How to Increase the Quality of Requirements Analysis in Information System Development—The View from Emotional Intelligence[*]

Chun-jie Xiang

Management School Wuhan University of Science and Technology, Wuhan 430081, China

Abstract - Accurate requirements are essential to the success of any information system development project. Over the years, numerous studies have investigated factors such as attitude, behavior, and performance that affect the information systems development (ISD) process. Our research focused on how developers' behavior affected end users and the requirements analysis from the emotional intelligence perspective. Specifically, we examined emotional intelligence factors (the quality of communication, control of conflicts between developers and users, and the developers' attitude towards the users) and enterprise characteristics (characteristics of developers, the stability of the staff in the development enterprise, and the characteristics of the project). Using data collected from ISD firms in China, we show that emotional intelligence and enterprise characteristics can both have positive effects on requirements analysis.

Index Terms - requirements analysis; emotional intelligence; enterprise characteristics; information system development

1. Introduction

A large number of system projects have failed or have suffered from poor quality of requirements analysis[1]. An investigation shows that, 31% of the projects they surveyed were cancelled before they were finished by the problem in requirement analysis phase[2]. Standish Group survey represents the top three problems, and all three indicate the importance of performing a complete and accurate requirements analysis process which are lack of user input, incomplete requirements and specifications and Changing requirements and specifications, respectively[3].

In the requirements analysis process, developers are in close contact with each other and their users, so behavioral factors often affect requirements analysis when the users become critical to the requirements analysis. Unfortunately, there is little research to identify how behavioral factors influence accurate and realizable requirements through interactions between developers and end users. The goal of our research is to better understand the behavioral influence of ISD task in the phase of requirement analysis. In the research of human behavioral interactions, the idea of emotional intelligence(EI) has ability to explain how people play in social networks and communicate with others[4], which is also worthwhile in the study of requirement analysis quality. Therefore, the research question of this paper is trying to investigate behavioral aspect of requirement analysis phase in information system development by the emotional intelligence theory.

2. Theoretical Background and Hypotheses Development

A. General Research Model

Emotional intelligence is defined as the ability to be conscious of one's own emotions and those of others, and using this knowledge and understanding to improve job performance, relationships, and quality of life[5-6]. The importance and improvement of emotional intelligence to job performance, job satisfaction, and work effectiveness has been proven in many papers. Emotional intelligence can play a significant role in making a harmonious and friendly work environment[7-8]. People with high emotional intelligence can better understand their own feelings and those of their friends or colleagues; they better realize their strengths and weaknesses; they better cope with their relationships; and they increase their adaptability to change. Therefore, high emotional intelligence can increase leader effectiveness, work performance, outcomes, and the success of the entire enterprise.

By emphasizing the importance of emotional intelligence on the quality of requirement analysis, it is necessary to notice other factors which are not related to emotional intelligence. We include some of these factors in the classification of enterprise characteristic. Enterprise characteristic represents the specially features of organization such as enterprise hardware conditions or the economic environment, which are relatively stationary and not been changed by developers themselves. In our research, we use it as independent variable and hope to compare the influence of it on quality of requirement analysis with emotional intelligence. So we have devised the following hypotheses. Figure 1 represents the general research model.

H1: Emotional intelligence is positively related to satisfaction of requirements analysis.

H2: Enterprise characteristic is positively related to satisfaction of requirements analysis.
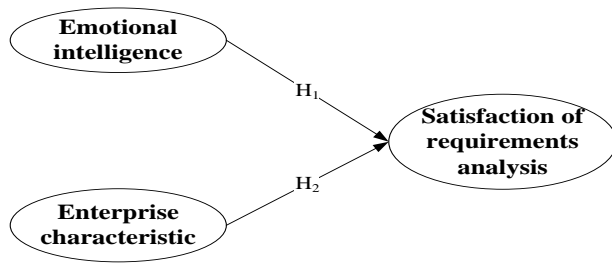

Fig. 1 The General Research Model

B. The Factors of Emotional Intelligence

Emotional intelligence has two components (personal competence and social competence) and each component has two clusters respectively (self-awareness and self-management, and social awareness and relationship management)[9-10]. Requirements analysis is a social work that needs communication, collaboration, and conversation, especially in today's IS project development because of the personalization requirement of the end users. This research tries to concentrate on the influence of EI on the improvement of relationship in requirement analysis so we chose the cluster of relationship management to represent the emotional intelligence of developers. Relationship management in EI involves effective communication, conflict control, and attitude management, which are the ability to help the developers work toward user's need. Therefore, we chose such three factors as the antecedents of EI from the aspect of relationship management.

