

Software project managers and project success: An exploratory study

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Received 15 August 2005; received in revised form 19 December 2005; accepted 15 January 2006

Available online 23 February 2006

Abstract

Traditionally, a project should deliver agreed upon functionality on time and within budget. This study examines the mindset of software development project managers in regard to how they ‘define’ a successful project in order to arrive at a richer perspective of ‘success’ from the perspective of project managers. Senior management and members of the development team can gain a better understanding of the perspective of project managers regarding some of the aspects of their work and the project as a whole. Such understanding can facilitate better communication and cooperation among these groups. We investigated components of the developed system (project) in terms of some of the aspects of the delivered system (outcome/project) in order to place traditional measures of success in context with other organizational/managerial measures that have been suggested in the literature. We also investigated specific work-related items. These items have potential implications for the intrinsic motivation of the project manager. The consensus among the project managers who participated in our study indicated that delivering a system that meets customer/user requirements and works as intended through work that provides a sense quality and personal achievement are important aspects that lead to a project being considered a success.

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Keywords: Software development; Success; Project manager; Practitioner; Project management

1. Introduction

The success of any software development project has traditionally been ‘defined’ from the organizational perspective, whereby a project should deliver agreed upon functionality on time and within budget (Keider, 1974; Boehm, 1981; Pinto and Slevin, 1988; Jones, 1995; Baccharini, 1999; Linberg, 1999). This study examines the mindset of software development project managers with regard to how they ‘define’ a successful project in order to arrive at a richer perspective of ‘success’ from their perspective. Such findings can be of value to other project stakeholders. In particular, senior management and members of the development team can gain a better understanding of the

perspective of project managers regarding some of the aspects of their work and the project as a whole. Such understanding can facilitate better communication and cooperation among these groups. We investigated components of the developed system (project) in terms of some of the aspects of the delivered system (outcome/project) in order to place traditional measures of success in context with other organizational/managerial measures that have been suggested in the literature. For purposes of comparison, we also investigated specific work-related items that the literature suggests have intrinsic value to those project managers supervise; namely practitioners (programmers, database developers, systems analysts, etc.) (Hackman and Oldham, 1980; Boehm, 1981; Herzberg, 1987; Couger, 1988; Brooks, 1995; McConnell, 1996; Saarinen, 1996; Linberg, 1999; Glass, 1999; Procaccino and Verner, 2002; Procaccino et al., in press). We use the term ‘practitioner’, as opposed to ‘developers’, to differentiate between the

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non-management (mostly technical) software development staff from project managers. Some researchers referred to both the technical staff and project managers as ‘developers’.

The literature reflects that any measure of success does not exist in isolation, as project outcome is predicated on the development process (including success drivers) (Boehm, 1975; Brooks, 1995; McConnell, 1996; DeMarco and Lister, 1999; Glass, 2001). Indeed, several studies of employees/developers and/or software project success have considered aspects related to both process and outcome (McConnell, 1996; Linberg, 1999; Saarinen, 1996; Couger, 1988). Wallace and Keil (2004) suggested that some elements of the development process are critical to the success of the end product, regardless of how ‘success’ is defined. However, for purposes of this particular study, we have not included any to the development process’s critical success factors. We also recognize that *all* stakeholders of a development project have important perspectives on success and what they would like to achieve through the completion of a particular project, including the development team, senior management, customers and end-users. However, the aim of this work is to provide current insight into the mindset of project managers in order to foster better understanding/communication among management, development teams and other project stakeholders.

Below, we present a review of the items included in this study. We then briefly outline our research methods, followed by our findings, and conclusions and recommendations for further study.

1.1. Review of investigated items related to the final system

As mentioned previously, we investigated items related to the outcome of the project, categorized as related to (1) the work performed, and (2) project outcome.

1.1.1. Items related to the work performed

Within this category, we were interested in project aspects that are intrinsic in nature (i.e., internal aspects that ‘come from within’) that are considered as related to interesting and motivating work. For the purposes of comparison, we were also interested in items that had been previously considered by practitioners because it has been suggested that project managers are not necessarily motivated in the same way as members of their development team (McConnell, 1996). Through investigating these items as they relate to managers, we can gain better insight into how developers compare with their managers with regard to motivation. Intrinsic factors can have implications for motivation, productivity and, ultimately, affect the chances of a successful project, regardless of how success is defined. Further, it has been suggested that motivation is the single most important contributor to software development productivity (Boehm, 1981; McConnell, 1996). We included

five items within the category of the work performed by the project manager, including the following:

