depends on these hypothetical factors:

Hypothesis 1. *Hypothesis* 1 focuses on Standardized PM Process for OPM: *A higher degree of standardizing PM process tends to increase the success of development projects in high-velocity industries.*

Rationale: Several studies identified the PM process as an important success factor in development projects [2,14,20,21]. Based on this logic, then, standardizing the PM process for development projects on the OPM level may also lead to their success. In particular, such a standardized process may drive the quality of execution of all elements of the process to a higher level, including standardized project life-cycle phases, project activities, and milestones. In the words of one group of researchers, SPM process on the OPM level can save project participants the cost of reinventing a new process for each individual project and have a positive impact on project success [19].

Hypothesis 2. *Hypothesis* 2 deals with Standardized Project Organization for OPM: *Development projects in high-velocity industries organized by more standardized practices of the project organization are more successful.*

Rationale: Multiple researchers have found that cross-functional, team-based project organizations are more successful than those without such organization [2,28]. Instead of this well-researched project-level view of the project organization, our study investigates an OPM level project organization, a relatively new organizational design said to have an important impact on project success. Frequent components of OPM's organizational design are project offices tasked to take care of specific PM practices, aiming at standardizing ways to align organizational projects with the organization's business strategy. Examples of these practices are project prioritization, resource capacity management, and portfolio balancing. The expectation is that the standardized practices will facilitate the accomplishment of project goals. As a consequence, this integration of the company's projects should lead to increased project success [1].

Hypothesis 3. *Hypothesis* 3 concerns Standardized Information Management System for OPM: *Using a more standardized OPM-level information management system leads to higher success of development projects in high-velocity industries.*

Rationale: Software-based PM information systems are often seen as contributing to project success [27,29]. Until recently, these systems were solely focused on the desktop software. Currently, an emphasis is also being placed on a standardized information management system on the OPM level, which is designed to integrate the desktop with Internet and enterprise systems. That enables management to integrate individual projects into a coordinated pool, including standardized information input from individual projects and output for the pool and individual projects. Also, this helps management to keep an eye on the pool and allocate necessary resources to it. Consequently, the pool is less prone to yield negative surprises and unexpected results. In this way, the system's capacity for gathering, integrating, and disseminating the standardized information output facilitates the controls in development projects in high-velocity industries, thus contributing to project success.

Hypothesis 4. *Hypothesis* 4 focuses on Standardized PM Tools for OPM: *Development projects in high-velocity industries that use more standardized PM tools tend to increase their project success.*

Rationale: PM tools include procedures and techniques by which a PM deliverable is produced. While many argue that adequately deployed PM tools have a significant role in accomplishing project goals, the related research evidence is scanty. The little available evidence points to the use of certain tools as factors in project success [3,13,20]. We posit that deploying more standardized PM tools as an OPM approach ensures higher quality in implementing project activities and, thus, a smoother process and the contribution to the success of projects. Examples of the tools that are often standardized are a WBS and the Gantt chart.

Hypothesis 5. *Hypothesis* 5 considers Standardized PM Metrics for OPM: *Development projects in high-velocity industries using a more standardized system of metrics to measure and monitor project performance will have higher project success.*

Rationale: Historically called ''project performance measures,'' metrics help measure and monitor project performance. They are often cited as a key to a development project's success [27]. If metrics were designed as a standardized system for OPM, they would include a structured and consistent set of measures for all strategic areas of project health. Such a set would also be tiered to reflect success indicators for all management levels in a project. Additionally, the set's metrics would be mutually compatible to create a further level of uniformity on the OPM level. When consistently applied, this standardized set would help detect how well the project strategy works and where and why it is flawed. It can also help devise actions to eliminate the flaws, hence increasing chances for success.