Communication means carefully listening and accurately sending messages during a conversation[11]. These are basic necessary skills when dealing with clients because developers are often more technically knowledgeable than their clients and they should learn to help their clients express their needs more accurately, and more thoroughly. Conflict control is defined as the ability to negotiate and resolve disagreements[11]. When discussing client requirements, conflicts may arise due to differing perspectives held by developers and clients. Developers tend to think about the technology and the complexity of the coding process, but clients care more about the practical use, operation, and even the user interface. How a person responds to these different perspectives reflects on their emotional intelligence[12]. Fostering a positive attitude toward end users is instrumental in developing positive relationships with clients[11]. Nurturing relationships is beneficial for improving an understanding of clients' needs and often contributes to a more sociable atmosphere for discussion and information exchange[13]. Based on these findings, we have formed the following hypotheses:

H3: *Good communication skills are positively related to the degree of EI of ISD team members.*

H4: *Good conflict control is positively related to the degree of EI of ISD team members.*

H5: *A positive attitude toward users is positively related to the degree of EI of ISD team members.*

C. Enterprise Characteristics

Enterprise characteristics are the abstract classification from some familiar factors in the literatures, such as task size and team size of a special project, geographic dispersion of the enterprise building, gender diversity and background diversity of the team members. Therefore, this factor contain so many aspects and we measure it as a formative second order factor with three reflective first order factors, characteristics of the developer, characteristics of the project, and task identity.

Characteristics of developers refer to personalities and attributes of the task members who do the requirements analysis with the end users[14], and it is the basic content of enterprise characteristics. Developers who have such features just as amity, honesty, and eloquence could use their abilities to help users identify and clarify their ideas for the development of a software application. As noted in the extant literature, when the project's attributes change, the differences should be done from the aspects of members' choice, or extra cost input[15]. In essence, the better a team's member understands the characteristics of the projects, the easier it is to express which type of information and knowledge is useful, as is the selection of its source. Therefore, we use it as another first order factor of enterprise characteristics. With regards to the actual ISD process and the interviews with our research targets, the enterprise characteristics could also been shown by the stability of the staff, which was under limited attention in the former research. If the people in different organizational hierarchies are stable, the enterprise could exhibit much power of cohesion and competition. When the employee who charges for discussing the requirements of the end users often changes, some processes of the job could be repeated again and again. It is a waste of time and the favorable impression of the end users.

As a result of studies discussed above, we have established the following hypotheses and detailed research model (figure 2):
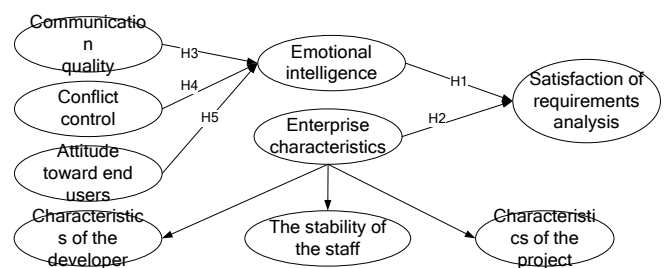

Figure 2. The Detailed Research Model

3. Research Methodology

A. Instrument Development

To test the hypotheses, multi-item scales adopted from prior studies were used for the measurement of constructs: 30 were measured, using a 7-point Likert scale ranging from "strongly disagree (1)" to "strongly agree (7)." Specifically, the items measuring the satisfaction of requirement analysis are adapted from Guinan, et al. [16]. We use the measurement

of Berman and West [17] to test the level of the IS developers' emotional intelligence, from the aspect of relationship management. The factor of conflict control is measured by the items adapted from Sawyer [18], while the communication quality is tested by adapting the items from Han, et al. [19]. And the factors of characteristic of the developer and characteristic of the project are both measured by the items adapted from Guinan, et al. [20]. At last, we developed three items to measure staff stability by ourselves according to the interviews with the developers and the discussion in some academic literature.

B. Samples

Data was collected from Chinese ISD firms. We sent out 300 questionnaires and received 275 responses. After deleting questionnaires with missing data or the same answer to all questions, we validated 251 valid responses.

Table 1 shows the demographic information of the dataset. About 81% of the subjects were male, and 19.9% were female—clearly demonstrating that Chinese IT industry employees are predominantly male.

TABLE I   Sample Demographics

Variables	Categories	Count	%
Gender	Male	201	80.1
	Female	50	19.9
Age	≤25 years old	58	23.2
	25~30 years old	141	56.3
	30~40 years old	48	19.2
	>40 years old	4	1.3
Major	Non-IT-related	20	7.9
	IT-related	88	35.1
	IT	143	57.0
Education	Associate's degree	33	13.2
	Bachelor's degree	181	72.2
	Master's or higher	37	14.6

4. Data Analysis and Results

A. Measure Validity and Reliability

The Bartlett's Test of Sphericity generated a Kaiser-Meyer-Olkin (KMO) statistic of 0.827, which was significant at 0.01 levels, indicating that it was suitable to use the principle component factor analysis on the data.

