Thesis for the Degree of Master Engineering

Stakeholder Management for the Success of Construction Projects in Vietnam

by

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Interdisciplinary Program of Construction Engineering and Management

The Graduate School

Pukyong National University

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A dissertation

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Abstract

Aim of the study is to explore the role of Stakeholder-based management for achieving the success of construction projects in Vietnam. Hence, a logical and systematical process of statistical analysis has been carried out based on data collection from the questionnaire survey. From initial 36 factors which were collected from previous studies, after pilot test, the finalized survey of 39 stakeholder management factors was conducted at construction sites in Vietnam. After a careful filtering process, 163 valid responses have been analyzed. From the result of factor analysis, 6 components are extracted including: (i) Work Environment, (ii) Management Activity, (iii) Stakeholder Information, (iv) Project Organization, (v) Stakeholder Characteristic, and (vi) Prediction. Although only Work Environment and Management Activity related factors impact directly on project success in accordance with the result of Structural Equation Modeling (SEM), the four remaining factors highly relate and influence on project success by indirect ways. The finding could assist to project management team and other authorities identify determinants of stakeholder management so that they can focus more on to achieve better project results. Additionally, this study introduces

a practical approach of Social Network Analysis (SNA) for enhancing stakeholder management at construction sites in which two cases of building project in Vietnam are chosen. Because of its importance, communication and workflow networks are employed and identified by requesting respondents to rate into the five-point scale questionnaire survey. Based on the measurement of four centrality metrics and then present them under sociograms with the aid of UCINET software, it can be seen that SNA is more useful and powerful in examining the relationship among individuals/ groups than traditional stakeholder analysis methods regardless of a project grows in both of size and complexity. Thereby, project managers and his/ her team can easily evaluate the degree of influence of each stakeholder and also reveal hidden relationships among them so that better managerial strategies would be built and the chances for achieving project success has been increased.

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From Nha Trang to Busan, it is not simply the geographical distance of over three thousand kilometers, it is a milestone in my life. Studying abroad was a nice dream when I was a kid, and now my dream has been come true.

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CHAPTER 1

INTRODUCTION

1.1 Background and objectives

For many years, the Vietnamese Construction industry (VCI) has performed poorly: Almost of construction projects were completed longer than original estimated duration and over budget with 75% and 66% of them respectively (Xuan, 2016; Luu et al., 2008). According to the Vietnam Federation of Civil Engineering Associations, 99% of investment projects were delayed (Duc, 2012) with more than 10% of the estimated schedule exceeding (Le-Hoai et al., 2008). Moreover, disputes between parties are common and become one of the most popular causes of project failure (Long et al., 2004). By conducting an extensive literature review from previous studies about problems of the VCI over the last 15 years, Le.N (2017) pointed out that in the list of 23 non-performance causes, most of them are related to and created by human or management errors. Belout and Gauvreau (2004) stated that human play the most important role for any organizations or projects, therefore, manage them effectively strongly impact on the result of construction projects. However, similar to other developing countries, the education and training system in Vietnam do not provide adequate qualified workforce to meet the increasing requirement of the industry (Le-Hoai et al., 2008). Nonetheless, the labor cost is so cheap that hire more labor is the top-priority solution in technical problem-solving (Er, 2017). Because most of employees come from the rural areas and are not well-educated, it is a main cause of the low culture standard at sites (Hung and Wang, 2016) and the lack of professional working attitudes (Ling and Bui, 2009). Although the lower labor

quality, the higher competent requirement for project manager and his/her team, they have not been trained adequately and managerial skills are not being fully utilized (Long et al., 2004).

On the other hand, each construction project is a temporary organization, therefore, relationships and interactions among individuals/ groups are continually changed to reflect the dynamic workplace – one of the unique characteristics of the construction industry (Dainty et al., 2003). Besides, they differ in thinking, background, and variety of purposes for a project which is a potential source of conflicts and adversarial relationships (Terje Karlsen et al., 2008). Furthermore, the differences of business culture, human characteristic in East Asian countries, Vietnam is no exception**,** human relationships are getting more complex (Chua et al., 2003; Khang and Moe, 2008). Dang and Le-hoai (2016) proved that the success of Design – Build projects in Vietnam could be achieved under the favorable working atmosphere where good relationships among stakeholders have been maintained. In fact, the dominance of the traditional procurement method which is the fragment between design and construction phase, combine with the risk and uncertainty, another typical characteristic of the construction industry, has caused the working environment increasingly complicated (Kim and Huynh, 2008). Although effective stakeholder management is a key to achieve project success, its limitation is the insufficient attention on relationships among stakeholders and the degree of their influence on each other (Cheung and Rowlinson, 2011). Combining with the limitation of traditional stakeholder analysis methods, the essence of a new model and in-depth analytical tool in evaluating stakeholder relationships has become increasingly important (Pryke et al., 2017). Due to its strength in comprehending and visualizing complex relations among individual/groups within a project, an approach of Social Network Analysis has become a big trend and promising tool for aiding stakeholder management at sites (Almahmoud and Doloi, 2015; Chinowsky et al., 2009).

Based on the above discussion, this study has four main aims:

1) Providing a theory of stakeholder management into the body of knowledge for the VCI.

2) Identifying factors of stakeholder management potentially affecting on project results.

3) Exploring inter-relationship between stakeholder management and project success.

4) Indicating that SNA is a powerful tool for aiding stakeholder management at sites.

1.2 Scope and methodology

1) The questionnaire survey was distributed in Vietnam, mostly in Nha Trang, a medium city but currently is one of the most dynamic places among construction markets in Vietnam.

2) The survey focuses on six internal stakeholder groups: the Owner (Owner, Owner's representative, Project management unit), the Consultant, the Designer, the General Contractor, the Sub-Contractor, and the Supplier.

3) The focal point of this study is the executing stage when the largest number of stakeholders involved that need effective managerial activities from project managers and his/her team (Kloppenborg, 2014)

The study uses the quantitative research methodology. To begin with, an extensive review from previous studies has been carried out. After collecting data from the survey, a process of statistical analysis have been continuously conducted in which the main research tools are used included:

- Exploratory Factor Analysis (EFA)
- Structural Equation Modeling (SEM)
- Social Network Analysis (SNA)

CHAPTER 2

LITERATURE REVIEW

2.1 Stakeholder management in the Construction Industry

2.1.1. Construction stakeholder

From previous studies, Littau et al (2010) categorized "construction stakeholder" into three main groups namely: (1) "interest-in", (2) "can affect and affected by", and (3) "mixed" group. While "stakeholder" was introduced "…who have a vested interest in the outcome of the project" (Cleland, 1995) in the first group, the second group defined "stakeholder" as "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman, 1984). Then, similar definitions have appeared for examples: "…stakeholders are individuals or organizations that are either affected by or affect the development of the project" (El-Gohary et al., 2006) or "project stakeholders can be broadly considered as any person or group that either impacts the project or is impacted by the project" (Assudani and Kloppenborg, 2010). The third category is a combination of two above definitions which were firstly appeared in 1996 and has defined "stakeholders" as individuals, groups, or organizations who may affect, be affected by, or perceive themselves to be affected by a decision, activity, or outcome of a project (PMI, 2013). Thereby, "stakeholder" is categorized by different ways. However, the most popular way for identifying "stakeholder" is based on their positions in a project, relationships between them, and legal relations with projects (Nguyen et al., 2009). Hence, McElroy and Mills (2000) concluded that there are two main types of stakeholder: *internal/ external* or *primary/ secondary* stakeholder.

