Leadership in Software Development: Comparing Perceptions of Agile and Traditional Project Managers

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Leadership in Software Development:
Comparing Perceptions of Agile and Traditional Project Managers

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ABSTRACT
Information systems development has always been a focal point of IS research. The most widely understood traditional methods for developing information systems are based on the “waterfall” life cycle model. Recently, agile methods have drawn increasing attention from IS practitioners and researchers worldwide, as a response to the shortcomings of the traditional methods. However, the impact of agile methods on project management is still not fully understood as empirical studies are scarce. This study uses a full range leadership model as a theoretical lens to analyze project managers’ perceptions of appropriate leadership styles when leading agile vs. traditional software development projects. The findings show that project managers perceive a need for more transformational leadership to achieve success in agile projects as compared to traditional projects.

Keywords
Agile methods, software development, leadership, project management.

INTRODUCTION
Management of information systems (IS) projects is a critical challenge to IS practitioners as well as a focal point of IS research. High IS project failure rates have been reported continuously for decades (Standish Group, 2001). Recent high-profile project failures such as the FBI Trilogy Program (McGroddy and Herbert, 2004) and the US IRS system update (Varon, 2004) remind us that IS project problems are increasingly in the public eye, and failures can cost tens, if not hundreds of millions of dollars. Improving outcomes from IS projects is a critical challenge to both practitioners and researchers.

In the quest to improve IS project outcomes, alternative approaches to organizing and conducting IS development have arisen. Prominent among the new approaches is a class of system development methodologies commonly referred to as agile methods (Beck et al., 2001). Agile methods adopt a more flexible and responsive approach to system development which, proponents suggest, is more appropriate for fast changing business environments (Highsmith, 2003). Agile methods stand in contrast to well-established “traditional” methods which are plan-driven and based around the sequential waterfall development concept (Boehm and Turner, 2005).

To be successful, agile methods require a different project management style and approach than do traditional methods. The command-and-control, plan-driven project management approach that characterizes management of traditional development projects should, proponents argue, give way to a more facilitative and collaborative management approach when agile methods are adopted (Nerur et al., 2005).

There is little doubt that project leadership is an important factor in project success (Thite, 2000). A meta-analysis by Hauschildt et al. (2000) showed that human issues including project leadership and top management support mattered far more for project success than did technical issues. Furthermore, in their study of 24 project managers, Leban and Zulauf (2004) reported that project managers’ leadership has a strong impact on project members’ performance.
Surprisingly, there has been little empirical research analyzing project management leadership needs of agile projects and how they differ from those of traditional projects. The objective of this paper, then, is to empirically explore the differences in appropriate leadership behaviors, if any, between agile and traditional project management, *as perceived by project managers*, and to uncover the underlying reasons.

**LITERATURE REVIEW**

A brief literature review of traditional and agile system development methods, project management, and leadership is provided below.

**Traditional and Agile Development Methods**

Traditional system development methods, also known as plan-driven, or “heavyweight” methods have dominated the system development field for decades (Boehm and Turner, 2005).

The key principles of traditional methods have emerged from engineering practice. These methods view the system development process as a one-way “waterfall” beginning with an overall development plan, followed by requirement analysis through system design, system building, to the end product (Boehm and Turner, 2003). Specific methodology packages are typified by Structured Systems Analysis and Design Methodology (Duncan et al., 1995).

Traditional methods assume relatively static system requirements which are negotiated with customers and documented in contracts at the beginning of a project. These methods rely on thorough up-front planning and requirements analysis for predicting the foreseeable pitfalls and controlling the development process (Boehm and Turner, 2003). Traditional methods also require comprehensive documentation, thoroughly recording all the details of each step, to maintain stability and control (Boehm, 2002).

The underlying assumption of relatively static system requirements implicit in traditional development methods rarely applies in today’s rapidly changing business environment. Attempting to capture the system’s requirements in advance in such environments is effectively impossible; by the time the system has been developed according to the original requirements, the organization’s processes have changed sufficiently that the emergent information system fails to match the current requirements (MacCormack et. al. 2001). Project failure in such situations is common (Gibbs, 1994).

