The role of leader personality in new product development success: An examination of teams developing radical and incremental innovations

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Abstract: Teams developing innovations work in a context ripe with uncertainty, and handling this uncertainty places special demands on the leaders of such teams. We empirically tested the role of leader personality in the success of two different types of New Product Development (NPD) teams: radical and incremental. Using the five-factor model of personality as a framework, results based on a sample of 116 NPD teams suggest that for NPD leaders, conscientiousness and emotional stability are important variables for NPD success. Additionally, depending upon the type of innovation, specific personality variables may be more important. Strong support was found for our proposal that NPD teams working on radical innovations would benefit from a more open leader. Radical NPD teams operate under conditions of market and technical uncertainty. More open leaders should be more easily able to encourage and handle new ideas that are necessary for managing radical innovations. Implications for selection and training of individuals to lead radical NPD teams are provided.

Keywords: leader personality; new product development success; new product development teams.


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Gary S. Lynn is the distinguished Service Professor and tenured Associate Professor of the Howe School for Technology Management, Stevens Institute of Technology. He had authored or co-authored four books and over 60 articles. In 2002, his book, *Blockbusters*, was selected as one of the key management publications in the world, and in 2003 it was chosen as one of the 30 management books published by Soundview, Concordville, PA. He actively works with venture capital firms and start-up companies, helping them start up new ventures. Dr. Lynn won the best Associate Professor Award at Stevens Institute of Technology; Best Teacher and Best Researcher in the School of Technology Management, Stevens Institute of Technology the Merrit Williamson Research Award was given by the Society for Engineering Management; and received the first innovation fellowship given by Rubbermaid, Inc. in 2002. In 2002, he was selected by *Business 2.0 Magazine* as one of the nine leading management gurus in the country. He was selected as being one of the most active and prolific scholars in the field of technology innovation management by the International Association for the Management of Technology.

1 Introduction

What makes those teams developing innovations successful? Because these teams work in a context ripe with uncertainty, handling this uncertainty places special demands on the leaders of such teams. Scholars have documented the value of effective leadership for project performance (e.g. Clark and Fujimoto, 1991; Brown and Eisenhardt, 1995; Sheremata 2000; Barczak and Wilemon, 2001). Researchers have explored the traits related to leadership within the teams (Stogdill, 1948; Mann, 1959; Lord, De Vader and Alliger 1986; Chidester, et al., 1991; Kirkpatrick and Lock, 1991; Zaccaro, Foti and Kenny 1991; Lepine et al., 1997; Judge et al., 2002). However, little or no research has attempted to directly examine the role of leader personality in New Product Development (NPD) team performance (Stevens, Burley and Devine, 1999; Reilly, Lynn and Aronson, 2002). Reilly, Lynn and Aronson describe the importance of team member’s personality for NPD performance. Stevens, Burley and Devine find significant differences between the number of decisions and the degree of success for different personality types of a project analyst, who considers new ideas for further development. Although this research does not directly bear on the issue of team performance, it provides evidence for the impact of personality traits on NPD. Further, researchers suggest that leader personality
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Effects ought to be examined in different kinds of teams, including cross-functional task teams in management (e.g. Peterson et al., 2003), or NPD teams. As an answer to this, we consider the role of leader personality in NPD success for two different types of NPD teams: radical and incremental. Radical NPD occurs when the market for the product is not clear and the technology used is new and uncertain; incremental NPD occurs when the markets are well established and there are few questions about the technology.

2 Theoretical background

Researchers have distinguished between two broad types of innovations that differ in the extent to which the innovation is similar to or different from the existing practice. Radical innovation represents significant change for the firm, and often opens up new markets and potential applications. Radical innovations include those products that are completely new to the firm, products based on new technologies and new ventures unrelated to the existing businesses. Such major innovations require skills, abilities and knowledge, different from those required to master the old technologies. Incremental innovation, in contrast, introduces relatively minor changes to an existing product. Incremental innovations are related to the firm’s current products and businesses, and generally take the form of product modifications, upgrades and line extensions. These innovations build on existing know-how (Tushman and Anderson, 1986). Because the nature of these innovations differ, the literature argues that the teams performing these innovations be different (Barczak and Wilemon, 1991). For example, Barczak and Wilemon note that the teams responsible for radical innovation should be autonomous and separate from the existing organisation. The more dissimilar the technology or markets from current practice, the greater should be the use of independent venture forms, they argue. NPD teams are accordingly assembled to implement their tasks outside the established organisation structure. Indeed, high levels of autonomy are reported throughout the teams studied in a recent investigation by Gemünden, Salomo and Krieger (2005). The work of Gemünden, Salomo and Krieger implies that high levels of autonomy also pose severe challenges (e.g. access to complementary resources is more difficult for separated units than for embedded units) for these NPD teams. In contrast, routine and related new products are best suited to be carried out within the firm’s existing divisions and units. These differences have implications for the way these teams are effectively managed, and for the personality traits their leaders should possess. However, research on the specific personality traits leaders should have to manage these respective teams effectively is noticeably lacking. To this end, we examine the role of leader personality traits in the success of teams developing radical and incremental innovations. We begin by describing the Five-Factor Model of personality (FFM) we use as a frame work for organising the research on leader personality traits.

2.1 The five factor model as a framework for assessing leader personality

Consensus is emerging that a five factor model of personality can be used to describe the most salient aspects of personality (Goldberg, 1990; Judge et al., 2002). The five-factor structure of personality was initially replicated by Norman (1963) and Tupes and Christal (1961). The five-factor structure has been recaptured through analyses of trait adjectives in numerous languages, factor analytic studies of existing personality inventories and
decisions regarding the dimensionality of existing measures made by expert judges (McCrae and John, 1992). Evidence indicates that the Big Five personality traits are heritable and stable over time (Costa and McCrae, 1988; Digman, 1989). Researchers have also established the cross-cultural generalisability of the five-factor structure through studies across countries (McCrae and Costa, 1997b).