From the scope of this research, “internal stakeholder” would be defined as individuals/ groups who are participating directly in project’s activities, possibly impact on or be impacted by the project outcomes. Accordingly, they can be divided into six main groups included: The Owner, the Consultant, the Designer, the Contractor, the Sub-contractor, and the Supplier.

1) Owner

This group comprises owners/ owner’s representatives/ members of project management unit. In Vietnam, they are usually the 3rd party (individual or company) who are employed by the Owner *or* Tenant to represent their interests and manage all aspects of a project because of their owner’s limited knowledge.

2) Consultant

Similar to the first group in representing the owner’s interest, however consultant’s responsibilities are more technical specifics and coordinate with other firms such as designers, contractors, to consult from the beginning of project (design, tender stage), monitor work on site, and make sure three important criteria time – cost – quality for the Owner.

3) Designer

Designer is an individual/ organization whose main roles are to prepare and produce drawings (architecture, structure, M&E, HVAC and so on); develop and modified designs for construction projects, instruct and control on people who construct on their drawings.

4) Main contractor

The people who directly operate their works on sites to make sure a project would be completed according to contract documents. So, their duties are varied from construct and complete the work to meet project objectives; assists in design; coordinates and supervises all sub-contract works and suppliers.

5) Sub-contractor

Conduct their works according to main contractor’s assignment.

6) Supplier

They are materials, equipment suppliers, and manufacturers who provide and install the hardware that constitutes for a project.

2.1.2 Project success

Project success is a controversial and difficult concept in measuring and cannot be defined clearly because it differs across people and change over time (Toor and Ogunlana, 2008). The classical criteria of project success are time, cost, and quality which are also called “iron triangle” (Atkinson, 1999). More clearly, the traditional measurement of project success was indicated by punctual time completion, under budget estimation, and acceptable level of performance (Ogunlana, 2010). However, it has been changed to achieve one more important project goal: The satisfaction of stakeholders (Jugdev and Müller, 2005; Yang et al., 2011), that echoes to the project management dimension success in the research of Baccarini (1999) because effectively managing relationships and achieving stakeholders’ satisfaction are the key for project success (Ogunlana, 2010). Therefore, currently, the satisfaction of project team members has also been noted as a key performance indicator (Chan et al., 2004) and satisfy stakeholder’s needs is a driver to achieve desired project outcomes (Rajablu et al., 2014).

In this thesis, project success can be known as the attainment of three preset project goals: time – cost - quality (Atkinson, 1999) and stakeholders’ satisfaction (Long et al., 2004; Jugdev and Müller, 2005).

2.1.3 Stakeholder management

Stakeholder management is not only the maintenance of favorable working relationship between project team and its stakeholders (Chinyio and Olomolaiye, 2009), but also it is the process of determining stakeholders and their expectations, analyzing their influences to support the effective managerial

actions of the project management team throughout the entire phase of a project. Because of its importance, “Project Stakeholder Management” has been added as the tenth knowledge area in the latest edition of the PMBOK to illustrate the necessary of “stakeholder management” for ensuring greater project success.

Freeman, who have commonly been confirmed as a pioneer of stakeholder management theory because of the theoretical basement concepts in his book - Strategic Management: A stakeholder approach (Freeman, 1984), initially introduced the influence of working relationships within a project (Yang et al., 2009). Then, many scholars have made great efforts in identifying factors affecting stakeholder management which promote to construction project success, such as: Jergeas et al (2000); Olander and Landin (2008); Chinyio and Akintoye (2008); Jepsen and Eskerod (2009); Aaltonen and Kujala (2010), and so on. However, because of their limited sample size or lack of verification, Yang et al (2009) were developed and grouped 15 factors of stakeholder managements under five components namely: (i) Precondition, (ii) Information Inputs, (iii) Stakeholder Estimation, (iv) Decision-making, (v) Sustainable Support and finally verified by conducting six interviews in Hong Kong. It could help project managers manage stakeholders better and conduct their professional works more effectively. Notwithstanding, due to the limitation of a comprehensive system, these factors are still inadequate (Yang and Shen, 2014). In the Gaza trips, 30 factors affecting on stakeholder management process have been identified in the research of Senaratne and Ruwanpura (2016), and in the UK, Molwus et al (2017) presented a causal structural model in which the inter-relationship between 23 critical success factors and project success have been evaluated. However, due to the differences in conditions of each construction market, factors affecting on the success of construction projects are differed significantly from country to country, human-related factors in particularly. To be more adaptive into the VCI, these

factors have been summarized and justified. They will be presented in the next chapter.

2.2 Social Network Analysis

2.2.1 An emergent model of Network Analysis

In the past, various stakeholder analysis models have been developed and applied, such as Stakeholder Salience Model (Mitchell et al., 1997), the Stakeholder Grid (Boddy and Paton, 2004); Stakeholder Circle Model (Bourne and Walker, 2005); the Power/ Interest Matrix (Olander and Landin, 2005) and so on. These traditional methods can help project managers analyze their impacts based on individual attributes (power, legitimacy, urgency, knowledge, influence and so on) or categorize them according to their roles within a project. However, it is still inadequate and requires a lot of skills and knowledge from project management team to conduct their managerial actions and evaluate interactions among stakeholders (Jepsen and Eskerod, 2009). Moreover, because the relationship among stakeholders is not received enough attention (Jepsen and Eskerod, 2009; Zedan and Miller, 2017) and the incomplete boundary when a project grows in both of size and complexity (Yang et al., 2009), an approach of SNA has become essential. Under sociograms, these relationships are considered and showed under graphical data so that it can portray and reveal clearly hidden influence among stakeholders (Lin, 2012).

Although the appearance and application of social network theory has been recorded long time ago, the research of Loosemore (1998) is widely accepted as the first SNA-based construction project management journal paper. Subsequently, the strong growth of SNA in this field has been confirmed by the increasing number of published papers. Zheng et al (2016) has summarized a wide range of SNA application into eight broad areas: (1) an model to access the effect of high-performing teams on project performance and effectiveness (Chinowsky,

2008 ; 2010); (2) an useful tool in communication and coordination network (Mead, 2001); (3) a tool to determine the importance of knowledge networks among project team members (Brooks et al 2006); (4) as a quantitative techniques to identify risk management (Loosemore, 1998); (5) an analytical tool and a theory of project governance (Pryke, 2004); (6) an adaptable and flexible method for strategic management (Li and Ling, 2012); (7) an information flow of project-specific websites in Information technology utilization field (Thorpe and Mead,2001) (8) a new area of SNA application in job-site management (Wambeke et al., 2011) and resource management (Pryke, 2011). With the main aim is to achieve the better possible project outcomes by focusing on strengthening the collaborative relationship among stakeholders and supporting managerial decisions, project management team need a practical useful tool in which SNA definitely satisfies this demand (Mok et al., 2015).

2.2.2 Network types

Literature review of SNA's application during (2007 – 2017) witnesses the highest attention of scholars on the network of interactions, communication and knowledge sharing network with nearly a half of total published papers (33 out of 69 papers) (Kereri and Harper, 2017). In order to demonstrate the usefulness of SNA in facilitating the better understanding and providing valuable information for project manager and his/her team, the communication and workflow network have been chosen for this study.