- Doing challenging work (Linberg, 1999; Glass, 1999).
- Learning something new (Brooks, 1995; McConnell, 1996; Glass, 1999; Linberg, 1999; Procaccino et al., in press, 2005).
- Having a sense of delivering sufficient quality (doing a good job) (Saarinen, 1996; Procaccino and Verner, 2002; Procaccino et al., in press, 2005).
- Having a sense of achievement (Fitz-enz, 1978; Boehm, 1981; Herzberg, 1987; Couger, 1988; McConnell, 1996; Procaccino et al., in press, 2005).
- Being provided with enough independence and freedom (autonomy) to work creatively on a project (Hackman and Oldham, 1980; Procaccino and Verner, 2002).

1.1.2. Items related to project outcome

We included nine items, which were related to meeting requirements, cost and schedule estimates, and delivering an easy to use system within the project outcome category. We consider this category of items to be related to outcome in the sense that they are typically evaluated at project completion. For purposes of comparison, we again were interested in looking at the view of project managers and practitioners. Specifically, we investigated the following:

- Requirements of customer/users were met by the completed system (Boehm, 1981; McConnell, 1996; Brooks, 1995; Pressman, 1996; Procaccino et al., 2005, in press). Related to this, we also asked managers of the importance of having the final system work as intended (Linberg, 1999). There is evidence in the management and psychology literature that meeting expectations (i.e., achieving project goals) has a positive influence on job satisfaction, organizational commitment, intent to remain, job survival, performance (Wanous et al., 1992), commitment, self-efficacy, and motivation (Tannenbaum et al., 1991). Brooks added that we all take pleasure in “making things that are useful to other people” as “we want others to use our work and to find it helpful” (Brooks, 1995).
- The project was completed within budget (McConnell, 1996; Linberg, 1999; Procaccino et al., 2005, in press). In order to evaluate the budget independent of its estimate, we also asked how important was completing the project at an *appropriate* cost (not necessarily within budget) (Glass, 2001).
- The project was completed on time (within schedule) (McConnell, 1996; Linberg, 1999). Similar to budget, in order to evaluate the schedule independent of its estimate which could be poor, we asked how important was completing the project *when needed* by the customer/users (not necessarily within schedule) (Glass, 2001).

- Completing a project (i.e., project was not cancelled, even if agreed upon functionality was reduced) (Linberg, 1999). This item has obvious organizational and professional implications for both project management and practitioners.
- Having that system consist of solid, thoroughly tested code (Linberg, 1999). This has directly implications for the quality of the system (i.e., lack of bugs), which we associate with reliability and stability (Boehm, 1975; Glass, 2001; McConnell, 1996).
- System was is easy to use (Saarinen, 1996; Procaccino et al., 2005, in press; Armstrong et al., 2005).

2. Research methods

All respondents were contacted through a nationwide mailing to 4786 US organizations that conduct software development through a commercially available database. These organizations represented commercial, government and academic institutions, located in each of the 50 States, plus the District of Columbia. Our mailing included a password unique to each organization that was entered by a respondent prior to providing his/her responses. Each was given the opportunity to enter his/her e-mail address if interested in seeing our results and each was also given the chance to enter a random drawing for a *Palm Pilot* in appreciation of their participation.

As mentioned previously, we have considered items that have potential direct relevance to project managers and developers (the work performed), and items that are applicable to the outcome of the project as a whole (the final system). The following were the instructions included with the set of statements that respondents were asked to address using a seven-point Likert scale, where “7” was very important and “1” was not important at all. (It should be noted that we did not calculate means, variance or standard deviations due to the fact that they are inapplicable given the ordinal measurement used for the questions. We also included the responses of “*Not applicable*” and “*Don’t know*” where appropriate.)

- “*Each of the statements relates to a specific aspect of the **process** of developing software. Please rate how significant you believe each is in its contribution to what you consider a ‘successful’ software project.*”
- “*Each of the statements relates to a specific aspect of the **final product** or **result** of developing software. For each of the following statements, rate how important you believe each is, in general, to **your definition** of successful software project.*”

Respondents were given the opportunity to explain their opinion on any of the statements. We also asked the following open-ended question to provide an opportunity to

include additional important contributors to outcome that we had not specifically asked:

“Indicate any additional aspects of project development that are important to your definition of project success.”