The dimensions comprising the FFM are stability, extraversion, openness to experience, agreeableness and conscientiousness (e.g. Costa and McCrae, 1992; Mount, Barrick and Strauss, 1994). Emotional stability represents the tendency to be calm, enthusiastic, poised and secure. Openness to experience represents the tendency to be imaginative, sensitive, intellectual and polished. Conscientiousness represents the tendency to be careful, thorough, achievement-oriented, responsible, organised self-disciplined and scrupulous. Agreeableness represents the tendency to be good-natured, gentle, cooperative, forgiving and hopeful. Extraversion represents the tendency to be sociable, talkative, assertive and active.

Meta-analytic research (e.g. Barrick and Mount, 1991; Tett, Jackson and Rothstein, 1991; Salgado, 1997; Hurtz and Donovan, 2000) suggests that personality traits, as measured by the FFM, have considerable utility for predicting how people behave and perform in the workplace. Of particular interest is the evidence (Day and Silverman, 1989; Barrick and Mount, 1991; Tett et al., 1994) that specific personality traits are related in predictable ways to the performance in certain kinds of jobs. A recent meta-analysis by Judge et al. (2002) provides support for the relevance of the FFM as a framework for organising the personality traits in leadership research. We next describe two different types of NPD teams: radical and incremental, and then examine the proposed effect of leader personality on the success of these teams.

2.2 Radical vs. incremental NPD teams

Two major types of teams responsible for NPD have been identified: operating and innovating (Barczak and Wilemon, 1989). Operating teams are concerned with maintaining the competitive positions in existing businesses and, as a result, they usually focus on incremental innovation or small improvements to current products. Characteristics of these groups include operating in relatively stable environments, being rule and planning-oriented and emphasising current products. Innovating teams, in contrast, focus on developing a new business for the firm. They are more likely to focus on important new products for unfamiliar markets. These types of teams produce radical or discontinuous innovations. The development of radical innovations is associated with more challenges than the development of incremental ones (O’Connor and Veryzer, 2001). Teams developing radical innovations are usually separated from the daily activities of the firm. Characteristics of innovating groups include operating in a dynamic environment, emphasising initiative and risk-taking and maintaining loose methods of control. These product development teams must choose an innovation strategy that is tailored to the degree of market and technology uncertainty (Ansoff, 1965, 1988; Moriarty and Kosnik, 1990). These two major types of NPD teams have been labeled incremental and radical (Lynn and Akgun, 1998). In the current study, we focus on the effect of leader personality on success in incremental and radical NPD teams.

Incremental innovation exists under highly certain environments, when a currently served market with mature technologies is targeted. Incremental innovations may include product changes or improvements, product line extensions and ‘me too’ products that are
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similar to the competition. A good example of incremental innovation is the double stuff Oreo cookie by Nabisco. Under such conditions, the appropriate innovation strategy focuses on being market-based and process-based. The customers are well defined and are typically well known, as is the technology required to produce the innovation. This type of innovation usually encounters fewer surprises than the more radical type.

Radical innovation, in contrast, exists when both market and technology uncertainties are high. Innovations of this type pose severe challenges for new product teams, because the market is not well understood and the product is still evolving and changing with the market. These types of innovations require a focus on a learning-based strategy, since experimenting is an essential component of the process. Product teams may try a product in the market to learn, improve it and try it again (Lynn, Morone and Paulson, 1996). For example, the early VCR models were too expensive and limited and, consequently, they failed in the marketplace. However, manufacturers continued to interact with the users, learned from them, and accordingly improved the technical performance of the VCR, reduced its price and successfully reintroduced the product to the market (Rosenbloom and Cusumano, 1987).

Scholars suggest that different personality styles are required depending upon the team’s task. Because NPD teams differ with respect to typical tasks, past scholarship would suggest that it is important to consider the role of leader personality for different types of NPD teams (Tuckman, 1967; Bouchard, 1972; DeBiasio, 1986; Driskell, Hogan and Salas, 1987). Although our research propositions are stated for two categories of teams, incremental and radical, it is important to recognise that the variables that distinguish between the two teams are continuous. Thus, a proposition that suggests a zero correlation between a personality variable and NPD success does not necessarily imply that this personality variable is completely unimportant for a NPD leader to possess, but rather that it is unlikely to distinguish successful from unsuccessful teams. As an example, a threshold level of creativity may be important for the leaders of incremental NPD teams, but may not differentiate success from failure. On the other hand, the level of creativity beyond the threshold level might have a significant relationship with success in innovation teams. We next propose the effects of leader personality on the success of NPD teams developing innovations that are radical and incremental.

2.3 Research on leader personality and NPD teams

2.3.1 Openness

Redmond, Mumford and Teach (1993) note that employee creativity, which is particularly important for the success of radical NPD teams, is enhanced when the leaders accept and exhibit an appreciation for cognitive diversity and non-conformity. Leader acceptance for innovation, that is, the leader’s openness to new ideas, is one of the cited factors necessary for motivating employees to be creative (Amabile et al., 1996). A similar view is presented by McCrae and Costa (1997a). A leader’s openness to new ideas should also reduce the likelihood of group think on the basis of Janis’ work (1989). Leaders high on openness exhibit a willingness to explore new ideas, listen to others’ points of view, and are interested in unusual thought processes (McCrae and Costa, 1987).
Openness has been associated with participative leadership styles according to Kirkpatrick and Lock (1991) and Zaccaro et al. (1991). Driskell, Hogan and Salas (1987) note that realistic and conventional groups resent participatory management, which they assume to be weak. Incremental NPD teams who perform tasks that are highly certain and routine would likely fall into this category.