Hypothesis 6. *Hypothesis* 6 focuses on Standardized Project Culture for OPM: *Development projects in high-velocity industries where cultural values are more standardized tend to have increased project success.*

Rationale: Organizational culture has been cited as a key success factor in development and innovation projects [30]. This culture is expressed as a set of clearly articulated, performance-oriented values [31] that are designed into PM practices/behaviors and then *uniformly* practiced (we call this ''a standardized culture''). The intention here is that project personnel in OPM have a sense of identity with the cultural values and accept the need to invest both materially and emotionally in their project. This should make them more engaged, committed, enthusiastic, and willing to support each other in accomplishing the project goals. As a result, they should work harder and be more effective, increasing success.

Hypothesis 7. *Hypothesis* 7 is related to Standardized Project Leadership for OPM: *Development projects in high-velocity industries that are managed by project managers with more standardized skill sets tend to have improved project success.*

Rationale: The concept of a strong project leader as a key to project success has been a recurring theme of many studies and many experts [32]. As a consequence, there is a strong drive in today's OPM approaches to define standardized project leadership skills. Examples of the skills include *customer intimacy and risk mitigation*. The expectation is, as Sobek et al. [19] argued, that project managers equipped with the same set of standard skills will be more effective in accomplishing their tasks, hence driving success of development projects.

4.3. Results from hypothesis testing

Tables 3 and 4 present a summary of the bivariate analysis and stepwise regression results of testing hypotheses 1–7. We view these results as *tentative* because of the exploratory nature of the study [33]. In summary, out of seven factors hypothesized to have an impact on project success, three were found to be of interest: *standardized PM tools*, *leadership*, *and process*.

4.3.1. Standardized project management tools, leadership, and process are of interest

As shown in Table 3, correlation coefficients of 0.48, 0.46, and 0.43 show a significant relationship between the standardized PM tools, leadership, and process, respectively, and project success. *t*-tests confirmed that there are significant differences in the standardization of these three variables between the high and low groups. This means that there is a possibility that higher standardization of *PM tools*, *leadership*, and *process* may contribute to higher project success. Still, the impact of these three SPM factors on project success is not very high.

Stepwise multiple regression was used to validate the previous bivariate analyses (see Table 3). Only one factor – standardized PM leadership – entered the equation. In the analysis, one predicted variable may capture the explained variance of the dependent variable

Table 3
Impact of standardized project management factors on development project success (bivariate analysis, $N = 55$)

Standardized project management factor	Correlation Coeffecient[a]	Mean values of standardization of project management factors			Top vs. low group, t-test
		Low group[b] project success	Middle group[b] project success	Top group[b] project success	
Standardized PM process	**0.43**[c] ($p < 0.01$)	2.33	2.40	3.25	**2.01** ($p = 0.05$)
Standardized project organization	0.05	3.00	2.68	2.92	−.14
Standardized information management system	0.27	2.50	2.28	3.21	1.19
Standardized PM tools	**0.48** ($p < 0.01$)	2.33	2.88	3.88	**3.65** ($p < 0.01$)
Standardized PM metrics	0.24	2.00	2.88	3.29	**2.53** ($p = 0.00$)
Standardized project culture	0.08	2.33	3.28	3.21	1.62
Standardized project leadership	**0.46** ($p < 0.01$)	2.33	3.40	4.00	**4.39** ($p < 0.01$)

[a] Correlation coefficients.
[b] Mean values of standardization of each PM factors for low, mid, and top groups of projects in terms of project success.
[c] Bold numbers are statistically significant.

Table 4
Multiple regression analysis of project management success versus standardization of project management factors (multivariate analysis)

Standardized project management factor	Beta coefficient (p-value)
Standardized Project Leadership	0.24 ($p = 0.03$)

$N = 55$; $R^2 = 34\%$, $R^2_{adj} = 25\%$, significant at <0.01 level.

by using its correlated factors. As a result, the correlated factors may not enter the equation. Since some SPM factors were strongly correlated with leadership – for example, the correlation values between the leadership and PM tools and process are 0.42 and 0.39 (at $p < 0.01$), respectively – it is quite possible to get a short list of factors in the equation. Specifically, our list includes only PM leadership as this predicted variable was statistically significant at 0.03 level. The equation itself was also strongly significant at the 0.004 level. The explained variance (adjusted R^2) of project success by using leadership as predictor was 0.25, indicating that other important factors beyond standardized PM leadership, standardized PM tools, and process impact project success as well, not an unusual phenomenon in studies of this type. For example, the well-cited study of Cooper and Kleinschmidt [24] had adjusted R^2 scores of 0.27 and 0.21. This modest explained variance indicates that other important factors beyond SPM factors impact project success. In summary, *Hypotheses 1, 4 and 7 were supported.*