2.1. Validity

In general, an analysis of validity assesses how well the research instrument investigates the concepts of interest. Validity cannot be proven for this, or any, study, but it can be evaluated in relation to the validity of the measures used, as well as the findings and conclusions. *Content* validity is a measure of “how much a measure [item] covers the range of meanings included within a concept” (Babbie, 2001). We expect this to be acceptable, as the questions were derived from a literature review and pilot testing. *Construct* validity addresses whether or not the measurement scales represent the attributes being measured (Babbie, 2001). Attributes should be based on a substantial body of previous research carried out before any specific item development. Our literature review leads us to believe that we have identified the important managerial/organizational components that potentially help ‘define’ software development success from the perspective of management.

2.2. Reliability

Reliability addresses the repeatability of the study’s findings. As an exploratory study, the reliability of this study must be carefully considered by the reader. Due to our low organizational response rate (less than two percent) and lack of information to conduct a non-response analysis, we must conclude that our sample is not statistically random. As a result, we do not propose that our findings are necessarily repeatable or generalizable to the US population of software developers as a whole; they may be an artifact of the particular project managers who responded to our request to participate.

3. Findings

We have arranged our findings as follows. First, we present respondent demographics and then an analysis that includes rankings of project-related items.

3.1. Respondent demographics

Data was collection between July and November 2003. Seventy-six (76) project managers responded, representing 74 different organizations. Seventy-four (74) percent of respondents were male. Over half of all respondents were between the ages of 45 and 54, and about one-third were between the age of 25 and 44. Just over half reported having a bachelor’s degree and more than a third a graduate

Table 1
Breakdown of respondents' professional experience

Professional experience	Percent of respondents (%)	N	Mean years	Median years	Maximum years
Project Manager/Leader	100	76	7.9	5.5	60
Programming Analyst	75	57	5.8	5.0	20
Programmer	66	50	4.8	2.5	23
Senior Manager	58	44	6.0	5.0	18
Team Leader	41	31	6.1	5.0	22
Business Analyst	39	30	5.8	4.0	35
Systems Analyst	36	27	4.6	4.0	20
Database Developer	28	21	3.6	2.0	15
Database Administrator	26	20	2.7	1.0	10
Change Control Officer	18	14	1.1	0.0	5
Quality Assurance Manager	13	10	0.5	0.0	3
Other position	25	19	5.2	3.0	21

degree. Table 1 shows the breakdown of professional software development-related jobs that have been, or are currently held, by our respondents. To be included in the study, respondents had to indicate that they primarily considered themselves to be a project manager and they had to have at least one year of experience as a project manager. Only three managers indicated that they had no development experience. Respondents had almost eight years of experience on average. About 75% reported experience as a programmer analyst, and 66% as a programmer. (Respondents could indicate more than one job, as we were interested in professional *experience*, not merely their current job title.) All respondents reported having lived the longest, and done the majority of their software development work, in the United States. Project managers from 31 states participated in our study. The states with the largest number of respondents included Texas (7), Illinois and New York (6 each), California (5), and Massachusetts, Ohio, Pennsylvania and Virginia (4 each).

We asked respondents what percentage of projects on which they have worked did they have a financial interest, other than earning a paycheck. We asked this in order to gain some insight into respondents' organizational

mindset, as this could influence how they perceive success. Seventy-five percent of respondents indicated that they have never had a financial interest in any project (also, about seven percent had an interest in five percent of projects and five percent had an interest in ten percent of their projects). Only about three percent indicated that they had a financial interest in 99% of their projects. Based on Chi-square analysis, the level of financial interest did not pose a threat to the validity of our results.

3.2. Perceptions of success

We have ranked responses by descending combined responses of "6" and "7" in each table (which corresponds to agree and 'strongly agree'), resulting in sorting responses in descending order of importance.

3.2.1. Analysis of items related to work and final system/project

We investigated five (5) *outcome/personal*-related items (see Table 2). Highest ranked was the intrinsic item of "having a sense of delivering sufficient quality (doing a good job)" (95% of project managers responded either "6" or "7"), which seems like good news for the customer and users. ('Quality' was not specifically defined through out survey instrument. However, it has been suggested that an accepted consensus includes elements of "portability, reliability (with implications for lack of bugs), efficiency, human engineering, testability, understandability and modifiability" (Glass, 2001).) We also associated 'quality' with a lack of bugs based on our previous work related to practitioners (Procaccino et al., in press) and comments from respondents. Having a sense of achievement was the second highest worked-related item (80% of project managers responded either "6" or "7"), which has some support in the literature (Fitz-enz, 1978; Boehm, 1981; Herzberg, 1987; Couger, 1988; McConnell, 1996). This should not be a surprise, as achievement helps to "supply the individual with personal satisfaction" (Fitz-enz, 1978). Based on the percentages shown in Table 2, most respondents did *not* associate learning new things or doing challenging work with successful development projects. This is in contrast to the perspective of practitioners, as suggested in the literature (Brooks, 1995; McConnell, 1996; Glass, 1999; Linberg, 1999).