Leaders of incremental NPD teams, in comparison with radical NPD team leaders, tend to use a narrower and more familiar range of methods to accomplish their tasks, as noted by Barczak and Wilemon (1989). It is proposed that incremental NPD leaders do this, because they feel they have little control or influence over their immediate environment. The context is set by developing products similar to current products, and the rules are set because such teams are part of the daily activities of the firm. Thus, incremental NPD leaders have less freedom to create a context for their team. On the other hand, leaders of radical NPD teams must seek a wide variety of creative and non-traditional techniques for getting members to successfully accomplish the objectives. These leaders constantly manipulate situations and surroundings to enable the team members to achieve the desired behavior. It is believed that radical NPD leaders behave in this manner, because they have to create a new context in which the team can work. We propose that leader openness should be particularly important when leading radical NPD teams.

Hypothesis 1: Leader openness will be positively related to NPD success when the innovation is radical, but will not be related to NPD success when innovation is incremental.

2.3.2 Emotional stability

Investigators note that a leader’s emotional stability is more important in organisations that develop new products or services than in the organisations that have established products and services (Hogan, Curphy and Hogan, 1994). Researchers report that the favorability of the leaders’ moods is inversely related to the team turnover (George and Bettenhausen, 1990). Radical product innovation typically takes longer than the incremental innovation, so that teams must function together for longer periods of time—a condition that makes the favorability of the radical NPD leader’s moods and the emotional stability of the leader an important trait.

Chidester et al. (1991) examined the relationship between certain leadership characteristics and the performance of commercial air flight crews. Air flight crews who had captains with characteristics such as the ability to withstand pressure made the fewest errors in comparison to air flight crews who had captains lacking similar characteristics.

Research by Taggar, Hackett and Saha (1999) reported that neuroticism had a strong relationship with emergent leadership (appearing after factors such as general cognitive ability and conscientiousness) during the performance of tasks that included creative problem-solving and decision-making. The emotional stability of leaders may be particularly important during radical NPD. Radical NPD encounters many more surprises than the incremental type, and the radical NPD leader deals with conditions of high market and technology uncertainty. Having a radical NPD team led by a leader who is emotionally stable should be particularly functional because of the uncertainty, rapid change and the surprises involved with radical innovation. Having an emotionally stable leader can help buffer the radical NPD team from the stress associated with this
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uncertainty, thus enabling the team to continue functioning together over long periods of time necessary for radical NPD. Emotional stability may be relatively unimportant for incremental NPD leaders, who work under conditions that are more certain and routine.

Hypothesis 2: Leader emotional stability will be positively related to NPD success when the innovation is radical, but will not be related to NPD success when the innovation is incremental.

2.3.3 Conscientiousness

Conscientiousness has an impact on several leadership components, such as goal-setting, motivating others and task orientation (Aronoff and Wilson, 1985; Costa and McCrae, 1992; Barrick and Mount, 1993). A positive relationship between responsibility and leadership has also been reported (e.g. Stogdill, 1948). Research by Taggar, Hackett and Saha (1999) found that conscientiousness had the second strongest relationship with emergent leadership (appearing after general cognitive ability). Lepine et al. (1997) reported that team decision accuracy is contingent on leader conscientiousness. Conscientiousness is also related to the overall job performance (Barrick and Mount, 1991), and this suggests that leader conscientiousness should be related to leader effectiveness (Judge et al., 2002) in both incremental and radical NPD teams. Kirkpatrick and Locke (1991) note that leaders should be persistent in their activities and follow through with their programmes or plans, and conscientious individuals are persistent (Goldberg, 1990). Planning is crucial for both types of NPD leaders according to Barczak and Wilemon (1989), although radical NPD team leaders must plan for a far more uncertain environment. Thus, we propose that the conscientiousness of the leader should be related to success in both types of NPD.

Hypothesis 3: Leader conscientiousness will be positively related to NPD success under both radical and incremental innovation conditions.

2.3.4 Agreeableness

Agreeableness represents the degree to which someone shows personal warmth, a preference for cooperation over competition and trust and acceptance of others (McCrae and Costa, 1987). However, the link between agreeableness and leadership is conceptually unclear (Judge et al., 2002). On the one hand, cooperativeness tends to be related to leadership (Bass, 1990), and interpersonal sensitivity was found to be related to leadership (Zaccaro et al., 1991). Altruism, tact and sensitivity have been described as the characteristics of an agreeable personality, and would suggest that leaders should be more agreeable. On the other hand, agreeable individuals tend to be modest (Goldberg, 1990), and leaders are not likely to be excessively modest (Bass, 1990). In addition, although it is often considered to be part of extraversion (Watson and Clark, 1997), many researchers consider affiliation to be an indicator of agreeableness (Piedmont, McCrae and Costa, 1991). Need for affiliation seems to negatively related to leadership (Yukl, 1998). These factors suggest that agreeableness should be negatively related to leadership. Due to these contradictory justifications, the possible relationship between agreeableness and leadership is ambiguous. Agreeableness was found to be the least relevant of the Big Five traits in a meta-analysis on the relationship between personality and leadership (Judge et
al., 2002). We propose that the agreeableness of the leader will not be related to success neither in incremental nor in radical NPD.

**Hypothesis 4:** Leader agreeableness will not be related to NPD success under neither radical nor incremental conditions.

### 2.3.5. Extraversion

An extrovert’s social confidence and prowess might be important in contexts that require high amounts of social interaction (Mann, 1959; Shaw, 1981; Stogdill, 1974; Lord, De Vader and Alliger, 1986; Kirkpatrick and Locke, 1991; Hogan, Curphy and Hogan, 1994). Meta-analyses (e.g. Barrick and Mount, 1991) report that extraversion is a valid predictor for occupations that have a social interaction component.

In Bass’ review (1990), results linking extraversion to leadership were inconsistent. Other reviews suggest that extraverts should be more likely to emerge as leaders in groups. Taggar, Hackett and Saha (1999) reported that extraversion had the third strongest relationship with emergent leadership (appearing after general cognitive ability and conscientiousness) during the performance on tasks that included creative problem-solving and decision-making. Gough (1990) found that both the major facets of extraversion – dominance and sociability were related to self and peer ratings of leadership. Extraversion was also strongly correlated with leadership across the study settings and leadership criteria in a meta-analysis conducted by Judge et al. (2002).