Agile methods have emerged in response to the mismatch noted above (Fitzgerald, 2006). In contrast to traditional methods, agile methods are characterized by short iterative and incremental development processes and high levels of collaboration. They are designed to be effective in high change environments using techniques that support feedback and learning; they emphasize the production of preliminary working software early in the development cycle (Beck et al., 2001).

Agile methods are based around four core values (Beck et al., 2001):

- **Individuals and interactions over processes and tools**;
- **Working software over comprehensive documentation**;
- **Customer collaboration over contract negotiation**;
- **Responding to change over following a plan**.

Since their inception, agile methods have attracted much attention and interest from IS practitioners and researchers (Ambler, 2007; Dyba and Dingsoyr, 2008) in their search for ways to speed up the delivery and improve the suitability of their final systems. Examples of popular agile development methodologies include Extreme Programming (XP) (Beck, 1999) and Scrum (Schwaber and Beedle, 2002).

Agile methods accept that business requirements are inevitably changing, so they aim to conduct “just enough” requirements analysis (Highsmith, 2003) to start system development as soon as possible. Requirements analysis within agile methods emphasizes adaptive learning rather than a conventional planning process, relying on “planning with the understanding that everything is uncertain” (Nerur et al., 2005, p.77). Also, in order to minimize the likelihood of system misfit, agile methods use short and flexible development cycles and deliver working software to customers frequently for validation (Nerur et al., 2005). Initially agile methods were considered to be suitable in small, collocated, greenfield, business projects with high user interface needs, and less suitable in projects that involve large teams, complex systems, contractors, geographically distributed teams, safety critical systems, systems with extensive legacy components, or those lacking a user interface.
Leadership Perceptions in Agile and Traditional Software Projects

(Beck, 2000; Schwaber & Beedle, 2002). However there is some research indicating that, with adaptation, these methods can be used under some of these conditions (Agerfalk & Fitzgerald, 2006).

### Agile versus Traditional Project Management

The academic literature examining project management in an agile method environment is limited and mostly non-empirical (i.e., normative, opinion-based). For example, Table 1 compares project management practice in agile versus traditional environments along three dimensions (Vinekar et al., 2006).

![Table 1: Normative differences between Agile and Traditional Project Management](image)

Adapted from Vinekar et al. (2006)

Highsmith (2003) has argued that “when using agile methods, the traditional role of a project manager as planner, organizer and controller disappears, to be replaced by the role of a facilitator who effectively manages the collaboration of team members without stifling their creativity.” Some observers have suggested that an agile project manager should be a mentor or coach (Coram and Bohner, 2005), a coordinator (Nerur et al., 2005), or a “protector” (Boehm and Turner, 2005) to guarantee the effective collaboration of the project team. These interpretations imply that, in contrast with the process-centric style of the traditional approach, agile project managers should work in a more people-centric way (Nerur et al., 2005).

Table 1 suggests that, in contrast to a “command and control” management style commonly used in traditional projects, agile project managers rely on “leadership and collaboration” (Cockburn and Highsmith, 2001; Coram and Bohner, 2005). However, there is no empirical research to date examining the validity of this presumption.

### Project Leadership and Leadership Theory

A number of academic studies have shown that project leadership is an important factor in project success (Thite, 2000; Barber and Warn, 2005). A Member Needs Assessment Survey, conducted by the Project Management Institute (PMI, 2001a) in 2000, showed that the three capabilities found to be most important to professional project managers are leadership skills (vision and motivating others), people skills (getting along with others), and management skills (directing and managing others). Project managers’ leadership is unquestionably an important determinant of project success.

Studies about leadership in projects mainly focus on the impact of leadership rather than specific leadership behaviors. However, the theory underlying those studies is based on full range leadership theory (Avolio and Bass, 1991). This theory has been widely recognized and adopted into leadership studies for over a decade (Lievens et al., 1997; Boerner et al., 2007). Full range leadership theory provides the theoretical basis of the present investigation.

