

# Building the Linkage between Project Managers' Personality and Success of Software Projects

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## Abstract

*As the core member in a software development team, the project manager's leadership level influences the development process in a great part. The existing literatures have shown the importance of individual's personality to his or her behaviors, which include the leadership behaviors. Exploring how the project managers' personality influences the success of the software development projects has significant potential utility. In this paper, we present a research integrating the Five Factor Model (FFM) for the personality with the existing work on the leaderships with the project success. Through the empirical study based on data from 116 software projects in real environment, we found general support for our hypothesized research model. The results not only reveal that the five big personality factors can be treated as indicators for the success of the software development projects, but also provide the evidence on how the project managers' personality influences the success of the software development projects through medium of the leadership constructs. The support for the relationship between leadership and the success of software development projects is also found.*

## 1. Introduction

The relationships between the project managers' individual characteristics and the success of the projects do not receive enough attentions in the software engineering literatures, especially for project managers' personality. However, it is no deny that project manager plays an essential role in any software development project. Project manager is the core member of the team and served as a hub for other stakeholders. His or her leadership level is crucial for the success of a specific project. Given that the personality partly influences the people's behavior [3], the leadership behaviors, as a major dimension of human behaviors, are greatly influenced by the individual's personality.

Therefore, it is necessary to use empirical study to explore whether there are some links between the

project managers' personality and the success of software development project. If there are, another challenge is to build a framework to illustrate how the project managers' personality influences the success of software development projects. This kind of studies will enhance our understandings towards the project managers' individual characteristics' impacts on the development process. It also can bring practical implications on the selecting and training the project managers, and hence facilitate the increase on the production of software development.

To fulfill this research gap, we conducted an empirical study to build the linkage between project managers' personality and the success of the software development project. We not only want to explore whether the project managers' personality influences the software projects' success but also want to find how it works. Therefore, the research question can be specified as follows:

**Research Question:** *Does the project managers' personality impact the success of the software development projects significantly? If yes, how it does?*

In this study, we proposed a model that integrating Five Factor personality model (FFM) [6] and Mohan Thite's model [9] to address above research question. Through analysis to the 116 software projects, general support for research model and corresponding research hypotheses was found.

The remainder of this article is organized as follows. Section 2 provides the theoretical backgrounds and related work. Section 3 presents the research model and the corresponding hypotheses. Section 4 describes the empirical research design. Section 5 provides the research results. Section 6 concludes this article.

## 2. Theoretical Backgrounds

### 2.1 FFM and Thite's Model

Individuals' attitudes, beliefs, cognitions and behaviors are determined by their personality in a great part. People's personality is reflected by their thoughts, behaviors, and life styles. Because of the unique role that personality plays in the human behaviors, it is

reasonable to expect the personality will also play a part in professional software development process. However, the number of personality attributes is overwhelming and lacks clearly major personality classification in existing models, which threatens the application of personality theory in the other quantitative research until the appearance of the Five Factor Model (FFM). FFM collapses all personality traits into five broad factors, which are: *{Openness, Neuroticism, Agreeableness, Conscientious, and Extraversion}*. Related theory has pointed out these factor has significant influence on people's job behaviors [10].

Mohan Thite [9] applied the Bass and Avolio's model [4] on transformational and transactional leadership to examine relationships between the project managers' leadership level with the success of IT projects through empirical study towards 70 IT project managers. *T-test* is used to identify the different project results due to the different project managers' leadership level, In short, it proved that the high leadership level can improve the performance of the IT projects.

### 2.3 Related Work

As far as our current knowledge, there is no established work on this issue in the software development area. However, there is one study [1] trying to build linkage between the *{software engineers' personality, team process, task characteristics}* and *{satisfaction, quality source code}*. The major problem of their work is it just ad hoc assumed there maybe some relationships and then verified it. Acuña *et al* [2] also discussed the personality issues in exploring the influence of human capabilities to the software development.

In the general project management area, there is also in lack of similar study. Two studies examined the relationship between the project manager's personality attributes and the project success. The first one [7] tried to build relationship between *{project managers' personality, process type}* and *{project success}*. In their study, they did not consider all personality constructs. The only took the openness into consideration. Besides, 73.5% (36 in 49) subjected projects are traditional projects but not high-tech projects.