Radical NPD team leaders, as opposed to incremental NPD team leaders, cite the importance of getting the team members to buy into and be committed to their project and its goals according to Barczak and Wilemon (1989). The authors propose that getting the members to buy into the project is more important for radical team leaders, because there are more unknowns and uncertainties with radical ventures. Kolb (1992) notes that the leader also needs to sell the idea to upper management in order to obtain necessary resources. When compared with incremental NPD teams, having a leader who can get the team members to buy into the NPD project and who can sell the idea to upper management is especially important for radical NPD teams, since radical teams are developing a completely new product for a completely new market.

**Hypothesis 5:** Leader extraversion will be positively related to NPD success when the innovation is radical, and will not be related to NPD success when the innovation is incremental.

### 3 Method

#### 3.1 Sample

We selected a contact person for 116 NPD teams in a variety of technology-based companies in the north-eastern USA to participate in this study. To avoid industry bias, we sampled a variety of industries including telecommunications, computers and electronics, fabricated metal products, information services, pharmaceuticals, chemical manufacturing, food manufacturing, and machinery manufacturing. In each company, the contact person chose NPD professionals as respondents, detailed later. Every respondent was asked by the contact person to select a completed NPD project. Our high response
rate (90%) was related to our use of participants in an executive management programme, most of whom worked in R&D organisations. Of 129 ‘contact people’ asked to participate, 116 returned the questionnaires. In our sample, 37.6% of the projects the NPD teams worked on involved a new technology, 38.3% involved several new technologies and 10% of the sample involved non-proven or non-existing technologies, which was consistent with what we expected to investigate at technology-based firms. The typical radical innovations in our study can be categorised as falling into one (sometimes more) of the following: electronics and computing; telecommunications; advanced materials and chemicals; pharmaceuticals. These categories are comparable to those presented by Veryzer (1998). Specific examples of radical innovations in our research include: Telcom Interactive Television; computer operating system; an automated mail processing system; MRS bulletin ‘link’ paper; anti-HIV therapy drug. The median NPD team size was 11 people, the average NPD team size was 23 people and the SD was 38. Most projects were from large companies: 69.6% of the projects were from the companies with annual incomes over 500 million dollars, 26.8% of the projects were from the companies employing 500–5000 workers, and 47.1% of the projects were from the companies employing more than 5000 people.

In each company, the contact person chose primarily product, senior engineering, technical and marketing managers as respondents. All these individuals were NPD team members. Participation in the study was voluntary, and the participants were assured that their responses would be kept confidential. About 41% of the respondents were product managers, 25 and 13% of the respondents were senior engineering or technical managers and the remainder were marketing managers, all of whom were project members. To test for the differences in respondent type, one-way analyses of variance (ANOVA) were performed, with all of the major personality constructs as dependent variables and respondent type as the independent variable. No significant differences were found.

The respondents were instructed to choose teams who had completed a NPD project. Our sample included a range of successful and unsuccessful NPD projects; however, our data were skewed towards successful projects. Some unsuccessful projects were undoubtedly not included because they were never completed. Such restriction in range tends to impact correlations more than regression weights, so we feel that this restriction did not seriously bias our results.

Further, to ensure a reasonably comparable level of familiarity with the NPD teams and their leaders across the sample, each respondent was asked to choose a team working on a NPD project with which he/she was intimately familiar with and involved with throughout its development. Product development studies routinely use the retrospective methods for reasons of feasibility (e.g. Meyer and Utterback, 1995). To improve the accuracy of retrospective reports, respondents were asked by the contact person to select recent projects, to eliminate the elapsed time between the events of interest and the collection of data.

In the current sample, there was one informant per NPD team. Based on our study’s empirical findings, we do not believe the respondents’ retrospective assessment of the personality of the NPD leader was dependent on the success of the team developing the new product. Our results show there were differences in correlations between leader personality and NPD success, depending on the type of NPD team. For example, the openness of the leader was associated with NPD success for radical NPD teams only. These findings support the argument that single responses do provide good data.
Finally, the use of self-report data is a common practice in management research, and has led to the so-called ‘common method variance’ problem. Reviews of other research and our own data would indicate that the method variance is not a significant issue in the present study. Theoretically, there are several explanations why method variance should not substantially affect our results. First, self-report data is most problematic for the topics that generate strong sentiments, such as attitudes (Cote and Buckley, 1987). New product success is a much less emotionally laden subject, and hence less likely to be distorted by self-reports. Second, social desirability bias often leads to response range compression (Podsakoff and Organ, 1986), which was not evident in our sample. Third, Lukas and Ferrell (2000) and Podsakoff and Organ (1986) found that managers rely on their own self-reports and provide reliable and objective data.