1) Communication network

Because project stakeholders differ in both of professional backgrounds and behaviors, communication can adapt themselves into new conditions and challenges so that the quality of working processes could be enhanced (Pinto and Pinto, 1990; Jugdev and Müller, 2005). Since the first use of Loosemore (1998) for solving conflict situations in the UK, application of communication network

are varied from examining the effects of changes in procurement strategy on project governance and project management systems (Pryke, 2004; 2005; 2012); identifying communication gaps in a construction project (El-Sheikh and Pryke, 2010); highlighting the benefits of using SNA in deepening the understanding of the structuring of PPP arrangements and how the network emerges from the relationships between project stakeholders (Chowdhury et al., 2011); examining the relationship between an actor's structural position in the communication network and his or her ability to coordinate project activities (Hossain., 2009); identifying salient stakeholders who individuals frequently talk to about project-related activities (Assudani and Kloppenborg, 2010); determining the informal network that exists within a project team (Chinowsky et al., 2008). Stakeholders use the communication network to provide information on their critical claims and demand immediate action (Aaltonen et al., 2010) or address conformance gaps in the project (El-Sheikh and Pryke, 2010). In addition, because communication patterns are the key in modeling the network to represent interpersonal relationships (Chinowsky et al, 2011), information exchange (or communication network) between parties is one of the most important component of SNA for overcoming the disadvantage of traditional models (Pryke et al., 2017).

2) Workflow network

According to the definition of Brass (1984), workflow network is the exchange of inputs and outputs among each working position within a project. It is constituted and delivered by construction team members. Project outcomes, therefore, is a consequence through the interaction between people, not by mechanical processes, procedures, and systems (Cooke-Davies and Arzymanow, 2003). Based on the role of each individual hold, the source of power can be derived that make them important in network. When they are in a focal position, there are no alternatives available (Brass, 1984). Besides, workflow network can provide other types of resources to the project included physical, financial, power

(Smith-Doerr et al., 2004). By asking for input into the project, the centrality metrics of each actor in workflow network point out salient project stakeholders who play the central role in a project (Assudani and Kloppenborg, 2010). Project work is structured around the positions that must be performed by key stakeholders in critical roles. Therefore, it could be expected that important project stakeholders derive power from their position in the workflow network.

2.3 Chapter summary

The above sections introduce stakeholder management theory and show the potential impact of stakeholder management on the success of construction projects in previous studies. Therefore, conducting this research area is necessary because it could not only provide the body of knowledge for the VCI but also possibly enrich the global knowledge due to typical characteristics of the VCI. However, although stakeholder management approach could be used to identify the importance/ influence of each stakeholder within a project, its limitation is the insufficient attention on the stakeholder's relationships and the degree of their influence on each other's decisions which possibly impact on project outcomes (Ki Fiona Cheung and Rowlinson, 2011; Prell et al., 2009). Thus, the utilization of SNA is suggested by many scholars to offer this powerful tool for examining relationships among stakeholders and the influence of stakeholder networks on project outcomes (Zedan and Miller, 2017).

CHAPTER 3

DATA ANALYSIS

This chapter begins with a general research process which is showed at the flowchart below (figure3.1).

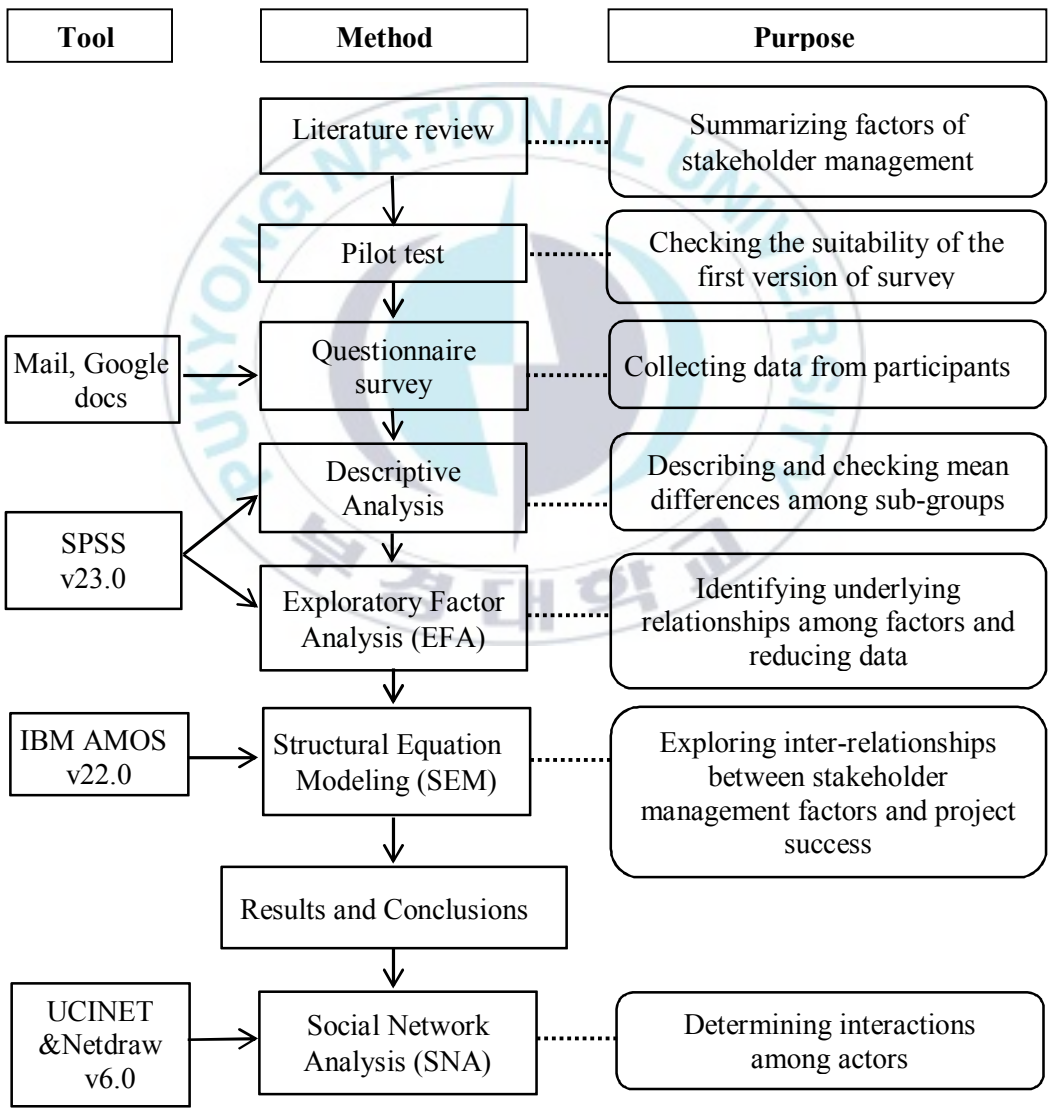


Figure 3.1 General research process

3.1 Data collection

3.1.1 Survey preparation

Through an extensive literature review, 36 stakeholder management factors affecting on construction project success have been collected and initially divided into 6 groups, however because the natural conditions are significantly different among each nation/region, human-related factors in particular, 3 more factors which were suggested by Vietnamese professional practitioners in pilot test are additionally provided. They are: “Exploring stakeholder's experiences” and “Understanding stakeholder's working style” in group 2, “Identifying stakeholder's strengths and restraints” in group 3. It can be explained that an important yardstick in assessing stakeholder in Vietnam is their reputation and experience because it shows their work performance in the past. So, it is a time-consuming process and a costly asset (Tam and Hadikusumo, 2015). Besides, because of the lack of industrial and professional behavior of Vietnamese construction employees (Ling and Bui, 2010), working styles of stakeholders, therefore, should be taken into account while acquainting and understanding them (Nguyen and Rose, 2009). Moreover, due to the common crises of construction company, unhealthy cash flow from the owner and the contractor (Kim et al, 2008), constant change of stakeholder involved, assessing their strengths and weaknesses should be analyzed carefully to familiar with the array of their partners (Chinyio and Akintoye, 2008).