Earlier studies of leadership emphasized traits (Weber, 1905), contingencies (Fiedler, 1967), and emotion and intelligence (Goleman et al., 2002). However previous leadership models have been criticized for failing to explain the full range of existing leadership styles and behaviors (Avolio and Bass, 1991; Bass, 1998). In response to such criticism, the concepts of transactional and transformational leadership have emerged. First proposed by Burns (1978), the concepts were later refined by Avolio and Bass (1991), who also added Laissez-faire leadership, resulting in the full range leadership model.
The full range leadership model has received a great deal of attention and interest from both academic and practitioner communities. It has become a focal point for a large body of leadership research. Each leadership style in the model is discussed in detail below.

### Table 2: Aspects of “full range” leadership

<table>
<thead>
<tr>
<th>Transformational</th>
<th>Transactional</th>
<th>Laissez-faire</th>
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</thead>
<tbody>
<tr>
<td>Idealized Influence</td>
<td>Contingent Reward</td>
<td>Laissez-faire</td>
</tr>
<tr>
<td>Inspirational Motivation</td>
<td>Management-by-Exception (Passive or Active)</td>
<td></td>
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<tr>
<td>Intellectual Stimulation</td>
<td></td>
<td>(Non-transactional)</td>
</tr>
<tr>
<td>Individualized Consideration</td>
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</tbody>
</table>

Adapted from Bass and Riggo (2006)

Transformational leadership is concerned with developing followers to their fullest potential. Kuhnert and Lewis (1987) describe transformational leadership as deriving from the personal values and beliefs of leaders, not in an exchange of commodities between leader and followers. A transformational leader is “one who articulates a vision of the future that can be shared with peers and subordinates, intellectually stimulates subordinates, pays attention to individual differences among people, is likely to use personal resources including time, knowledge and experience and serves as a coach teacher and mentor” (Shivers-Blackwell, 2004, p.43).

Transformational leadership consists of four dimensions: First, idealized influence describes leaders who act as strong role models for followers to emulate (Bass, 1998). These leaders usually have very high standards of moral and ethical conduct and can be counted on to do the right thing. Inspirational motivation describes leaders who communicate high expectations to followers, inspire them, and motivate them to commit themselves to the team (Northouse, 1997; Bass, 1998). Thirdly, intellectual stimulation includes leadership that stimulates followers to be creative and innovative, and to challenge their own beliefs and values as well as those of the leader and the team (Northouse, 1997; Bass, 1998). Last, individualized consideration refers to leadership that provides a supportive climate in which the leader listens carefully to the individual needs of followers (Northouse, 1997). Leaders act as coaches and advisors while assisting members to achieve and grow. Bass (1998) contends that transformational leadership is likely to emerge in an unstable, uncertain environment.

Transactional leadership is identified as largely “contingent reward” based: leader-follower relationships are based on a series of exchanges of reward to the followers for efforts and performance. The leader clarifies the standards for compliance. Also the leader specifies what constitutes ineffective performance and may punish followers for failing to meet those standards (Bass, 1998).

Transactional leadership embodies two key aspects. First, contingent reward refers to an exchange process between leaders and followers in which effort by followers is exchanged for specified rewards (Northouse, 1997). The leader tries to obtain agreement from followers on what needs to be done, and what the payoffs will be for doing it. Secondly, management-by-exception refers to leadership that involves corrective criticism, and negative feedback (Bass, 1998).
can be effective to the extent that they clarify expectations and goals, but they generally neglect to focus on developing the long-term potential of followers (Lievens et al., 1997).

In contrast with transactional leadership, laissez-faire leadership comprises non-transactional behaviors. Laissez-faire leadership is effectively the avoidance of leadership. Necessary decisions are not made. Actions are delayed. Responsibilities of leadership are ignored. This “hands off” leadership has been reported as having a strongly negative effect on team effort and performance (Skogstad et al., 2007).