Table 2
Outcome/personal (work)-related items from project managers (ranked by descending combined responses of "6" and "7")

Items	Rank	N	Median	← Agree					Disagree →	
				7	6	5	4	3	2	1
You had sense that you delivered sufficient quality	1	75	7	63%	32%	3%	3%	0%	0%	0%
You had sense of achievement	2	74	6	38%	42%	9%	7%	1%	1%	1%
You were provided with enough independence/freedom	3	75	6	25%	32%	25%	9%	5%	1%	1%
You learned something new	4	75	5	8%	29%	31%	15%	9%	3%	5%
Your work was a challenge	5	74	5	5%	28%	31%	19%	7%	4%	5%

Table 3
Outcome/project-related items from project managers (ranked by descending combined responses of “6” and “7”)

Items	Rank	N	Median	← Agree							Disagree →	
				7	6	5	4	3	2	1		
Requirements were met by completed system	1	75	7	68%	27%	3%	3%	0%	0%	0%		
Final system worked as intended	2	73	7	56%	38%	4%	1%	0%	0%	0%		
Project was delivered when needed by customer/users	3	74	6	46%	38%	9%	7%	0%	0%	0%		
Final system consisted of solid, thoroughly tested code	4	75	7	55%	27%	16%	3%	0%	0%	0%		
Users found final system easy to use	5	75	6	27%	45%	25%	3%	0%	0%	0%		
Project completed at cost affordable to customer	6	73	6	27%	42%	21%	8%	1%	0%	0%		
Project completed on time	7	74	5	12%	36%	35%	8%	7%	1%	0%		
Project completed (i.e., not cancelled)	8	75	5	25%	20%	27%	20%	4%	3%	1%		
Project completed within budget	9	72	5	11%	28%	38%	15%	6%	1%	1%		

We also tested each of the five work-related items for any significant relationship between the gender, age, level of education and years of experience as a project manager. Chi-square tests did not suggest any such relationships with gender and age. Interestingly, it was somewhat more likely for project managers/leaders with *less* years of experience to value having a sense of delivering sufficient quality ($\alpha = 0.025$) and having a sense of achievement ($\alpha = 0.000$). College educated project managers were somewhat more likely to indicate the importance of having a sense of delivering sufficient quality ($\alpha = 0.000$). The reader is cautioned that all of the results of our Chi-square tests included too many cells with low frequencies for a reliable analysis.

We investigated nine (9) *outcome/project*-related items (see Table 3). Similar to the highest ranked *work*-related item, the highest ranked *project*-related items seem to be good news for the customer and users, including, “requirements of customer/users were met by the completed system” (95% of project managers responded either “6” or “7”) and “the final system worked as intended” (94%). Conceptually, these items seemed similar, and a test of bivariate correlation (Spearman’s rho) produced a significant coefficient of 0.308 ($\alpha = 0.007$). “The project was delivered when needed by the customer/users (*not necessarily* within schedule)” was the third highest ranked item (84%). The relatively high ranking of having a sense of achievement is consistent with McConnell (1996). Having a sense of delivering sufficient quality and a final system consisting of solid, thoroughly tested code also seemed to be conceptually related based on literature that suggests quality can be thought of, in part, as a lack of bugs in the software code, resulting in a stable and reliable system (Boehm, 1975; Glass, 2001; McConnell, 1996). A test of bivariate correlation (Spearman’s rho) produced a significant positive correlation coefficient of 0.503 ($\alpha = 0.000$).

Most respondents did not associate completing a project on time and within budget with project success. Perhaps our respondents had an understanding that these are merely estimates, with an assumed measure of flexibility often included. In some cases, these estimates may be some-

what padded up front to assist in making a project appear more successful and well-managed to the customer/users (Brady and DeMarco, 1994). Our respondents may also disassociate success from estimates of schedule and budget because they have had experience with projects in which one or both of these estimates was not reasonable or practical. Any stakeholder (senior management, customer, users, etc.) who may put pressure on a project manager to deliver a project (including associated milestones) to meet particular deadlines given available resources (including both human and technical) can have an impact on system quality. Excessive pressure can contribute to managers considering having their team take shortcuts (in prototyping, testing, coding, etc.), making it more likely that quality will get shortchanged (McConnell, 1996).