All of 39 stakeholder management factors are summarized in the table 3.1

Table 3.1 Summary table of stakeholder management factors

S. No	STT	Stakeholder management factors	Jerges et al 2000	Karlsen 2002	Bourne & Walker 2006	Chiniyo & Akintoye 2008	Olander & Landin 2008	Yang et al 2009; 2011	Jespen & Eskerod 2009	Takim 2009	Nguyen et al 2009	El-Sawalhi& hammad 2015	Molwus 2017	Pilot test	Remark
Group 1 – Management Support (MS)															
1	MS01	Commitment										√			1
2	MS02	Allocating resources efficiently				√	√		√						3
3	MS03	Well-organized project team members													1
4	MS04	Flexible project organization					√					√	√		3
5	MS05	Project manager competencies		√	√							√			3
	Group 2 – Information Input (II)														
6	II01	Well-defined project objectives	√					√				√			3
7	II02	Identifying and listing stakeholders		√			√	√	√						4
8	II03	Exploring stakeholder's experiences												√	1
9	II04	Understanding stakeholder's needs and expectations			√		√			√	√	√	√		6
10	II05	Understanding stakeholder's working style												√	1

Table 3.1 Summary table of stakeholder management factors (continued)

S. No	STT	Stakeholder management factors	Bourne & Walker 2006	Chiniyo & Akintoye 2008	Olander & Landin 2008	Yang et al 2009; 2011	Jespen & Eskerod 2009	Takim 2009	Nguyen et al 2009	Altonen & Kulaja 2010	El-Sawalhi& hammad 2015	Yang & Shen 2015	Molwus 2017	Pilot test	Remark
	Group 3 – Stakeholder Assessment (SA)														
11	SA01	Assessing and determining stakeholder's power	√		√		√								3
12	SA02	Assessing and determining stakeholder's legitimacy							√		√				2
13	SA03	Assessing and determining stakeholder's urgency		√					√						2
14	SA04	Assessing and determining stakeholder's proximity		√		√									2
15	SA05	Assessing and determining stakeholder's knowledge							√						3
16	SA06	Identifying and understanding stakeholder's attitudes			√					√					2
17	SA07	Identifying and exploring stakeholder's areas of interests							√						1
18	SA08	Identifying and predicting stakeholder's influence each other	√		√						√	√	√		5
19	SA09	Identifying possible coalitions/conflicts among stakeholders				√	√	√					√		4
20	SA10	Identifying stakeholder's strengths and restraints												√	1

Table 3.1 Summary table of stakeholder management factors (continued)

S. No	STT	Stakeholder management factors	Jerges et al 2000	Karlsen 2002	Bourne & Walker 2006	Chiniyo & Akintoye 2008	Olander & Landin 2008	Yang et al 2009; 2011	Jespen & Eskerod 2009	Altonen & Kulaja 2010	El-Sawalhi& hammad 2015	Yang & Shen 2015	Molwus 2017	Remark
	Group 4 – Decision Making (DM)													
21	DM01	Clear and transparent decisions						√			√			3
22	DM02	Evaluating alternative solutions based on the stakeholder's concerns				√				√			√	3
23	DM03	Stakeholder's involvement in decision-making process							√					2
24	DM04	Predicting the influence of decisions on stakeholders			√									1
25	DM05	Predicting stakeholder's reactions in implementing decisions		√				√				√		3
	Group 5 – Action and Evaluation (AE)													
26	AE01	Implementing strategies based on schedule plans									√	√		2
27	AE02	Implementing appropriate strategies to manage stakeholders			√		√		√		√			4
28	AE03	Flexibility in handling stakeholder's reactions									√	√		2
29	AE04	Compromising conflicts among stakeholders							√		√	√		3
30	AE05	Evaluating stakeholder's satisfaction in achieving preset									√	√		2

Table 3.1 Summary table of stakeholder management factors (continued)

S. No	Code	Stakeholder management factors	Jerges et al 2000	Karlsen 2002	Bourne & Walker 2006	Chiniyo & Akintoye 2008	Olander & Landin 2008	Yang et al 2009; 2011	Senaratne & Ruwanpura 2015	El-Sawalhi& hammad 2015	Yang & Shen 2015	Molwus 2017	Remark
	Group 6 – Continuous Support (CS)												
31	CS01	Communicating with stakeholders	√			√		√	√	√	√	√	7
32	CS02	Maintaining good relationships with stakeholders	√			√		√					3
33	CS03	Promoting trust and respect each other		√	√			√		√			4
34	CS04	Building knowledge and experience sharing working environment			√								1
35	CS05	Reducing uncertainty		√	√					√			2
36	CS06	Making alignment to achieve mutual project objectives	√			√					√		3
37	CS07	Promoting positive relationships among stakeholders	√	√	√								3
38	CS08	Top management support		√						√			2
39	CS09	Continuing analyze the change of stakeholders				√		√			√		3

3.1.2 Questionnaire design 1

Because of the remote distance, questionnaire survey is the most sufficient and convenient way to make conversation with target respondents.

The questionnaire contains two parts: The first section consists of general personal information of respondents. The second one is concerned with stakeholder management factors potentially affecting on the success of construction projects in Vietnam (Appendix 1). Respondents were asked to select their choices according to five-point Likert scale. The assigned scales are presented as follow:

Table 3.2 Patterns of five-point Likert scale

Very few influential	Slightly influential	Somewhat influential	Very influential	Extremely influential
1	2	3	4	5

3.1.3 Pilot test

Pre-testing with expert group is very important step to check the suitability and comprehensibility of potential factors which were extracted from literature review. Four experts who participated in this preliminary test are rich of experience in construction project management with seven years-of-experience at least. Thank to them, the suitability and comprehensibility of the questionnaire survey are reviewed and checked so that a finalized version was formed.

3.1.4 Survey distribution

The researcher employs a self-administered questionnaire distribution with the aid of friends of mine and colleagues who are involving in construction projects during the survey period. Thereby, hand delivery, email, and Google docs were conveniently delivered to suitable respondents. After few times reminding, the survey was finished in total of one and a half month. The received responses were

then filtered carefully to exclude inappropriate answers and valid dataset go to data analysis stage.

3.2 Analysis methods

3.2.1 Descriptive Analysis

The aim of this step is to check the mean value of all factors and mean difference among sub-groups. Figure 3.2 below portraits the flowchart of Descriptive Analysis.