Research Questions

Despite the rapidly growing popularity of agile methods in commercial practice, the implications of this for project management – and particularly project leadership – are still not well understood. In addition, most insights and suggestions provided by previous researchers have been based on judgment and personal experience, as opposed to empirical investigation.

The objective of the present study is to explore the leadership differences, if any, between agile and traditional project management, and attempt to understand the underlying reasons for any differences. The following two research questions are posed:

1. What leadership behaviors do traditional software project managers think are most appropriate for traditional projects? Why?

2. What leadership behaviors do agile software project managers think are most appropriate for agile projects? Why?

The full range leadership model provides our theoretical lens, and the model’s seven leadership aspects comprise the leadership behaviors we investigated. Details of our research approach and methodology are described next, followed by our findings and conclusions from the study.

RESEARCH METHOD

This study utilized both quantitative and qualitative methods, in part to provide a degree of triangulation. Quantitative data were gathered using a questionnaire developed for the present study, and based on the Multifactor Leadership Questionnaire (MLQ) (Bass and Avolio, 1992). The MLQ was tailored to fit the context of a software development project. The tailored version included some demographic questions, together with 21 questions to assess transformational, transactional and laissez-faire leadership. Each question was answered on a five point Likert scale, from “Strongly disagree” (0) to “Strongly agree” (4). The MLQ has been thoroughly validated and is widely recognized in leadership research literature (Lievens et al., 1997; Boerner et al., 2007).

Qualitative data were gathered from a series of semi-structured interviews with project managers. As this study sought explanations and personal insights from the participants, semi-structured interviews allowed them to explain situations in more detail and expand on specific topics if necessary (Creswell, 2003). The semi-structured interviews were also based on the MLQ. Each interview was structured around seven sets of questions, derived from the seven leadership dimensions.

Study participants were recruited from the local community of system development project managers in Wellington New Zealand. Upon initial contact (via telephone or email), the purpose of the study was described, and certain demographic data were requested from the potential participant. Based on the information provided, a final set of participants was selected according to pre-determined criteria.

First, the participants selected had to have the job titles of “project manager” and be working in the software development sector; second they had to have been using either agile, or traditional, development methods for the past three years. We also sought participants from different organizations, of varying sizes (as measured by number of employees). Selecting participants from diverse organizational settings helped to mitigate the possibility of a common opinion formed because of the same organizational culture influences rather than the influence of the SDM used.

Eight software project managers from seven different organizations agreed to participate in this study. Four were managing agile development projects, and four were managing traditional projects.

Each participant was emailed a copy of the survey instrument (along with other information describing the purpose of the study, human ethics sign-off, etc.), and asked to complete it and return it to the researchers. The individual interviews lasted between 30 and 50 minutes, and were conducted at the participants’ work locations. The participants were assured of
anonymity and confidentiality in order to encourage open opinions and views. With participants’ signed consent, all eight interviews were digitally recorded. The recording was transcribed soon after the interview. The transcripts were then returned to the participants for validation.

Interview data were analyzed following the approach described by Creswell (2003). The transcripts were studied in depth, and topics identified, labelled, and grouped into the seven pre-defined full range leadership categories. A two-layer coding scheme was developed. The first layer consisted of the seven aspects of leadership. The second layer was determined from the topics identified in the interview transcripts. The next step was to refine the coding scheme iteratively generating interpretation and themes. From that, a narrative was written to convey the findings, and an interpretation of the narrative was conducted. As a final step, the interview findings were compared with earlier findings from agile literature and leadership theory.

Internal validity was addressed principally through the use of the well-validated MLQ instrument. Also, care was taken in having the interview transcripts reviewed and verified by the participants. Strong claims for external validity cannot be made here; a larger, random sample could be employed in future research to improve external validity. Reliability was strengthened through the mixed qualitative and quantitative data gathering employed, and via a pre-testing of both the questionnaire and the interview protocol with two experienced project managers.