3.2. Measures

3.2.1 Personality

As a part of the questionnaire designed to measure practices supportive of team learning, development speed and new product success (Lynn, Reilly and Akgun, 2000), five single items were developed to assess leader personality (five-item measure of the Big Five). Building on past research (e.g. Tett, Jackson and Rothstein, 1991; Costa and McCrae, 1992; Lindner, 1998; McCrae and Costa, 1999), each item of this measure of personality was designed to measure a single Big-Five trait (Appendix). We obtained evidence to support the construct validity of this five-item measure of the Big Five as follows. In one study (Lindner, 1998), 193 students responded to the five-item measure of the Big Five, Goldberg’s Adjective Checklist (1992) and the NEO-FFI (Costa and McCrae, 1992), all of which measure the Big Five personality traits. (Note that there was no overlap in items between the three personality measures). Correlations among similar constructs between the five-item measure of the Big Five and Goldberg’s Adjective Checklist were 0.67, 0.61, 0.63, 0.55, 0.66 for extraversion, agreeableness, conscientiousness, neuroticism and openness to experience, respectively, providing the evidence for convergent validity. The correlations among similar constructs between the five-item measure of the Big Five personality traits and the NEO-FFI were 0.56, 0.56, 0.64, 0.55, 0.50, respectively. In both analyses, correlations across dissimilar constructs were much lower, providing the evidence for discriminant validity. For comparison purposes, the convergent validities between the NEO-FFI and Goldberg’s Adjective Checklist were very similar to the convergent validities reported earlier, 0.59, 0.61, 0.72, 0.64, 0.42, respectively for each of the five personality traits. These results are quite similar to those reported by other researchers. For example, Goldberg (1992) reported the correlations between similar personality dimensions from a set of 100 Big Five markers and the NEO-PI (a Big Five personality measure (Costa and McCrae, 1985)) that ranged from 0.46 to 0.69 as evidence for the construct validity of those markers. Barrick and Mount (1993) reported the correlations among similar personality dimensions from the Personal Characteristic Inventory (PCI, a Big Five personality measure) and the NEO-PI that ranged from 0.56 to 0.71 as evidence for the construct validity of the PCI. In summary, the rather high correlations of similar constructs of the Five-item measure of the Big Five with those on the NEO-FFI and Goldberg’s Adjective Checklist, and the low correlations between dissimilar constructs, which are similar to those reported by other researchers, provides evidence about the construct validity of the personality measure used in the current study.
Empirical evidence supporting the construct validity of this five-item measure of the Big Five was confirmed in the current study as well. Table 2 provides important evidence for discriminant validity between the five personality variables, with generally moderate correlations between leader personality variables. These correlations are comparable to the correlations reported elsewhere for the FFM of personality (e.g. Boudreau, et al., 2001; Barrick, Stewart and Piotrowski, 2002). Further, leader personality was differentially related to this study’s criterion (NPD success), providing additional evidence that this measure is a useful measure of the Big Five traits.

The NPD development professionals in the current study rated the NPD team leader’s personality, using the five-item measure of the Big Five, on a scale from 1 to 5 (Appendix). Justification for using observer ratings of personality can be found in the past research (Mount, Barrick and Strauss, 1994; Aronson, 1998). Observers’ assessments of leader personality are at least as valid as self-assessments, because they are based on the observations of this individual, almost exclusively in the work environment. On the other hand, individuals (NPD team leaders) see themselves in numerous situations, such as at home, at play and at work. Consequently, self-ratings of personality have less point-to-point correspondence between the predictor and the criterion.

3.2.2 Radical vs. incremental innovation

We were interested in teams developing radical innovations and teams developing incremental innovations. Based on the work of Lynn and Akgun (1998) described earlier, leader personality variables were analysed under high uncertainty (radial innovation) and low uncertainty (incremental innovation). A measure of radical vs. Incremental innovation was derived based on the information provided by the respondents to two items representing market and technology uncertainty. Both items were rated on a scale ranging from 0 (strongly disagree) to 10 (strongly agree) and were as follows: ‘The technology required to develop this product (R&D) was totally new to our company’, and ‘This product had to be sold to people or organisations outside our company’s traditional customer base’. The rationale for this measure is that teams working on incremental innovation operate under more certain environments, when a currently served market with mature technologies is targeted. On the other hand, teams working on radical innovation operate under more uncertain environments, when both market and technology uncertainties are high. We were interested in the role of leader personality in the success of two types of teams: NPD teams that develop radical innovations and operate under conditions of high uncertainty and NPD teams that develop incremental innovations and operate under conditions of low uncertainty. Accordingly, we first took the average of the two items and then dichotomised at the scale midpoint. Consequently, the 116 NPD teams yielded 58 incremental and 58 radical NPD teams.

3.2.3 NPD success

The criterion, NPD success, was measured with multiple items rated on a scale ranging from 0 (strongly disagree) to 10 (strongly agree) (Lynn, Reilly and Akgun 2000). Cronbach’s alpha for the success measure was 0.96. The following items were included in the success measure: this product
1 overall, met or exceeded sales expectations
2 met or exceeded profit expectations
3 met or exceeded return on investment expectations
4 met or exceeded overall senior management’s expectations
5 met or exceeded market share expectations
6 met or exceeded customer expectations.

3.2.4 Analyses
Analyses included the means and standard deviations for all the FFM leader personality variables for incremental and radical NPD teams. Correlations between all leader personality variables and between the dependent variables (NPD success) were computed for the entire sample. Correlations between each of the FFM leader personality variables and the dependent variable were also calculated separately for radical and incremental NPD teams. A series of hierarchical regression analyses were also performed, to test whether the correlations between leader personality variables and NPD success were significantly different for radical vs. incremental innovation. The slopes and intercepts of the regression lines for each of the five factors were tested for differences, using a technique described by Cohen and Cohen (1993). Finally, a Multiple Regression analysis was conducted using NPD success as the dependent variable, to test which of the FFM leader personality variables was most important for NPD success.

4 Results
The means and standard deviations for all leader personality variables for incremental and radical NPD teams, and for the entire sample, are presented in Table 1. No significant differences existed between the two types of NPD teams, with respect to all leader personality variables. The intercorrelations between all five leader personality variables for all NPD teams and NPD success are reported in Table 2. The magnitude of the correlations for leader conscientiousness, openness and emotional stability were 0.32, 0.29 and 0.22 ($p < 0.01$), respectively, and for extraversion the correlation was 0.15 ($p < 0.05$). As expected, the correlation for leader agreeableness with NPD success was not significant.