4.4. The four standardized project management factors of lower interest

The four factors with little or no impact on project success in the statistical analysis were standardized metrics, the information management system, project culture, and project organization. This finding was further corroborated by the stepwise regression, wherein none of these SPM factors enter the equation (Table 3). Because they do not appear to impact project success, *Hypotheses 2, 3, 5 and 6 are NOT supported.*

Note that in research step 3, we discuss these findings with the practitioners to enrich and refine these findings. The results of these multiple-case interviews are summarized in the next section.

5. Discussion

5.1. The state of PM standardization

We made some observations about the overall state of SPM, something *not* in our original plan of research. It appears that the level of PM standardization in our research sample is solid. When we calculated the mean standardization score for all three critical SPM factors, we found that the mean value is 3.20. A value of 3.20 out of 5.00 may look like a mediocre level of PM standardization. However, the following two reasons provided by our interviewees offer an explanation. First, the PM standardization concept is a relatively new phenomenon that has not had much time to infiltrate companies. Second, an approach of lower standardization with a sufficient amount of variation in PM methodology is actually linked to the inflection point we learned about in the research step 1 (Fig. 1). In particular, we learned from preliminary interviews that increasing the degree of standardization of the factors to the inflection point may lead to the increase in project success. However, increasing the degree of standardization of the factors beyond that point tends to lower project success. Also, the location of the inflection point seems to be company-specific. In the follow-up interviews of the step 3, we heard the same. The rationale is that because of their high speed, complexity and risk level, lower degrees of SPM factors with a sufficient amount of variation in SPM are a more appropriate approach to running projects in high velocity industries. Brown and Eisenhardt's research confirms these beliefs of the interviewees in high-velocity industries [6].

What we have not found out was at what standardization degree the inflection point was determined. Trying to be pragmatic, it seems that most companies opted to create an SPM methodology and set a broad rule that project managers are allowed to decide when to veer off the SPM, and simply improvise within the boundaries of SPM. In words of one of the interviewees, "we want our project mangers to be process experts, not process slaves." The point is that this company has a standardized PM methodology but empowers project managers who really know the methodology inside out to change it as an uncertain project task and environment pose challenges. Some companies followed a procedure that project managers had to request an approval for deviating from SPM.

5.2. Three standardized project management factors of interest

Based upon our results, there is a possibility that higher standardization of PM tools contributed to higher project success in our sample of companies. To better understand the nature of standardizing PM factors, we conducted several follow-up interviews (note the small number of interviews – a limitation factor), which also yielded several best practices, shown in Table 5. If standardized PM tools are not offered to project managers, the interviewees argued, it is not reasonable to presume that each one of them – especially the less-experienced – would have the resources and expertise to quickly and consistently select their own set of tools. According to the interviewees, having standardized PM tools helps with project success: more punctual schedules, more satisfied customers, better cost-effectiveness, and higher-quality accomplishments.

This finding was somewhat surprising to us. First, some research studies found PM tools to drive project success on the individual project level [3,13]. From this perspective, our finding is not a surprise. What was a surprise is that our study indicated that *standardized* PM tools (as a group of tools) on OPM level may impact project success; this is new. The reason for this, as seen by the interviewees, is perhaps rooted in the practice of a great many companies, where the standardized PM tools are integrated with the PM process in order to consistently support process deliverables at necessary times.