RESULTS AND DISCUSSION

The eight participants, all based in Wellington, were from seven different countries on five continents – i.e., they presented a diverse set of backgrounds. There were four men and four women; their ages ranged from 30 to 50; and all eight had at least 6 years’ PM experience. Project team size ranged from 5 to over 50 people. Other demographic details are given in Table 3.

<table>
<thead>
<tr>
<th>Table 3  Demographic information of the participants</th>
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<tbody>
<tr>
<td><strong>Participant</strong></td>
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<tr>
<td><strong>Gender</strong></td>
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<td><strong>Age</strong></td>
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<td><strong>Culture</strong></td>
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<td><strong>Industry</strong></td>
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<tr>
<td><strong>Organization Size</strong></td>
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<td><strong>Job Title</strong></td>
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<tr>
<td><strong>Project management experience</strong></td>
</tr>
<tr>
<td><strong>General</strong></td>
</tr>
</tbody>
</table>

**Questionnaire Results**

Three individual questions were used to measure each of the seven leadership dimensions. Summative scales were used to determine a score for the corresponding leadership dimension, for each respondent. Following Bass and Avolio (1992), a score from 9-12 is considered as “high,” i.e., the respondent considered that this aspect is important to his or her project’s success; a score in the range 5-8 means the respondent considered the aspect to be of moderate importance to the success of the project; while a 0-4 score means that the respondent considered this aspect as unimportant to the project’s success. The
responses to the questionnaire were first divided into two groups, agile and traditional, and the final scores of each group were calculated separately. To determine whether there was a common opinion on a given aspect, consensus was deemed to have occurred when the distance between the highest score and the lowest score was no larger than 3 points.

**Distributions for the Agile Project Managers**

Figure 3 provides the score distribution of the four agile project managers across all seven leadership factors. Each color represents an individual participant (PA--PD).

![Figure 3 – Score distributions for the agile PMs](image)

All four aspects of transformational leadership were rated 9 or higher by every participant (with one exception: one participant rated one dimension an 8). Some scores on idealized influence and inspirational motivation reached the maximum 12. This indicates that all four agile project managers felt that all of the transformational leadership dimensions were very important in managing agile projects. Furthermore, none of the individuals differed by more than 3 points on any of the four importance ratings, thereby demonstrating a high level of consensus among agile project managers that all four transformational leadership behaviors are seen as important to their project success.

For the dimensions reflecting transactional leadership, the scores were lower, and did not show as much convergence. *Contingent reward* received scores varying from 3 to 9 points, whereas *management-by-exception* scores ranged from 5 to 10 points. This dispersed score distribution suggests that there is less consensus among agile project managers as to importance of these two dimensions with regard to project success.

Finally, for the dimensions reflecting *laissez-faire* leadership, the scores were very low. No participant rated this dimension higher than 4. Laissez-faire leadership was commonly perceived by agile project managers as unimportant to their project success.

**Distributions for the Traditional Project Managers**

Figure 4 provides the score distribution of the four traditional project managers. As with Figure 3, each participant is represented by a single color (PE--PH).
For the dimensions reflecting transformational leadership, only individualized consideration was rated by the participants consistently around 9 points (i.e., “high”). This leadership behavior tended to be commonly perceived by traditional project managers as important to their project success. Inspirational motivation was rated relatively consistently, although in the “moderately important” range. The other two factors were scored diversely; no common opinion can be identified from the data. The means, however, were again in the “moderate” range.

For the aspects reflecting transactional leadership, contingent reward was scored lower and was more widely dispersed therefore no common opinion could be seen, while management-by-exception was rated relatively consistently, in the upper end of the moderate range.

Finally, as with the agile managers, laissez-faire scored consistently under 4. It tended to be considered by traditional project managers as unimportant to their project success.

Figure 4 - Score distributions for the traditional PMs

Comparison Across Groups

Table 4 provides a comparison of the quantitative data between agile and traditional groups. The major differences between these two groups occurred on the transformational leadership aspects. For the agile group, the four aspects associated with transformational leadership all fall into the high interval, while for the traditional group, only one of these four dimensions scored 9.25 on average; the other three were rated much lower, from 6.75 to 7.5, which put them in the middle interval.