Table 1 Means and standard deviations for leader personality variables for incremental and radical NPD teams*

<table>
<thead>
<tr>
<th>Variable</th>
<th>All products</th>
<th>Incremental</th>
<th>Radical</th>
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<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>4.44</td>
<td>0.81</td>
<td>4.55</td>
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<tr>
<td>Emotional stability</td>
<td>4.21</td>
<td>0.82</td>
<td>4.22</td>
</tr>
<tr>
<td>Openness</td>
<td>4.30</td>
<td>0.73</td>
<td>4.17</td>
</tr>
<tr>
<td>Extraversion</td>
<td>4.07</td>
<td>0.84</td>
<td>3.96</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>4.05</td>
<td>0.77</td>
<td>4.07</td>
</tr>
</tbody>
</table>

*n = 116 overall; n = 58 incremental NPD; n = 58 radical NPD.
Table 2  Correlations between leader personality variables for all NPD teams and NPD success

<table>
<thead>
<tr>
<th>Variable</th>
<th>E</th>
<th>A</th>
<th>C</th>
<th>S</th>
<th>O</th>
<th>NPD success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraversion (E)</td>
<td>0.08</td>
<td>0.12</td>
<td>0.13</td>
<td>0.24*</td>
<td>0.15*</td>
<td></td>
</tr>
<tr>
<td>Agreeableness (A)</td>
<td>0.22*</td>
<td>0.62**</td>
<td>0.50**</td>
<td>0.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conscientiousness (C)</td>
<td>0.23*</td>
<td>0.50**</td>
<td>0.32**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional stability (S)</td>
<td></td>
<td>0.47**</td>
<td>0.22**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Openness (O)</td>
<td></td>
<td></td>
<td>0.29**</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (two-tailed).
**Correlation is significant at the 0.01 level (two-tailed).

The correlations between leader personality variables and NPD success for incremental and radical innovation teams are provided in Table 3. All leader personality variables had higher correlations with NPD success when the innovation was radical, as opposed to incremental innovation. As hypothesised, the correlations with radical NPD success were significant for both leader openness ($r = 0.45$, $p < 0.01$) and emotional stability ($r = 0.27$, $p < 0.05$). For teams developing radical and incremental innovations, the correlations for leader conscientiousness were significant ($r = 0.45$, $p < 0.01$ and $r = 0.21$, $p < 0.1$, respectively) as proposed. Leader agreeableness was unrelated to NPD success under both innovation conditions as we expected. Overall, our results support hypotheses 1 through 4 regarding leader openness, emotional stability, conscientiousness and agreeableness. The results for leader extraversion, presented in Table 3, are in line with our hypothesis; however, the correlation obtained with radical NPD success was not significant ($r = 0.2$, $p > 0.05$). As noted previously, the correlation for leader extraversion with NPD success when all NPD teams were analysed simultaneously was significant (Table 2; $r = 0.15$, $p < 0.05$). Although some results linking extraversion to leadership have been inconsistent (Bass, 1990), we believe that the non-significant result for leader extraversion with radical NPD success can be attributed to a reduction in sample size from $n = 116$, when all NPD teams were analysed together, to $n = 58$ when the analyses were conducted separately for radical and incremental NPD teams.

Table 3  Correlations between leader personality variables and NPD success for incremental, and radical NPD teams

<table>
<thead>
<tr>
<th>Variable</th>
<th>Incremental ($n = 58$)</th>
<th>Radical ($n = 58$)</th>
<th>All projects ($n = 116$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conscientiousness</td>
<td>0.21†</td>
<td>0.45**</td>
<td>0.32**</td>
</tr>
<tr>
<td>Emotional stability</td>
<td>0.18</td>
<td>0.27*</td>
<td>0.22**</td>
</tr>
<tr>
<td>Openness</td>
<td>0.14</td>
<td>0.45**</td>
<td>0.29**</td>
</tr>
<tr>
<td>Extraversion</td>
<td>0.10</td>
<td>0.20</td>
<td>0.15*</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>0.01</td>
<td>0.19</td>
<td>0.10</td>
</tr>
</tbody>
</table>

†Correlation is significant at the 0.10 level (one-tailed).
*Correlation is significant at the 0.05 level (one-tailed).
**Correlation is significant at the 0.01 level (one-tailed).
Hierarchical regression analyses were performed to test whether the regression lines for leader personality and NPD success were significantly different for radical vs. incremental innovation. A dummy variable was created to represent radical vs. incremental innovation, and cross-product terms were computed by multiplying this dummy variable by each of the five-factor personality scores for each NPD type. The slopes and intercepts of the regression lines were compared for each of the leader personality variables. The slope tests for leader openness showed a significant difference for radical vs. incremental NPD, thus strongly supporting hypothesis 1. As hypothesised, the slope of the regression line was significantly higher for leader openness when the innovation was radical ($F = 3.358; df=1.112; p < 0.05$; one-tailed, Figure 1).

Figure 1  Regression lines for NPD success on leader openness under radical and incremental innovation conditions

Finally, a multiple regression analysis was conducted using NPD success as the dependent variable to test which of the leader personality variables was most important for NPD success. Table 4 shows the beta weights and multiple correlations between all FFM variables and the dependent variable NPD success. Conscientiousness and emotional stability had the highest beta weights. For NPD success, the beta weight for leader conscientiousness was significant ($\beta = 0.23, p < 0.05$). The beta weight for leader emotional stability was marginally significant ($\beta = 0.18, p < 0.10$). Overall, for NPD success, leader personality variables had a multiple correlation of $R = 0.4$, indicating support for measuring leader personality variables using the FFM model.
Table 4  Regression results – beta weights and multiple correlation for all leader personality variable and NPD success for all NPD teams

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>SE</th>
<th>Beta</th>
<th>r</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conscientiousness</td>
<td>0.70</td>
<td>0.31</td>
<td>0.23*</td>
<td>0.32**</td>
<td>2.25</td>
</tr>
<tr>
<td>Emotional stability</td>
<td>0.54</td>
<td>0.35</td>
<td>0.18†</td>
<td>0.22**</td>
<td>1.53</td>
</tr>
<tr>
<td>Openness</td>
<td>0.48</td>
<td>0.41</td>
<td>0.14</td>
<td>0.29**</td>
<td>1.18</td>
</tr>
<tr>
<td>Extraversion</td>
<td>0.24</td>
<td>0.27</td>
<td>0.08</td>
<td>0.15*</td>
<td>0.87</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>−0.43</td>
<td>0.38</td>
<td>−0.13</td>
<td>0.10</td>
<td>−1.12</td>
</tr>
<tr>
<td>R</td>
<td>0.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F-test of $R^2$ 3.663**