According to our results from statistical analysis and the follow-up interviews, project managers with *standardized project leadership* skill sets are likely to be more successful and effective, thus influencing project success. It appears that our interviewees believe that such skill sets are critical because project managers in development projects in high-velocity industries often act in a matrix environment, where they have no direct

Table 5
Examples of best practices in standardized project management factors

Factors that may impact project success in SPM	Examples of best practices
Standardized PM Tools	• Select mutually compatible tools that work in sync; use them consistently. • Balance simple and advanced tools. • Integrate tools with the standardized PM process; each process deliverable is supported by specific standardized PM tools. • Start off with template tools; adapt the templates for use in a specific project.
Standardized Project Leadership	• Both lead and manage; managing provides functions of planning, organizing, and controlling projects; leading adds the ability to develop project vision, communicate the vision, inspire and motivate project participants. • Standardize business skills (e.g., customer intimacy or reading financial statements). • Standardize process skills (e.g., project scope and schedule management). • Standardize interpersonal skills (e.g., conflict management and negotiations) and intrapersonal skills (e.g., self-motivation). • Standardize technical skills (e.g., knowledge of project product applications).
Standardized PM process	• Build a shared process, where all project managers use the same standardized PM process. • Build a repeatable process that provides the same sequence of project phases, end-of-phase gates, milestones, activities, and major deliverables to each project. • Build a flexible process that clearly encourages and states how to adjust the standardized process to account for specifics of projects with significantly different size and complexity. • Build an integrated PM process whose elements are linked with upstream and downstream processes (e.g., strategic planning) to provide the integration of the overall business process across the organization.

authority over project team members but still bear the responsibility for delivery of the project. Faced with this difficult task, project managers are more likely to deliver on cycle time, customer satisfaction, quality, and cost goals when given a standardized skill set that can address all sorts of project challenges than they are when left to randomly develop such skills. We were not surprised by this finding. The earlier research in conventional manufacturing industries, for example, that of Sobek et al. [19] corroborates our finding.

Testing results also point to the possibility that projects organized via *standardized PM processes* contribute to improved project success in our sample of companies. Our interviewees argued that customers expect projects to be delivered according to their requirements. In an organization engaged in many projects, this means repeatability. The organization must be able to consistently deliver a stream of consecutive projects per customer requirements every time. As a consequence, such projects minimize variation in how they are executed, improving speed and quality, leading to lower cost because they result in less rework, fewer mistakes, fewer delays and snags, and better use of time. The interviewees believed that the level of repeatability is higher when a standardized PM process is in place. This finding was not unexpected, even that there is no prior SPM process research on OPM level. Many researchers have found that the PM process may be a factor in project success on the individual project level [4,19,27,1,13]. Perhaps, quality management initiatives – total quality management and ISO 9000, for example – that were introduced to the corporate world and PM in the 1980s and 1990s which strongly emphasized process standardization also helped PM process standardization.

In summary, standardized PM tools, leadership, and process on the OPM level may have an impact on higher project success and, therefore, are candidates for more detailed future research. This tentative statement should be viewed in the context of the exploratory nature of this study, its research design, and the small number of follow-up interviews.

5.3. The four standardized project management factors of lower interest

We described the four SPM factors – the standardized project organization, information management system, PM metrics, and project culture – as low interest factors because the statistical analysis in this exploratory study showed them to be of little significance. Our follow-up interviews help us in interpreting this finding.

According to the interviewees, the concepts of *standardized project organization* and *information management system* (on OPM level) are new to most companies. Because of this short timeframe, the two SPM factors – as the interviewees explained – might have not been widespread enough in our sample in order to make a discernable impact.

As for *standardized PM metrics*, the interviewees have seen the metrics as a required part of SPM but not of high importance. Perhaps this may hint to the modest correlation of the metrics with project success (correlation coefficient is 0.24; *t*-test confirms this; Table 3).

In our discussions with the interviewees, many of them expressed the view that *standardized project culture* equated with organizational culture, which they saw as the province of executive management, not project personnel; i.e. as not being important to project participants.