For the aspects reflecting transactional leadership, both groups tended to have similar scores. Both groups’ scores placed both aspects of transactional leadership in the middle interval.

Laissez-faire leadership behavior for both the agile group and the traditional group was rated in the low interval.

In summary, all four transformational leadership aspects were consistently and highly rated by the agile project managers, whereas three of the four were rated “medium” by the traditional project managers (only individualized consideration was rated highly by the traditional PMs). The traditional PMs also evidenced more dispersion in their ratings of transformational leadership aspects. Transactional leadership was rated in a similar way by both groups, and the rating scores were quite dispersed. Laissez-faire leadership was consistently rated lowest by both groups.

While the sample size in this study is too small to allow us to make statistically significant conclusions, nonetheless the data are suggestive and intriguing: Agile PMs would appear to need to focus strongly on their transformational leadership.
capabilities, whereas these are generally less important for traditional PMs. Transactional leadership capabilities are of only moderate importance regardless of the development approach being taken.

The question remains, however, why do the PMs perceive these differences? In order to uncover some answers to the “why” question, we completed the second part of the study, face-to-face semi-structured interviews with each PM. The interviews themselves were structured around the same seven aspects of leadership that guided the survey stage. Analysis of the transcript data unveiled a variety of underlying perceived driving forces. Space limitations prevent us from providing extensive detail regarding the interview findings (these are available from the authors). The key findings are contained in Table 5.

Laissez-faire leadership was consistently viewed negatively by the interview subjects, so has been omitted from the table.

As shown in Table 5, the rows labeled “opinions” summarize the opinions of the participants on each leadership dimension. The “major reasons unveiled” row in Table 5 represents the major reasons underlying those opinions, determined from the interview data.

The agile group consider idealized influence, as shown in Table 5, to be important to project success because it contributes to the trust building between the agile team and the project manager. Such trust is critical because most activities in an agile project are not pre-structured. Inspirational motivation is believed to be important because it contributes to project agility and project adaptability, allowing the team to take initiative in embracing changes. Intellectual stimulation is suggested to be important because it contributes to agile project planning. Frequent, short planning sessions require a constant stream of innovation and creativity. Individualized consideration is highly emphasized by agile project managers, as it contributes directly to team satisfaction and indirectly to team collaboration and knowledge sharing, and produces better internal relationships among team members. The four agile PMs held varying views of the role and relevance of transactional leadership, with no consistent pattern emerging (this is also reflected in the survey data).

In contrast, traditional PMs shared little or no common views on three of the four transactional leadership aspects. They were, however, strongly consistent in their perception that individual consideration contributes to team satisfaction which may lead to a better project performance. The traditional PMs also share a common view on contingent reward, and management-by exception. They generally believed that contingent reward is an appropriate incentive mechanism only when the team members are sensitive to monetary rewards, but is unlikely to be important to project success; while they viewed
management-by-exception as the usual way of working, as a standard organizational procedure. This finding seems to support the proposition of Bass (1998) that when the environment is relatively stable (which traditional projects imply), transactional management-by-exception may be adequate. Consequently, these data suggest that management-by-exception is an appropriate leadership dimension for traditional project management whereas contingency reward may not be.

CONCLUSIONS

This study is subject to a number of limitations. The sample size is too small to allow us to make statistical conclusions. There is a possibility of self-report bias by the participants. Many of the respondents worked in a common industry (computers/telecommunications), presenting another possible source of bias. Nevertheless, this study suggests that there are important differences in PM leadership style to be considered when managing traditional vs. agile development projects. While an increasing number of organizations are adopting agile development, at least for some projects, the leadership implications associated with such adoption are still not fully understood. Among other things, there is an evident risk in a mis-match between project methodology and leadership style of the PM. The present study is a first step towards a better understanding of an appropriate leadership style for agile projects and how this differs from that of traditional projects.

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