†$p < 0.10$

*$p < 0.05$

**$p < 0.01$

5 Discussion

The handling of the uncertainty that the innovation teams face places unique demands on the leaders of such teams. Few studies have attempted to directly examine the role of leader personality in NPD success for the teams developing radical and incremental innovations. The present study’s results suggest that, for NPD team leaders, emotional stability and conscientiousness have an important influence on NPD success. Emotional stability and conscientiousness have strong correlations with NPD success, and have the highest beta weights, when all personality variables are entered into a multiple regression equation. However, our research shows that when considering the type of innovation the teams are working on, the relationship between leader personality variables and NPD success varies. Our hypothesis that the radical NPD would benefit from a more open leader was strongly supported by the data. The slope tests for leader openness showed a significant difference for the teams developing radical innovations vs. the teams developing incremental innovations. Radical NPD teams operate under conditions of greater market and technical uncertainty. More open leaders may be more easily able to encourage and handle new ideas that are necessary for managing radical innovations. Radical NPD frequently involves a great deal of learning and improvising. The need to learn more about the markets and the technical issues, which are necessary to successfully bring the product to market, makes the openness of the leader a crucial personality characteristic for NPD success. Moreover, creating a vision involves the cognitive ability to mesh together the firm competencies and strategies, with the needs of the market to create an effective product concept (Brown and Eisenhardt, 1995). For teams developing radical innovations, identifying customer needs and translating them into product technical specifications may be more complex. Consequently, leaders of NPD teams developing radical innovations who are high on openness should be more effective in the task of meshing together the firm’s competencies (e.g. technical or marketing) and strategies with the needs of the market (consumer preferences for style and cost) to create an effective product concept that will be presented to the customer.
Additionally, our findings regarding leader emotional stability and conscientiousness show that the magnitude of the correlations were higher for radical NPD success. Although the slope tests did not show a significant difference for radical vs. incremental NPD teams, having a radical NPD team led by a leader who is emotionally stable seems to be functional because of the uncertainty, rapid change and surprises involved with radical innovation. Having an emotionally stable leader can help buffer the radical NPD team members from the stress associated with this uncertainty, thus enabling the team to continue working together over long periods of time, which is necessary when the innovation is radical. Similarly, results show that although the conscientiousness of the leader is important for NPD success, for teams developing both types of innovations, it seems to play an even more important role in NPD success for teams developing radical innovations. This makes good sense in that while planning is considered essential for both radical and incremental NPD team leaders, radical NPD team leaders must plan for a more uncertain environment.

A number of studies have examined the effect of leader traits on general leader effectiveness. Scholars have argued that leadership effectiveness should be assessed in terms of team effectiveness (Hogan, Curphy and Hogan, 1994); however, most studies evaluate leadership effectiveness in terms of ratings provided by superiors, peers or subordinates (Judge et al., 2002). Our study contributes to sparse research on the effect of leader personality traits and effectiveness assessed in terms of NPD success. Furthermore, our findings relating leader openness to radical NPD success make an especially important contribution. Openness to experience is the most controversial and least understood of the Big Five traits (Judge et al., 2002). One of the problems is that, with a few exceptions, such as creativity and sociopolitical attitudes (McCrae, 1996) along with meta-analytic results appearing to relate openness to leadership in business settings (Judge et al., 2002), openness has not been related to many applied criteria. The current study’s results show that leader openness is significantly related to NPD success when the innovation is radical.

5.1 Limitations and future research

As is always the case, there are reasons to exercise caution in generalising from any one study. There are a number of limitations that should be noted. The first potential limitation of the present study is the single-source methodology employed. Aviolo, Yammarino and Bass (1991) note that studies employing single-source methodology may be biased by artificially high intercorrelations because of an overall positive, or negative, response bias. Aviolo Yammarino and Bass emphasise, however, that simply assuming that single-source data are less valid than multi-source data is overly simplistic, advancing our argument presented in the method section. In addition, much of the research on the effect of single-source bias has been done with instruments that involve social perception (e.g. ratings of the performance of peers or supervisors). Although it is not our intent to minimise the potential effects of response bias, the kinds of information sought in the present survey with respect to NPD success tended to be more objective in nature than many surveys used in research in the social sciences. Implicit theories, cognitive schema and other cognitive frameworks applied by respondents to social-perceptual stimuli, may not apply to the same extent with our survey. Thus, responding to questions regarding NPD success should be based on objective data. In addition, our data support the relative lack of response bias. Our results show discriminant validity between
constructs with generally moderate correlations between personality variables, and the leader personality variables are differentially related to NPD success.

Future research could obtain archival data for some variables such as NPD success as objective measures. Further, data for a single NPD team could be gathered from multiple sources. Personality measures could be provided by the NPD team leader, and success ratings could be provided by the customer or senior managers. Another variation of this approach is to obtain complete data from multiple sources so that the inter-rater reliability and response bias issues can directly be examined.

The magnitude of some of the validities that we found may have been weakened due to the methodology used to gather data on the personality of the leaders. However, empirical evidence supporting the construct validity of this five-item measure of personality traits has been provided (Lindner, 1998), replicated in the current study (Table 2), and the discriminant validity results are comparable with the results reported elsewhere for the five-factor model (Boudreau et al., 2001; Barrick, Stewart and Piatrowski, 2002). The validities obtained between leader personality and NPD project performance are also similar to the validities reported in the literature (Judge et al., 2002). Moreover, our study points to the potential usefulness of this five-item personality measure for researching questions on personality performance relations. Most inventories assessing personality are lengthy. The five-item personality measure allowed us to gather data and conduct comparisons between specific leader traits and NPD success for teams developing radical and incremental products. Gathering this data from busy NPD professionals would be difficult, using lengthy personality inventories. By combining the five-item personality measure with data on the criteria, we were able to substantiate the leader personality NPD success link.