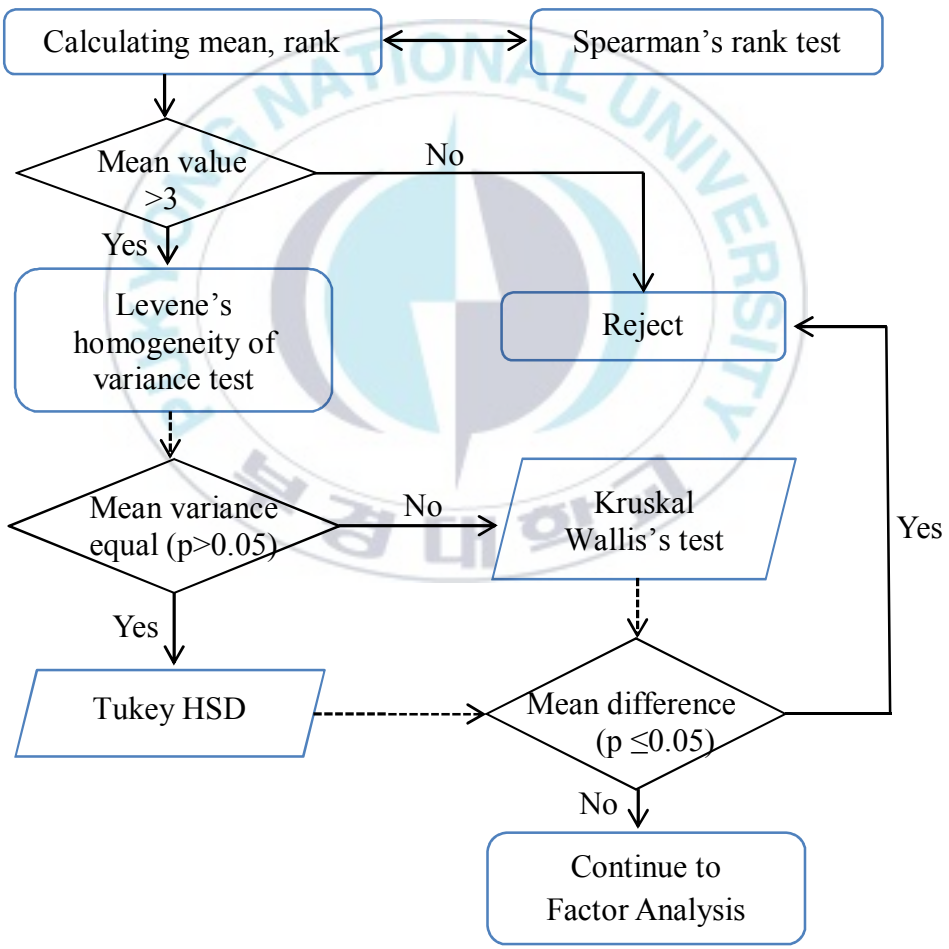


Figure 3.2 Flowchart of Descriptive Analysis

3.2.2 Factor Analysis

Initially, the reliability of factors will be tested by checking Cronbach's Alpha coefficients. Next, KMO and Barlett's test are used to check whether the result of Factor Analysis is suitable or not.

Steps of Factor Analysis are presented as follow (figure 3.3).

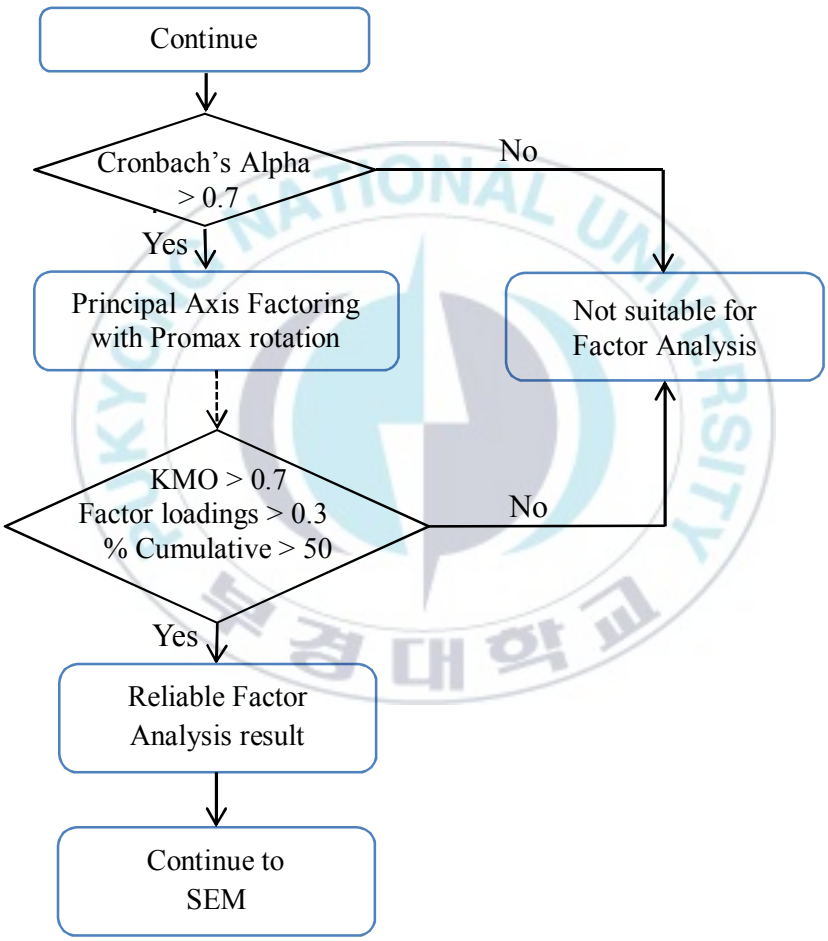


Figure 3.3 Factor Analysis process

Table 3.3 below explains and describes those steps which are used in this stage.

Table 3.3 Factor Analysis process and descriptions

S. No.	Step	Description
1	**Cronbach's Alpha coefficient**	The reliability of the questionnaire is checked by measuring the Cronbach's Alpha coefficient of each factor. If corrected item total correlation) ≤ 0.3, it will be excluded from the dataset. (Field, 2015)
2	**Validity/Adequacy test**	**Kaiser-Meyer-Olkin (KMO) test:** KMO test are employed to examine whether observed attributes are mutually correlated or not. To confirm the appropriateness of performing factor analysis, this value must be greater than 0.6 and statistical significance with p-value is lower than 0.05. **Bartlett's test:** The correlation matrix is concluded that it is not an identity matrix if the index of Bartlett's test is significant at 0.05 (sig < 0.05)
3	**Retaining of variables**	To ensure the distinction among factors: - Factor loading coefficients of an attribute loading on factors are greater than 0.3. - Components are better when the eigenvalue is larger than 1 (Tabachnick and Fidell, 2007). - Components must exceed of 50% of the total variance (Field, 2009).

3.2.3 Structural Equation Modeling (SEM)

After Factor Analysis stage, SEM has been next employed. The figure 3.4 is the framework of SEM development process.