Similar to our analysis of the work-related items, we also tested each of the nine outcome-related items for any significant relationship between the gender, age, level of education and years of experience as a project manager. Chi-square tests did not suggest that any of the items were related to gender. We did see some evidence of a few other significant relationships. It was somewhat more likely that college educated project managers were more like to indicate higher importance on meeting customer/user requirements ($\alpha = 0.001$), and delivering a system that worked as intended ($\alpha = 0.006$) and was easy to use ($\alpha = 0.000$). Older respondents (through the age of 54) were somewhat more likely to indicate higher importance on completing a project within budget ($\alpha = 0.000$). Interestingly, it was somewhat *less* likely for project managers/leaders with more years of experience to value a system that was easy to use ($\alpha = 0.042$), delivering a final system that consisted of solid, thoroughly tested code ($\alpha = 0.000$), completing a project on time ($\alpha = 0.000$), and delivering a project when needed by customer/users ($\alpha = 0.002$). We should again caution the reader that all of the results of our Chi-square tests included too many cells with low frequencies for a reliable analysis.

Project managers were also provided with the opportunity to explain any of their responses regarding any of the items related to the project outcome. Respondents

provided the following responses, with some of our thoughts also included:

- “Internal projects only—when we get them ROI, etc. already performed. Our time is charged to Admin, we are judged on schedule and bugs”, which is interesting because budgetary concerns, at least to some extent, are secondary compared to time and quality/bugs.
- “At our company, delivery dates are often selected at the beginning of an idea without regard to actual time required and costs.” This seems like a formula for failure (i.e., late delivery, excessive cost and frustrated development teams, management and customers/end-users).
- “Value of the work is the project value, not how you feel about it. Sometimes the best solution is to kill the project.” We asked about the value of not having a project cancelled, but as the respondents comments reflect, sometimes this is not the worst of outcomes when talent, time and money are being wasted.
- “Long-term perception of a ‘successful’ project depends more on its final quality than its resource (\$ and time) consumption.” This seems to reflect the thought of a project manager who has a more user-centered focus than we would associate with budgeting and scheduling concerns.

Through an open-ended question, we also asked respondents if there were any additional *outcome*-related items that are important contributors to defining successful software development (see Table 4). Twelve (12) project managers provided a total of 14 responses. (No managers provided responses directly related to the work they perform. This seems to be consistent with the point included above by a project manager who suggested that the “value of the work is the project value, not how you feel about it”.) Responses related to *requirements/functionality* included, “Project exceeded expectations”, “The project

charter and specifications” and “‘Extras’ could be included within resource constraints”. Responses related to the *development team* included, “Quality of working relationship amongst all the parties/stakeholders enhanced as result of the experience” and “Did we build a team that can work together and succeed”. We categorized the responses related to lack of bugs, stability and reliability to *system quality*. Specific responses included, “We have instituted scorecards for Proj[ect] Mgt, Dev[elopment], and QA—balance out schedule, bugs and requirements in determining project quality” and “Application is secure”. Other responses provided by managers included the following:

- “If the users are not happy with it, it does not matter how technically successful the product is. KISS”.
- “Code is maintainable and meets IT standards.”
- “It depends on whether exceeding cost/dates was managed properly through change control, or mismanaged as part of unapproved overruns.”
- “If delivery timing of the project is important, it should be planned that way. That may mean some desired items may have to go.”
- “If [the system is] used.”
- “[The system] adds value.”
- “Customers came back for ‘more.’”

Lastly, one of respondents recognized the relationship between development schedule and bugs through a comment reflecting the importance of “balanc[ing] out schedule, bugs and requirements in determining project quality”. System quality (mentioned previously) has implications for meeting schedule deadlines because less time is needed to fix defects and re-testing code (McConnell, 1996).

Several categories of items suggested in the literature were not mentioned by our respondents. These included the system’s performance (Saarinen, 1996), accuracy (Saarinen, 1996; Armstrong et al., 2005), reliability (Saarinen, 1996), and format/clarity of reports (Saarinen, 1996; Armstrong, 2005). Related to the impact on the organization using the system, managers also did not mention the system resulting in cost savings over time, improvement in work processes, or the quality of decision making (Saarinen, 1996).