Another study [5] is more completed, their study show that the openness and conscientious are good predictors for the project success. However, the data collection of this study suffers several severe problems. In the first place, it uses subjective *self-reported* data from their students rather than objective data collected from industrial organizations. In the second place, it

does not focus on the IT project separately. So, we can not assume that their results can be directly applied to the software development domain. Another problem of this study is the sample size was too small.

### 3. Conceptual Research Model

Based on above two theories, we assumed the project managers' personality attributes will influence mainly through medium of "leadership". Therefore, we built the conceptual model depicted in figure 1.

This model contains 6 independent variables (five factors of FFM, and the leadership), 4 control variables (Experience, Training, Team capability, and Project Complexity), and 1 dependent variable (Success of the software project). According to the leadership theory [8], the leadership level can be improved through the accumulation of past experience and the professional training. Therefore, we used two control variables: *Experiences* and *Training*.

The dependent variable (DV) is "Success of Software Projects". The second half of this model can be treated as an application of Thite's Model. Given the software development process is complex and with high uncertainty, we chose another two control variables in our study. They are "Project Complexity" and "Team Capability", which has significant influence the final results of the software development projects. We did not put all potential possible factors (e.g. project duration, project type, etc.) into the research model. This decision mainly based on the scope of our research. Besides, some factors, such as the project size and team composition, are closely correlated with the selected two control variables (project complexity and team capability). We did not consider them separately. This study also mainly focused on project team level; therefore, the organizational factors are beyond the scope of this study.

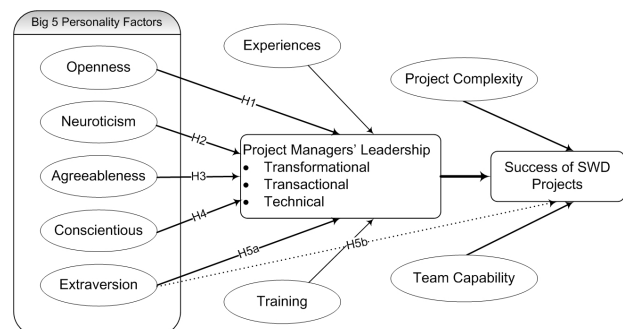


Figure 1. The Conceptual Research Model

We supposed the personality factors would directly influence the project managers' leadership level, and

hence indirectly influence the result of the software development project (H1-H5a). One big personality factor (Extraversion) is also supposed to have direct influences to the results (H5b). Therefore, the major hypotheses we want to test are as follows:

H1. *Openness will be positively associated with the technical leadership performance of a project manager.*

H2. *Neuroticism will be negatively associated with the leadership performance of a project manager.*

H3. *Agreeableness will be positively associated with the leadership performance of a project manager.*

H4. *Conscientiousness will be positively associated with the leadership performance of a project manager.*

H5a. *Extraversion will be positively associated with the leadership performance of a project manager.*

H5b. *Extraversion will be positively associated with the Success of the software development project directly.*

## 4. Research Design

### 4.1 Data Collection

We first selected 50 subjected software development teams whose sizes range from small to large. The subjected teams belong to ten software development organizations. All the projects were finished between 06/2006-06/2008. The number of surveyed projects (well-documented only) is 116.

For each project, following information was collected in three steps:

- Collect the personality data and two control variables for leadership from project manager.
- Ask the subordinate rate the leadership of the project managers.
- Extract the project related information from the project review documents.

There were teams finished more than one projects, therefore the project manager's personality and leadership were not repeatedly measured if the project manager did not change during this period.

### 4.2 Measurement Instruments

#### 4.2.1 Independent Variables

Big 5 Factors in FFM: The first five independent variables (FFM Big 5 Personality factors) were measured with the established Neo-Five-Factor Inventory (NEO-FFI) [6, 8]. This is a well validated and frequently used measure of big 5 personality factors. It has been adopted by a lot of researches in measuring personality.

Project Manager's Leadership: It was rated by the subordinates using the Multi-factors Leadership Questionnaire (MLQ Form 5x) [4]. However, we made some slight changes to it based on Thite's study. The

revised leadership evaluation contains six dimensions (Transformation: 3, Transaction: 2, Technical: 1), each dimension was scored separately. For each manager, at least three subordinates' ratings were collected.