5.4. This study's findings vs. industry practice

To see how much our findings are in agreement with the practices in the industry, we referred to Project Management Body of Knowledge (PMBOK) [29], a widely accepted document. We found that PMBOK talks about SPM practices on more than 15 occasions taking up 1.5 pages out of 200+, while placing a strong emphasis on the standardized PM tools and processes, but ignoring other SPM factors. Over all, PMBOK is light on SPM, focusing primarily on the individual project level. OPM3, another standard from PMI, a recently released document on the OPM level is heavy on SPM, suggesting standardization as a first step in the implementation of all processes in project, program, and portfolio management. The major emphasis is on PM process and tools, although some emphasis is placed on metrics, organization, and information systems. Over all, while PMBOK 2000 showed some support, OPM3 [7] points to a high level of support of industry practices for SPM and our findings.

6. Managerial implications

This exploratory study's objective was to identify and then get a better understanding of the factors that may impact project success and, thus, be of interest in future research related to SPM efforts in development projects in high-velocity industries. The findings of the investigation point out that some factors are of higher interest than the others. In this section, we sum up our learning from the investigation.

Standardized PM may drive project success. Our findings indicate that increasing the level of standardization of some PM factors may lead to higher project success.

Building a standardized PM toolbox may help. Creating a standardized PM toolbox on the OPM level, this study found, may help accomplish project goals, an essence of project success.

Growing project managers with standardized project leadership skills may matter. It appears that project managers with standardized project leadership skill sets may be a factor in project success.

Insisting on a standardized but flexible PM process. This is another major message coming out of this exploratory research. Deploying a standardized PM process from the OPM level may increase project success but only to a certain point. Increasing standardization further beyond this point – which we referred to as an inflection point – may actually stifle project success. Hence, providing flexibility in the form of allowed variation in SPM methodology beyond the point is recommended.

Using a contingency approach in standardizing PM. This approach means that one size of SPM factors does not fit all organizations. In short, project success and SPM factors that may enhance it will be customized to fit the strategic purpose of the company, and thus each organization may have its own set, or "size," of SPM factors on the OPM level.

It is wrong to assume that standardizing PM factors will automatically enhance project success. Standardizing PM may not necessarily improve project success and we cannot argue that increasing the level of standardization of PM factors will automatically lead to an increase in project success.

The most original contributions from this research study are in the OPM and flexibility areas. In the OPM area, a primary contribution is the focus on the overall organizational orientation. In particular, most of other the well-known studies of critical project success factors – such as [2,14,20,21,27,28], took what Engwall [34] called a "lonely" project approach. This means developing the factors to accomplish success in individual projects. Our study takes a different view, looking at issues of interest related to those factors standardizing PM practices that help successfully manage projects individually *and* collectively. Our approach, although only exploratory, "opens up" the research on success factors thru standardization on the OPM level. The second area of contribution, in the flexibility area, is the identification of an inflection point, which hints to a strong need for a certain level of variation in implementing standardized practices in development projects in high-velocity industries. This receives scant attention in the existing studies on critical success factors. While the contributions in terms of type of critical success factors that we identified are not unique – tools, leadership, and process, identifying them so solidly makes them more useful for future researchers and practitioners.

The limitations of the study are its exploratory research design and a relatively small number of data points; in addition, the findings reported here relied only on development projects in the high-velocity computer and software industries.

7. Conclusions

Significant results and lessons of this exploratory study can be organized around its two research questions. First, what are the major factors in SPM efforts on the OPM level? Second research question, what SPM factors on the OPM level are of interest because they may impact project success? We uncovered the seven factors that may have a role in SPM efforts. These include standardized PM tools, leadership, and process; and standardized PM organization, information management system, metrics and culture on OPM level. Testing of our hypotheses indicated that the first three factors are of higher interest, the remaining four may be of lower interest.

These lessons learned underscore that major contributions of this research are the identification of critical factors on OPM level, and the finding that companies tend to standardize PM only to a certain level (inflection point), while maintaining a certain level of flexibility.

A further step in comprehending the evolving nature of SPM on the OPM level would include more research to validate that these SPM factors are critical. Also, more empirical testing is necessary to learn more about the correlation of standardized enterprise project organization, information management systems, and project culture and project success. Light should be also shed on how an organization's competitive strategy influences the architecture of its SPM. Finally, studying companies' strategies for deploying SPM factors would be another high-value research topic.

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