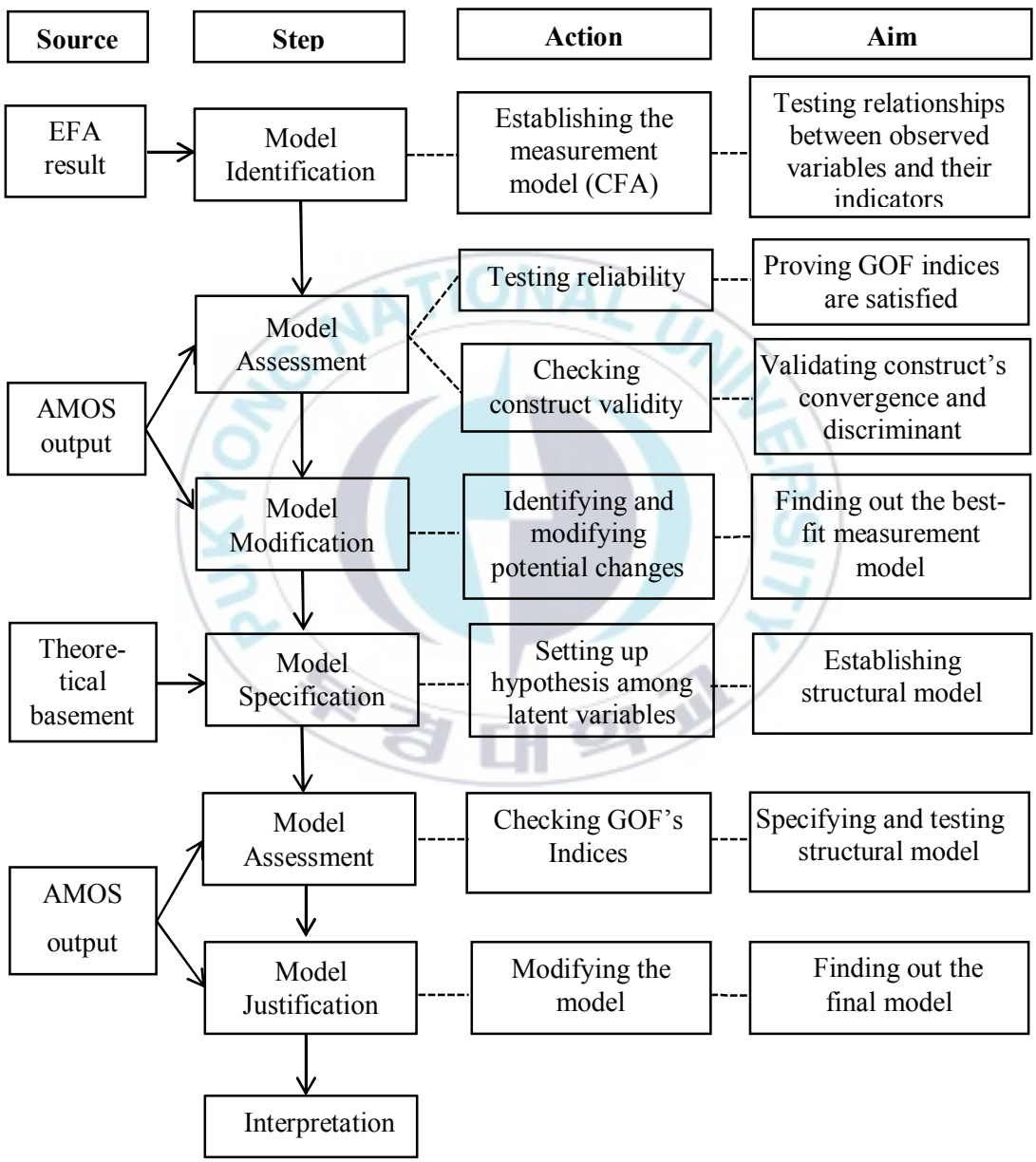


Figure 3.4 SEM development process

1) Confirmatory Factor Analysis (CFA)

To start with SEM, CFA has been firstly used in which steps and descriptions of CFA are presented as the following table (table 3.4).

Table 3.4 Steps and descriptions of CFA

S.N.	Step	Description
1	**Model Identification**	Based on factors extracted from factor analysis, CFA has been established to test relationships between constructs and their indicators. These relationships are presented by one-way or two-way arrow (Xiong, 2015)
2	**Model Assessment**	- Reliability test is used to access the reliability and appropriateness of the conceptual model. - Construct validity ➢ Convergent validity • Composite Reliability (CR) > 0.7 • Standardized regression weights (SRW) > 0.5 • Average variance extracted (AVE) > 0.5 ➢ Discriminant validity AVE values of one construct should be greater than its highest squared correlation with other constructs (Xiong et al., 2015).
3	**Model Modification**	According to (Kline, 2015), variables are considered to exclude for improving measurement model which have: • The path coefficients (factor loadings) < 0.5 • The signs of multi-co-linearity (modification indices (MI) > 4) • The values are greater than 1 in the standardized residual correlation matrix

2) Structural Equation Modeling (SEM)

All steps of SEM are explained in the table below (table 3.5)

Table 3.5 Steps and descriptions of SEM

S.N.	Step	Description
1	**Model Identification**	After CFA stage, structural model is established to test inter-relationships among constructs. Initially, two-way arrows in the measurement model are replaced by one-way arrows in the structural model. Each arrow represents the direct relationship among two constructs based on theoretical knowledge from previous studies in the subject area.
2	**Model Assessment**	Similar to the CFA stage, Goodness of Fit (GOF) indices in this stage are used to assess the reliability and appropriateness of the structural model.
3	**Model Identification**	The identification of potential model changes and model modification will be then assessed based on the GOF indices combine with the results extracted from AMOS software
4	**Model Evaluation**	➢ Squared values of the path coefficient (SMR) It is interpreted like multiple regressions in term of the variance in one variable are explained by, or is in common with the other variables. ➢ Standardized path coefficients It is similar to the factor loading in EFA, therefore, the greater value of Standardized coefficients shows the stronger association.

GOF indices which are used for the reliability test are showed in the table 3.6

Table 3.6 Goodness of Fit (GOF) Indices

Criteria	Threshold	Author
Chi-square/DF (CMIN/DF)	1 (very good) – 2 (threshold)	Kline (2005)
RMSEA (Root Mean Squared Error of Approximation)	< 0.05 (very good) – 1 (threshold)	Tabachnick *et al* (2007)
CFI (Comparative Fit Index)	0 (no fit) – 1 (best fit)	Kline (2005)
TLI (Tucker Lewis Index)	0 (no fit) – 1 (best fit)	Kline (2005)
GFI (Goodness-of-Fit Index)	0 (no fit) – 1 (best fit)	Garson (2006)

3.2.4 Social Network Analysis

The below flowchart (figure 3.5) shows steps of SNA.

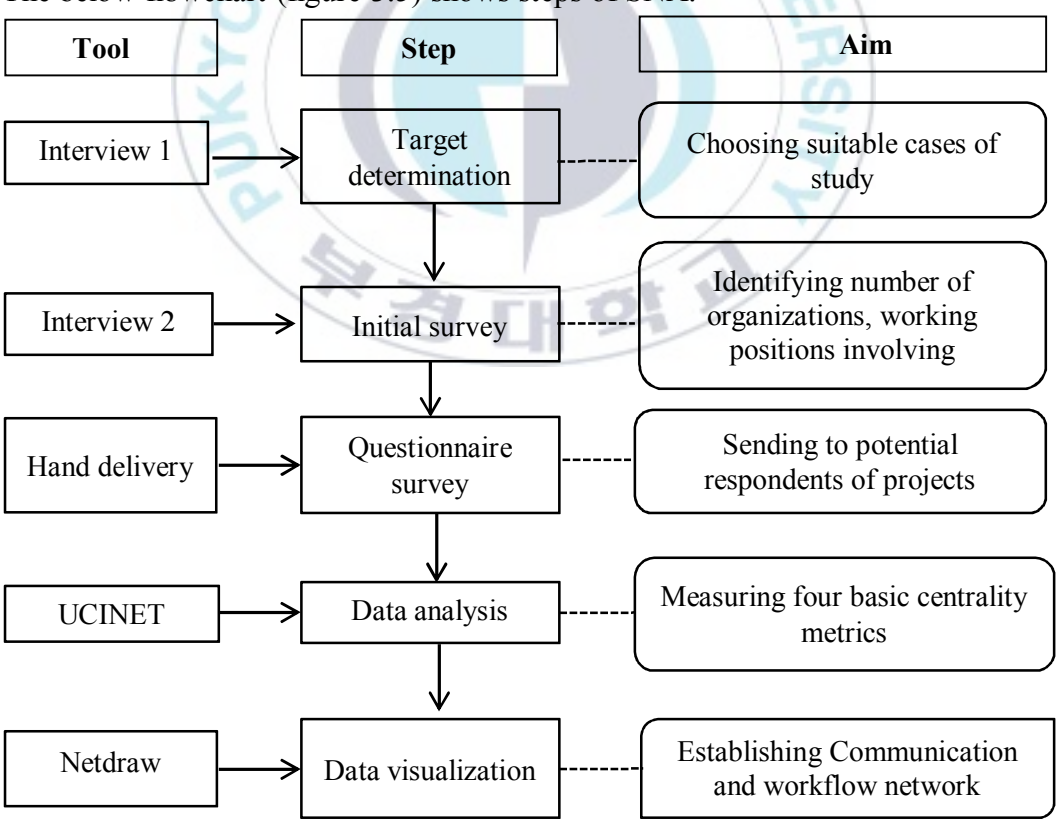


Figure 3.5 Process of Network Analysis

1) Questionnaire design 2

Before distributing official survey, a preliminary test was carried out to identify who are participating in each construction project.