#### 4.2.2 Dependent Variables

The Success of Software development Project was rated in 5 scoring mechanism 5 means the most success project, while 1 means failed project. We extracted this information from the projected final report which approved by high level managers.

#### 4.2.3 Control Variables.

The first two control variables *Experience* and *Training* are self-reported by the project managers. The experience is measured through the months of served as project manager role. And the training is measured by 0 and 1, where 1 mean the manager has obtained a professional (PMP1 or equivalent) certification.

We recoded the *Task difficulty* into 5 point scale, where 1 means the simplest and 5 means most difficult. For the convenience consideration, *Team capability* was reported by the project managers.

## 5. Results

### 5.1 SEM Analysis Results

The hypotheses presented in section 3 were tested through a structural equation modeling (SEM) analysis. SEM analysis is suitable for confirmatory study rather than exploratory study. We used LISREL 8.7 (for Windows) in the path analysis.

To ensure the reliability of the constructs, we conducted several test to examine the scale used in this research. Cronbach's alpha revealed they have acceptable reliabilities (Cronbach's alpha > 0.7). As the first step of the SEM, the factor loading from CFA were all significant, suggesting the unidimensionality of constructs is well supported. The Bentler-Bonnet test showed the convergent validity was acceptable.

Table 1. SEM Path Analysis Results

<i>Hypothesis</i>	<i>Std. Para. estimate</i>	<i>Significant?</i>
H1. Openness	0.18	Sig. (*)
H2. Neuroticism	-0.19	Sig. (*)
H3. Agreeableness	0.26	Sig. (*)
H4. Conscientiousness	0.17	Sig. (*)
H5. Extraversion	0.15	Sig. (*)
(a & b)	0.20	Sig. (*)

#### 5.1.1 Hypotheses Test Results

Table 1 shows the results of the Path Analysis, we can find all path related to the research hypotheses are significant (at 0.05 level). The path coefficients can be

<sup>1</sup> Major professional project management certification.

treated as standardized regression coefficients with their significance indicated next to them. Firstly, we observed the support to H1~H5a, indicating the relationship between FFM big five factors (Openness, Neuroticism, Agreeableness, Conscientious, Extraversion) and leadership level. All are positive except the relationship between Neuroticism and leadership level. The H5b also supported, which means the Extraversion has direct influence to the dependent variable besides the indirect influence through the leadership medium.

### 5.1.2 The Significance of Adding FFM Constructs

We also examine the explanatory power of the FFM constructs over the leadership and success of the software development projects. For our model is recursive model, we can use Squared Multiple Correlation (SMC) to determine the influence of the adding FFM Constructs. The SMC for the leadership increased from 26% to 38%. From the statistical perspective, this provides evidence of the practical significance of adding the FFM constructs.

### 5.2 Model Fit Indicators

1.  $\chi^2/df$  (Chi Square/Freedom Degree) is 1.62, far less than 5 (Good Fit), and also less than 2 (Perfect Fit);
2. GFI (Goodness Fit Index) is 0.94 (>0.90);
3. AGFI (Adjusted Goodness Fit Index) is 0.91;
4. RMSEA is 0.035 (<0.05).

All these four measures represent the theoretical model matching the actual data model well; we can safely deduce that the overall model is in good fit.

## 6. Conclusions

In conclusion, this study explores the possibility that the theories focus on individual characteristics (in this study, personality) in psychology field have a role in empirical software engineering researches. Through combining two existed model, we present a conceptual framework to describe how project managers' personality factors influence the success of software development projects. We also used 116 project data in real software development environment to verify it. Compared with other studies, this study more focuses on the software development projects, provides the model on how the personality works, and also uses real project data for verification. Besides, this study also reflects the human factors do play important roles in software development process.

Personality has been largely ignored in the empirical software engineering researches over the past several decades. We believe our study that builds the linkage between project managers' personality and success of software development projects points out a new potential research direction in this area. For the future

study, we plan to link the FFM construct with more software development variables (for example, SPI or cost estimation), and hence increase the understanding of the human dimension of the software development process. Other opportunities for future research include identifying other moderating relationships and so on.

## 7. References

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