3.2.2. Comparing project managers and practitioners

We compared our results of this study to our 2005 study of software practitioners and project success (again, using the framework of the work preformed and the final system (Procaccino et al., in press)), and we found quite consistent perceptions between project managers and practitioners regarding all of the work-related items, and most of the project-related items (none were statistically significant). Table 5 includes rankings among the outcome-related items (also shown are the combined percentage of respon-

Table 4
General outcome-related categories of open-ended responses from project managers

Category	Number of responses	Percent of responses (%)
Requirements/functionality	3	21
Development team	2	14
Quality (lack of bugs, stable, reliable)	2	14
Customer/users	1	7
Maintainability	1	7
Project management	1	7
Schedule	1	7
Other*	3	21
Totals	14	100

* System is used, system adds value, system contributes to additional work from customer.

Table 5
Comparing project managers' and practitioners' outcome-related item rankings

Item	Project managers		Practitioners*	
	Rank	Combined percent ("6" or "7")	Rank	Combined percent ("6" or "7")
<i>Work (personal):</i>				
• You had sense that you delivered sufficient quality	1	95%	1	93%
• You had sense of achievement	2	80%	2	84%
• You were provided with enough independence/freedom	3	57%	3	66%
• You learned something new	4	37%	5	30%
• Your work was challenge**	5	34%	4	37%
<i>Final System/Project:</i>				
• Requirements of customer/users were met by completed system	1	95%	1	97%
• Final system worked as intended	2	95%	2	90%
• Project was delivered when needed by customer/users	3	84%	3	83%
• Final system consisted of solid, thoroughly tested code	4	81%	4	83%
• Users found final system easy to use	5	72%	5	76%
• Project was completed at cost affordable to customer/organization	6	70%	8	55%
• Project was completed on time	7	49%	6	60%
• Project was completed (i.e., not cancelled)	8	45%	7	57%
• Project was completed within budget	9	39%	9	24%

* Procaccino et al. (in press).

** Item wording to practitioners was, "Your work was a technical challenge".

dents that responded either "6" or "7", corresponding to important or very important). Project managers and practitioners were quite consistent in their rankings of the five work-related items. (McConnell (1996) suggested that both project managers and programmers ranked achievement very high among investigated motivational items. Couger (1988) found similar results between project managers and programmers/analysts.) In regard to consistent results between project managers and practitioners, we should keep in mind that most of the project managers included in our study indicated that they also had experience as a practitioner. This is reflected in the literature that suggests that technical staff often get promoted through the ranks to management positions (Ridings and Eder, 1998; DeMarco and Lister, 1999). (Although our data included too many cells with low frequencies for reliable Chi-square analysis of, there was some evidence that having a sense of both delivering sufficient quality (doing a good job) and achievement were each significantly related to the number of years of experience as a project manager.)

We noted a few differences between the percentage of managers and practitioners that considered a few items related to project outcome important. Project managers were more likely to associate completing a project at an affordable cost with success than practitioners (70% vs. 55%). Perhaps this is a reflection of the particular perspective of managers in relation to the customers, who are paying for the system. Similarly, managers were more likely to consider completing a project within budget more important than practitioners (39% vs. 24%). It is interesting to note that neither percentage is considerably high, given that meeting the budget, as has previously been noted, has been traditionally associated with project success. Con-

versely, we found it more likely that practitioners considered completing a project on time, as well as not cancelling the project, more important in defining success than did managers. We expected that project managers would have considered these more important, again, given their overall position in the development process, as well as the traditional definition of success.

4. Conclusions and future research

The consensus among the project managers who participated in our study indicated that delivering a system that meets customer/user requirements and works as intended through performing work that provides an intrinsic sense of quality and personal achievement are important aspects for them to consider a project to be a success. Our findings point to some common objectives and perceptions of both project managers and their teams. Each group seems to have the best interest of users and, to some the extent, customers, at heart when considered in the context of user satisfaction. It has been suggested that user satisfaction is made up of meeting customer/user requirements, delivering the system when needed, delivering a quality product (for our study, quality was at least partially measured by the concepts of solid, thoroughly tested code and ease of use) and delivering the system at an appropriate cost (affordable to the customer) (Glass, 2001). Managers and their teams have also indicated that they each value delivering solid, well-tested code and an easy to use interface. All of these desired outcomes, of course, require realistic scheduling and resource planning (McConnell, 1996). A hastily prepared or, perhaps even worse, politically-inspired schedule and/or budget are not likely to support these outcomes, as

well as the largely intrinsic goals of a sense of achievement and delivering quality. Not supporting these personal goals, in turn, does not support a challenging and creative work environment for both project managers and practitioners, and has negative implications for motivation and productivity (Boehm, 1981; McConnell, 1996; Linberg, 1999).