The questionnaire survey was then conducted to investigate two main points:

- The general information of respondents
- The workflow and communication relationship between the chosen respondents and their partners.

To determine communication network, respondents were requested to indicate the frequency of communication with whom they exchange project-related information according to five points Likert scale, it is showed at the table 3.7.

Table 3.7 Five-point scale and explanation of communication network

Scale Code	Definition	Explanation
1	Rarely	less than once a month
2	Infrequently	less than once a week
3	Sometimes	1 to 2 times per week
4	Often	several times per week
5	Always	More than once per day

Similarly, workflow networks request participants to rate corresponding working positions whose work and decision possibly affect to their work (refer as the table 3.8 below).

Table 3.8 Five-point scale of workflow network

Very few influential	Slightly influential	Somewhat influential	Very influential	Extremely influential
1	2	3	4	5

2) Network measurements

Sociogram is commonly used to present social networks and shows the interactions among individuals. According to Chinowsky et al (2010), there are two main patterns which constituted in a sociogram with "node" represent individual that relate to one another and "tie" represent connections between two nodes if an interaction has occurred. In this thesis, each "node" represents for a working position in project.

-Degree centrality

This metric represents the number of links connected to a node (how many people a stakeholder is directly connected to), so it can identify who is influential and important in network. The nodes with higher out-degree is more central (choices made).The nodes with higher in-degree is more prestigious (choices received). This thesis uses the index of out-degree (k^{out}). From the adjacency matrix of a directed graph the out-degree centrality is calculated as:

$$D=\frac{k^{out}}{n}=\frac{A^T e}{n}$$

Where: $A^T e$ is column sum of A

n: Number of columns

-Betweenness Centrality

This measure refers to the incidence in which a node lies on the middle between two other nodes. It can point out informal power because an actor with the highest betweenness value has the best opportunity to filter or change information flowing to others in the network, thus information can be delayed, changed, or stopped at this point in the network (Pryke, 2012).

The following formula describes the value of Betweenness:

$$\text{Betweenness} = \sum_{s \neq \upsilon \neq t \in V} \frac{\sigma_{st}(\upsilon)}{\sigma_{st}}$$

Where: σ_{st} is total number of shortest paths from node to node.

t and $\sigma_{st}(\upsilon)$ is the number of those paths that pass through υ

-Eigenvector Centrality

It is the extent to which a node is connected to influential other nodes. It is calculated by measuring the average of the shortest paths from a node to all other nodes in the network. These measures can tell how fast project information from the owner will reach the rest of the construction team members.

Using the adjacency matrix to find eigenvector centrality

For a given graph G:=(υ,E) with |V| vertices let A = $(a_{\upsilon t})$ be the adjacency matrix, i.e. $(a_{\upsilon t})$ = 1 if vertex υ is linked to vertex t , and $(a_{\upsilon t})$ =0 otherwise. The relative centrality score of vertex υ can be defined as:

$$x_{\upsilon}=\frac{1}{\lambda}\sum_{t\in M(\upsilon)} x_{\mathrm{t}} = \frac{1}{\lambda}\sum_{t\in G} a_{\upsilon,\mathrm{t}}\, x_{\mathrm{t}}$$

Where M(υ) is a set of the neighbors of υ and λ is a constant. With a small rearrangement this can be rewritten in vector notation as the eigenvector equation

-Closeness centrality

It is the average of the shortest distances to all other node in the graph. It can estimate time to hear information and point out rapid diffusion. The following formula describes the value of Closeness (whether in a directed or non-directed network). This value can be calculated as follow:

$$Closeness(i) = \frac{1}{\sum_{j=1}^{g}(distance_j)}$$

3) Network matrices

(Appendix 3)

CHAPTER 4

RESULT AND DISCUSSION

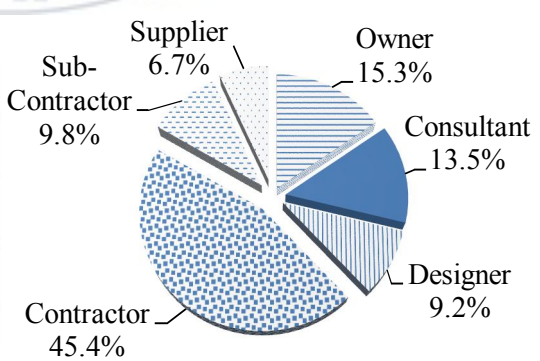
4.1 Respondent profiles

4.1.1 Respondent's profile in the first survey

1) Types of organization involved

Because this research focuses on internal stakeholders, there are 6 groups participating in the survey. In the total of 163 responses received, nearly an half of them are contractors (accounted for 45.4%), 25 owners (15.3%), and 22 consultants (13.5%). The participants in the designer, sub-contractor, and supplier group are 9.2%, 9.8%, and 6.7% respectively. The data of respondent's organization types is showed at the table 4.1

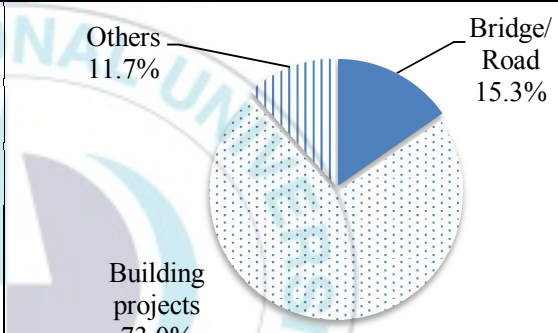
Table 4.1 Types of organization

Organization	Frequency	Percent	Remarks
Owner	25	15.3	
Consultant	22	13.5	
Contractor	70	45.4	
Designer	15	9.2	
Sub-contractor	16	9.8	
Supplier	11	6.7	
Total	**163**	**100**	

2) Types of project

In regardless of project types, building construction projects occupied the largest part of pie (equal to 73%) with 119 respondents are participating. 25 respondents are working at Bridge and Road projects (accounted for 15.3%), and 19 respondents come from other types of infrastructure construction projects, equivalent to 11.7% (see as the table 4.2).

Table 4.2 Project types

Organization	Frequency	Percent	Remarks
Bridge/road	25	15.3	
Building project	119	73	
Others	19	11.7	
Total	**163**	**100**	

3) Total investment budget

According to the assumption in the research of Long et al (2004), a project with total investment budget more than 1 million dollar, from 1 to 32.5 million USD, and greater than 32.5 million USD can be seen as a large, relatively large, and especially large project respectively. In fact, because of the increase of project size in Vietnam, their assumption is not appropriate. In this study, construction projects are divided into 3 sub-categories namely: Type A, Type B, and Type C regardless of the total budget investment based on the decree on Construction Project Management No. 59/2015/NĐ-CP of the Vietnamese Government (refer as the table 4.3 and 4.4)

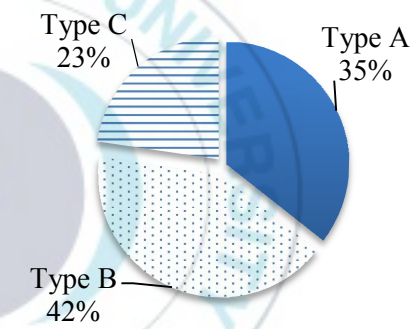
Table 4.3 The classification of Vietnamese construction projects