A final methodological limitation is limited statistical power, especially in the comparisons between slopes. Statistical power for each test was limited by two factors: within-group sample sizes and the operational definition for teams working on radical and incremental innovation used in the present study. Future research conducted with larger samples would allow the formation of more extreme groups leading to stronger findings for the comparisons of slopes.

Future research might also examine variables (e.g. cohesion, teamwork) that mediate the relationship between NPD leader personality and NPD success. For example, Tjosvold (1984) found that leaders high in personal warmth, a facet of agreeableness, tend to encourage team cohesion. NPD team cohesion should in turn influence NPD success. Based on the work by Janis (1989), NPD team cohesion should have a negative influence on radical NPD success, in that it may discourage open expression of new ideas that are in contrast with existing ones. Conversely, from this vantage point, NPD team cohesion may not have the same influence on incremental NPD success where the work is more routine and certain.

5.2 Practical implications

The decision to develop radical innovations carries significant implications for companies. One major implication is for firms to measure the personality of their NPD professionals. Once this is done, organisations can use the personality assessments to make selection decisions for project managers. For example, it makes sense that companies establish threshold levels of emotional stability for employees who are being considered to lead NPD teams. Additionally, minimum levels of conscientiousness might
be established as selection criteria for these individuals, detailed earlier. However, our findings show that depending on the type of innovation certain personality variables are more important for NPD success. The current results demonstrate that selecting NPD team leaders who are high on openness is crucial when the innovation is radical, and can differentiate success from failure. It is noteworthy that our sample for radical and incremental NPD showed no difference in means for any of the leader personality variables, suggesting that there might be considerable room for improvement by using personality in addition to functional expertise in assigning leaders to different types of NPD teams.

A second type of application is developmental in nature. An understanding of the personality characteristics of employees assigned to lead NPD teams should allow superior developmental planning and coaching of these individuals. For example, a highly open person selected to lead a radical NPD team, operating under conditions of uncertainty, may be coached to use this strength to craft the optimal context in which the team members can work, and to seek a variety of creative techniques for motivating the team members to accomplish NPD team objectives. Additionally, since radical NPD frequently involves a great deal of learning and improvising, the selected leader who is high on Openness can be trained to use this asset to learn more about the markets and the technical issues necessary to successfully bring the product to market. This highly open individual can also be coached to use this strength to encourage and handle new ideas that are necessary for managing radical innovations.

Conclusion

This study contributes to our knowledge of NPD team leadership, in that it demonstrates the relationships between the Big Five personality traits and NPD success for teams developing radical and incremental innovations. We encourage others to replicate our research using alternative measures. The current study provides evidence that, for NPD team leaders, emotional stability and conscientiousness are important personality variables in their influence on NPD success. Our data also suggests that, depending upon the type of innovation, certain leader personality variables may be more important than others for NPD success. Our hypothesis that radical NPD would benefit from a more open leader was strongly supported by the data.

References

The role of leader personality in new product development success


The role of leader personality in new product development success


Appendix

Five-item measure of the Big Five personality traits

1 Extraversion–Introversion: the extent to which the NPD team leader was sociable, talkative, assertive, active (extroverted) vs. retiring, sober, reserved, cautious (introverted)

Please place an ‘X’ in the cell that best describes your NPD team leader.

<table>
<thead>
<tr>
<th>Highly extroverted</th>
<th>Somewhat extroverted</th>
<th>Neither extroverted nor introverted</th>
<th>Somewhat introverted</th>
<th>Highly introverted</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
</tr>
</tbody>
</table>

2 Agreeableness: the extent to which the NPD team leader was good-natured, gentle, cooperative, forgiving, hopeful (agreeable) vs. irritable, ruthless, suspicious, uncooperative, inflexible (disagreeable).

Please place an ‘X’ in the cell that best describes your NPD team leader.

<table>
<thead>
<tr>
<th>Highly agreeable</th>
<th>Somewhat agreeable</th>
<th>Neither agreeable nor disagreeable</th>
<th>Somewhat disagreeable</th>
<th>Highly disagreeable</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
</tr>
</tbody>
</table>

3 Conscientiousness: the extent to which the NPD team leader was careful, thorough, responsible, organized, self-disciplined, scrupulous (conscientious) vs. irresponsible, disorganised, undisciplined, unscrupulous (unconscientious).

Please place an ‘X’ in the cell that best describes your NPD team leader.

<table>
<thead>
<tr>
<th>Highly conscientious</th>
<th>Somewhat conscientious</th>
<th>Neither conscientious nor unconscientious</th>
<th>Somewhat unconscientious</th>
<th>Highly unconscientious</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
</tr>
</tbody>
</table>
Emotional stability: the extent to which the NPD team leader was calm, enthusiastic, poised, secure (emotionally stable) vs. depressed, angry, emotional, insecure (emotionally unstable).

Please place an ‘X’ in the cell that best describes your NPD team leader.

<table>
<thead>
<tr>
<th>Highly emotionally stable</th>
<th>Somewhat emotionally stable</th>
<th>Neither emotionally stable nor emotionally unstable</th>
<th>Somewhat emotionally unstable</th>
<th>Highly emotionally unstable</th>
</tr>
</thead>
<tbody>
<tr>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
</tbody>
</table>

Openness to experience: the extent to which the NPD team leader was imaginative, sensitive, intellectual, polished (open to Experience) vs. down to earth, insensitive, narrow, crude, simple (unopen to Experience).

Please place an ‘X’ in the cell that best describes your NPD team leader.

<table>
<thead>
<tr>
<th>Highly open to experience</th>
<th>Somewhat open to experience</th>
<th>Neither open to experience nor unopen to experience</th>
<th>Somewhat unopen to experience</th>
<th>Highly unopen to experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>___</td>
<td>___</td>
<td>___</td>
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<tr>
<td>___</td>
<td>___</td>
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</table>