As shown in table 2, all of the Composite Reliabilities (CR) and Cronbach's Alphas were over 0.7, indicating the scales had good reliability. Most of the standard loadings were over 0.70 and all loadings were significant at the 0.001 level. In addition, the Average Variance Extracted (AVE) for each construct was over 0.5, demonstrating that the scales had good convergent validities.

Discriminant validity was tested by comparing the square root of AVE of each factor and its correlation coefficients with other factors. As shown in table 3, all square roots of AVE were larger than the correlation coefficients of the factors, thus showing good discriminant validity.
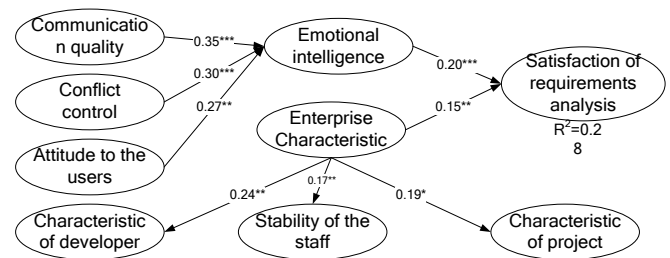
TABLE II   AVEs, CRs and Cronbach's alphas

Factor	AVE	CR	Cronbach's Alpha
Satisfaction of requirement analysis	0.68	0.89	0.889
Conflict control	0.71	0.88	0.878
Communication quality	0.70	0.90	0.854
The attitude to the user	0.58	0.85	0.815
Characteristics of developer	0.57	0.84	0.809
The stability of the staff	0.61	0.83	0.859

Table III   Square Roots of AVE and Correlation Coefficients

	SR	CQ	CC	AU	CD	SS	CP
SR	0.82						
CC	0.107	0.84					
CQ	0.355	0.301	0.84				
AU	0.087	0.074	0.245	0.76			
CD	0.211	0.179	0.595	0.263	0.75		
SS	0.191	0.162	0.537	0.353	0.618	0.78	
CP	0.116	0.098	0.327	0.031	0.374	0.266	0.79

B. Hypothesis Testing

In our research, we choose PLS (Partial Least Squares) because it is suitable to be used in such situation that some factors are second-order. And the factor of enterprise characteristic is just a second-order factor which has three formative first-order factors. We summarized the research model testing results with the PLS coefficients as shown in figure 3. All paths were significant, so we see that the EI and enterprise characteristic all have impact on requirements analysis. Communication quality, conflict control, and attitude toward the user are three antecedents of EI. The characteristic of developer, the stability of the staff, and characteristic of project consist of the factor of enterprise characteristic. The whole model explains 28% of the final requirements analysis satisfaction from the view of both EI and characteristics of enterprise.

Note: * p<0.05; ** p<0.01; *** p<0.001

Figure 3. PLS Results

5. Conclusion and Discussion

The significance of H1 indicates that it is appropriate to use EI to explain the satisfaction of requirement analysis in ISD tasks, and EI actually impact the requirement analysis results. Therefore, the effective ways to improve EI of ourselves could help us control our emotions and understand other's thoughts and intentions easily and deeply, which are critical when doing the requirement analysis job. Meanwhile,

the enterprise characteristic factor can also have a positive influence on the satisfaction of requirements analysis (H2). Enterprise characteristic is a second-order formative variable in this paper, which has three first-order factors named characteristic of developer, the stability of the staff, and characteristic of project. When we emphasize the importance and improvement of EI, we should not ignore some traditional factors, which are still the basis of enterprise development.

The significance of hypotheses 3-5 indicate that all these three factors are the antecedents of EI. Communication between users and developers should start at the pre-prototype phase and continue throughout the process up to and including the system launch. Developers should also learn to rely on others when they do their jobs. By approaching their tasks with professionalism and dedication, talking freely with users and other developers about project-related issues, and responding constructively and caringly, they can then develop emotional ties in their working relationships. Such ties can help developers effectively consider and resolve conflicts between themselves and their clients, or among themselves. If conflicts occur during the requirements analysis process, they should be regarded as opportunities to improve the understanding of issues and to improve the resulting product. Interestingly enough, when developers have a good attitude toward users, including developing trust and building a friendly relationship, the requirements also tend to be more reliable—a result of working within a positive and amiable environment.

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