Only one of the three items traditionally used to measure success, meeting requirements, proved to be highly regarded in our investigation of project managers. However, the other two items, completing a project on time and completing it within budget, did not appear to have much relevance for many of our respondents, as these two items were among the lowest ranked items. We had assumed that project managers would be more likely to consider budgetary and scheduling concerns relatively important to success (Saarinen, 1996; Glass, 2001) because, at least to some extent, they are held responsible for completing a project on time and within budget. However, their perspective was consistent with that of practitioners (Linberg, 1999; Procaccino et al., in press). Also, given that the presumed organizational/managerial intent is to design, construct and deliver a *completed* system, it seemed reasonable to expect that a baseline component of project success from the perspective of project managers (and the organization/department responsible for software development) is that a project is actually completed. However, less than half of managers indicated that completing a project (i.e., not resulting in cancellation) was important in defining success. This finding seems consistent with the mentality of, and work performed by, practitioners because they have indicated an interest in aspects and outcomes of software development that are not necessarily related to the traditional definition of project success (Glass, 1999; Linberg, 1999; Procaccino et al., in press). As a result, even a cancelled project could give practitioners a sense of achievement and learning something new. So in general, our investigation suggests that *both* project managers and practitioners can conceivably find some measure of 'success' in projects that may be considered at least a partial failure from an organizational perspective (i.e., delivered late and over-budget, or not delivered at all) (Linberg, 1999; Glass, 1999). Perhaps the relative consistency between responses from project managers and practitioners can at least be partially explained when we consider that most of our respondents indicated having professional experience as a practitioner.

Further work should have two main objectives: (1) to refine our survey instrument and (2) try to obtain a sample that is a better representation of our target population. We would like to refine our survey instrument to include questions that will allow us to better understand the nature of the development work that respondents have done in the past, as well as their most recently completed (i.e., new project development, maintenance of existing system and/or enhancement of existing system). We would also like to

expand the instrument to include elements related to the development process that have been suggested by Linberg (1999), Saarinen (1996) and McConnell (1996), among others, including those related to the knowledge and commitment of customer/users and senior management, the level of intercommunication between stakeholders, and knowledge of relevant business processes by all applicable stakeholders. We could then collect data for recently completed projects from the perspective of several stakeholders, including customers, users, project managers and practitioners. This data could be used to test the predictability of these items as they relate to various success outcomes. This would also facilitate further investigation into the data we have already collected and help gain a richer perspective of the items we have presented in this paper. We asked project managers to consider specific items in isolation of any particular project, but we wonder if the relative importance or unimportance that project managers and practitioners placed on outcome measures, such as having a sense of achievement, learning something, and completing a project (not cancelling), would still hold true for managers, compared to a member of their development team, when respondents are asked to evaluate an *actual* recent project that may have been delivered late and/or over budget, or perhaps even cancelled. We would also be interested in investigating the impact on various project outcomes of the effectiveness with which management selects and assigns software practitioners, each with their own personality, mentality and set of problem solving skills, to particular task(s) associated with completed software projects (Howard, 2001).

In order to make our sample more representative of software professionals in future work, we would like to collect more responses, perhaps from multiple databases and professional organizations. Sources that include e-mail addresses would assist us in following up with those organizations that did not respond to the first mailing. A larger sample size would facilitate a better statistical comparison of the perceptions among professionals with varying amounts and types of software development experiences. In this study, for example, we did not have enough responses to reliability compare between respondents with no project management experience with those that have been both managers and practitioners (i.e., technical development). It would also be interesting to expand our data collection outside of the US in order to compare developers and development projects across different countries and cultures.

Acknowledgements

The authors acknowledge the assistance of Dr. Steven J. Lorenzet, Assistant Professor of Management and Human Resources in The College of Business Administration at Rider University (Lawrenceville, NJ USA), in the preparation of this manuscript.

Appendix A. Survey instrument

Section 1 of 4: your background

- 1.1 Your gender:
 Male Female
- 1.2 Your age range:
 16–19 years 20–24 years 25–34 years
 35–44 years 45–54 years 55–64 years 65+
- 1.3 Your *highest completed* level of education:
 Some high school High school/equivalent graduate Some college, no degree
 Associate degree (2-year) Bachelor degree (4-year) Graduate degree
 Doctorate (PhD)
- 1.4 Indicate the approximate number of years (full-time equivalent) that you have worked in *each* of the following jobs (if zero, leave blank):
 Business Analyst Change Control Officer Database Developer
 Database Administrator Network Engineer Programmer
 Programming Analyst Project Manager/Leader Senior Manager
 Systems Analyst Team Leader Other (specify job):
- 1.5 In your career, in what percentage of software development projects did you have a financial interest, *other than earning a paycheck* (i.e., ownership/shares in the company, etc.)? (For example, if you have only ever received a paycheck/benefits for your development work, then your response would be 0%.)
 %
- 1.6 In which country have you done the *majority* of your software development-related work?
- 1.7 In which country have you lived in the longest?

Section 2 of 4: process of developing software

Each of the statements in this section relates to a specific aspect of the *process* of developing software.

Please rate how significant *you* believe each is in its contribution to what *you* consider a ‘successful’ software project.

Each question begins with the phrase, “It is important to your perception of project success that. . .” [Each response uses the following scale: (Very significant 5 4 3 2 1 Not at all significant Not applicable Don’t know]

The Process & Your Team:

- 2.01 The development team is small and high performing.
- 2.02 There was sufficient access to business and/or technical experts outside of the development team.
- 2.03 The development team is able to negotiate changes in necessary resources (time, money and/or personnel).
- 2.04 Overall, the development team is sufficiently skilled.
- 2.05 The development team is included in the decision making process (estimation, scheduling, etc.).

The Process & Project Management:

- 2.06 You, as the project manager, provide developers with feedback on their work on the project.
- 2.07 The development team does *not* feel pressured by the schedule/deadlines.
- 2.08 There is *on-going* and *realistic* evaluation by you, as the project manager, of the time and personnel necessary to deliver the required functionality.
- 2.09 There is a defined development methodology (either your organization’s own or another).

The Process & (Internal/External) Customer/Users:

- 2.10 Customer/users provide the development team with feedback on their work.
- 2.11 Customer/users have realistic expectations (including related to time and functionality).
- 2.12 The customer/users and development team have a good relationship (cooperative, mutually responsive, etc.).

The Process & Project Requirements:

- 2.13 There is a lack of ‘scope creep’ (expanding requirements).
- 2.14 Requirements are accepted by the project team as realistic/achievable.
- 2.15 Requirements are clear and understood by the development team.
- 2.16 If necessary, explain below your opinion on any of the statements in this section.
- 2.17 Indicate any additional aspects of the *process* of developing software that contribute to a successful project.

Section 3 of 4: defining project success

Each of the statements in this section relates to a specific aspect of the *final product* or *result* of developing software. For each of the following statements, rate how important *you* believe each is, in general, to *your definition* of successful software project.

Defining Success—Your Work:

- 3.01 Your work was a challenge.
- 3.02 You learned something new.
- 3.03 You had a sense that you delivered sufficient quality (did a good job).
- 3.04 You had a sense of achievement.
- 3.05 You were provided with enough independence and freedom (autonomy) to work creatively on a project.

Defining Success—Final System/Project:

- 3.06 Requirements of customer/users were met by the completed system.
- 3.07 Users found the final system easy to use.
- 3.08 The final system consisted of solid, thoroughly tested code.
- 3.09 The final system worked as intended.
- 3.10 The project was completed within budget.
- 3.11 The project was completed (was not cancelled, even if agreed upon functionality was reduced).
- 3.12 The project was completed at a cost affordable to the customer/organization (*not necessarily* within budget).
- 3.13 The project was completed on time (within schedule).
- 3.14 The project was delivered when needed by the customer/users (*not necessarily* within schedule).
- 3.15 If necessary, explain below your opinion on any of the statements in this section.
- 3.16 Indicate any additional aspects of project development that are important to your *definition* of project success.

Section 4 of 4: other perspectives of success

- 4.01 What aspects of software project development do *you* believe are important to your *development team's* definition of project success, relating to the process and/or the final software product?
- 4.02 What aspects of software project development do *you* believe are important to your *users'* definition of project success, relating to the process and/or the final software product?

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