Project types	Type A	Type B	Type C
Bridge/road	Over 1,500	120 – 1,500	Under 120
Building projects	Over 800	45 – 800	Under 45
Others	Over 1,500	60 – 1,500	Under 60

Note: The classification is based on the decree on Construction Project Management No. 59/2015/NĐ-CP of the Vietnamese Government (Unit: Billion VND)

Table 4.4 Types of project based on the total budget classification

Project types	Frequency	Percent	Remarks
Type A	58	35	
Type B	68	42	
Type C	37	23	
Total	**163**	**100**	

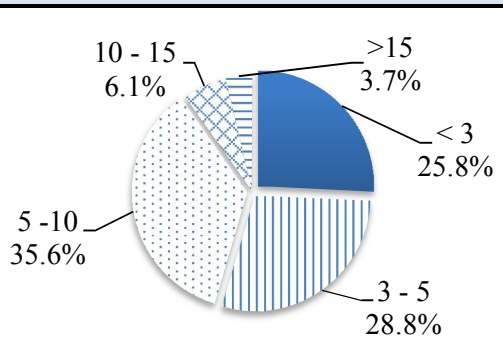


Accordingly, the largest number of respondents work at type B projects accounted for 42%. 35% and 23% of them are involving in type A and type C project with 58 and 37 respondents involved.

4) Years-of-experience

In the term of experience of respondents, the largest percentage (35.6%) is 5 to 10-year groups with 58 peoples, 47 respondents own 3 to 5 year of experience (accounted for 28.8%). Although 42 participants have less than 3 years (equal to 25.8%), it is made sure that all of them are involving in large size of construction projects (type B at least), so their contribution are valuable. The remaining 16 respondents (equivalent to 9.8%) have worked for the construction industry more than 10 years. The detail data will be showed at the table 4.5.

Table 4.5 Year-of-experience of respondents

Year-of-experience	Frequency	Percent	Remarks
Under 3	42	25.8	
From 3 - 5	47	28.8	
From 5 to 10	58	35.6	
From 10 to 15	10	6.1	
Over 15	6	3.7	
Total	**163**	**100**	

4.1.2 Data collection in the second survey

General information of two cases of building project are showed at the table 4.6

Table 4.6 Basic information of two building projects

	Project A	Project B
Building type Procurement type	Condotel Design – Bid – Build	Hotel Design – Bid – Build
Estimated budget	3,200 billion VND	120 billion VND
Scale of project	36 stories, two blocks, 10,000 m^2 floor in total	20 stories 4,700 m^2 floor
Status on 30th May 2018	Civil and rebar work at the 23rd floor and panel installment at the typical floors.	Finishing works: painting, tiling plastering, and installing (HVAC) system.
Organization involved	01 PM Unit 01 Consultancy firm 03 design firms (architecture, structure, pre-stressed concrete floor) 01 General contractor 05 sub-contractor	01 PM Unit 01 Consultant and design firm 07 contractors (civil, MEP, HVAC, plaster and paint, door and window, furniture, marble

1) Project A

Project A is a very large project (type A) in which hundreds of project team members with more than thirty working positions are involving during the survey period. The survey focuses on five main groups with twenty-three working positions. However, only fifteen of them participated in the survey. Their general information are showed at the table 4.7

Table 4.7 Respondent's information in project A

S. No	Working position	Organization	Group	Year-of-experience	Duration of participation (month)
1	Owner's representative	Project management Unit	1	6	26
2	Project manager			12	26
3	Project management team member			9	24
4	Representative of firm	Consultancy firm	2	19	24
5	Consultant team			10	26
6	Supervisor			10	24
7	Designer team leader	Architecture firm	3	9	24
8	Designer team			5	24
9	Site manager	General contractor	4	11	1
10	Site management team member			7	10
11	Superintendent			5	7
12	Chief of construction			12	24
13	Quality Control			3	11
14	Sub-Superintendent	Wall panel installation sub - Contractor	5	6	12
15	Sub- Chief of construction group			8	12

2) Project B

Project B is a medium size of building construction project (type B). Among seven contractors, civil contractor and ME contractor was chosen. The questionnaire survey invited twenty-three potential respondents and nine-teen responses received as a result. The list of them is showed at the table 4.8

Table 4.8 Respondent's information in project B

S. No	Working position	Organization	Group	Year-of-experience	Duration of participation (month)
1	Owner's representative	Project management Unit	1		
2	Project manager			15	12
3	Project management team member			12	6
4	Representative of firm	Consultant & Design firm	2		
5	Consultant team leader			16	12
6	Supervisor			13	12
7	Resident architect			1.2	7
8	Representative of firm	Civil contractor	3	15	8
9	Site manager			6	9
10	Site management team member			4	9
11	Superintendent			4	9
12	Chief of construction			10	9
13	Quality Control			2	8
14	ME-Representative	ME contractor	4		
15	ME-Site manager			8	7
16	ME-SM team member			6	3
17	ME-Superintendent			3	3
18	ME-Chief of construction group			11	3
19	ME-Quantity surveyor			4	2

4.2 Results of Descriptive Analysis

4.2.1 Mean, rank

Table 4.9 Overall ranking of 39 stakeholder management factors

Code	Stakeholder management factors	Mean	S. D
MS01	Commitment	3.96	.870
MS02	Allocating resources efficiently	4.02	.909
MS03	Well-organized project team members	3.93	.883
MS04	Flexible project organization	3.96	.891
MS05	Project manager competencies	4.13	.879
II01	Well-defined project objectives	3.93	.857
II02	Identifying and listing stakeholders	3.67	.935
II03	Exploring stakeholder's experiences	3.80	.917
II04	Understanding stakeholder's needs and expectations	3.62	.938
II05	Understanding stakeholder's working style	3.47	1.044
SA01	Assessing and determining stakeholder's power	3.72	.977
SA02	Assessing and determining stakeholder's legitimacy	3.67	.937
SA03	Assessing and determining stakeholder's urgency	3.64	.887
SA04	Assessing and determining stakeholder's proximity	3.56	.896
SA05	Assessing and determining stakeholder's knowledge	3.74	.961
SA06	Identifying and understanding stakeholder's attitudes	3.90	.944
SA07	Identifying and exploring stakeholder's areas of interests	3.69	.864
SA08	Identifying and predicting stakeholder's influence each other	3.55	.944
SA09	Identifying possible coalitions/conflicts among stakeholders	3.48	1.021
SA10	Identifying stakeholder's strengths and restraints	3.56	.969
DM01	Clear and transparent decisions	3.90	.890
DM02	Evaluating alternative solutions based on the stakeholder's concerns	3.76	.815
DM03	Stakeholder's involvement in decision-making process	3.73	1.037
DM04	Predicting the influence of decisions on stakeholders	3.50	.932
DM05	Predicting stakeholder's reactions in implementing decisions	3.36	.967
AE01	Implementing strategies based on schedule plans	4.14	.867
AE02	Implementing appropriate strategies to manage stakeholders	3.97	.939
AE03	Flexibility in handling stakeholder's reactions	3.91	.866
AE04	Compromising conflicts among stakeholders	3.50	.834
AE05	Evaluating stakeholder's satisfaction in achieving preset goals	3.59	.829
CS01	Communicating with stakeholders	4.15	.833
CS02	Maintaining good relationships with stakeholders	3.91	.823
CS03	Promoting trust and respect for each other	3.82	.862
CS04	Building knowledge and experience sharing working environment	3.66	.952
CS05	Reducing uncertainty	3.64	.873
CS06	Making alignment to achieve mutual project objectives	3.90	.883
CS07	Promoting positive relationships among stakeholders	3.85	.886
CS08	Top management support	3.93	.927
CS09	Continuing analyze the change of stakeholders	3.77	.865

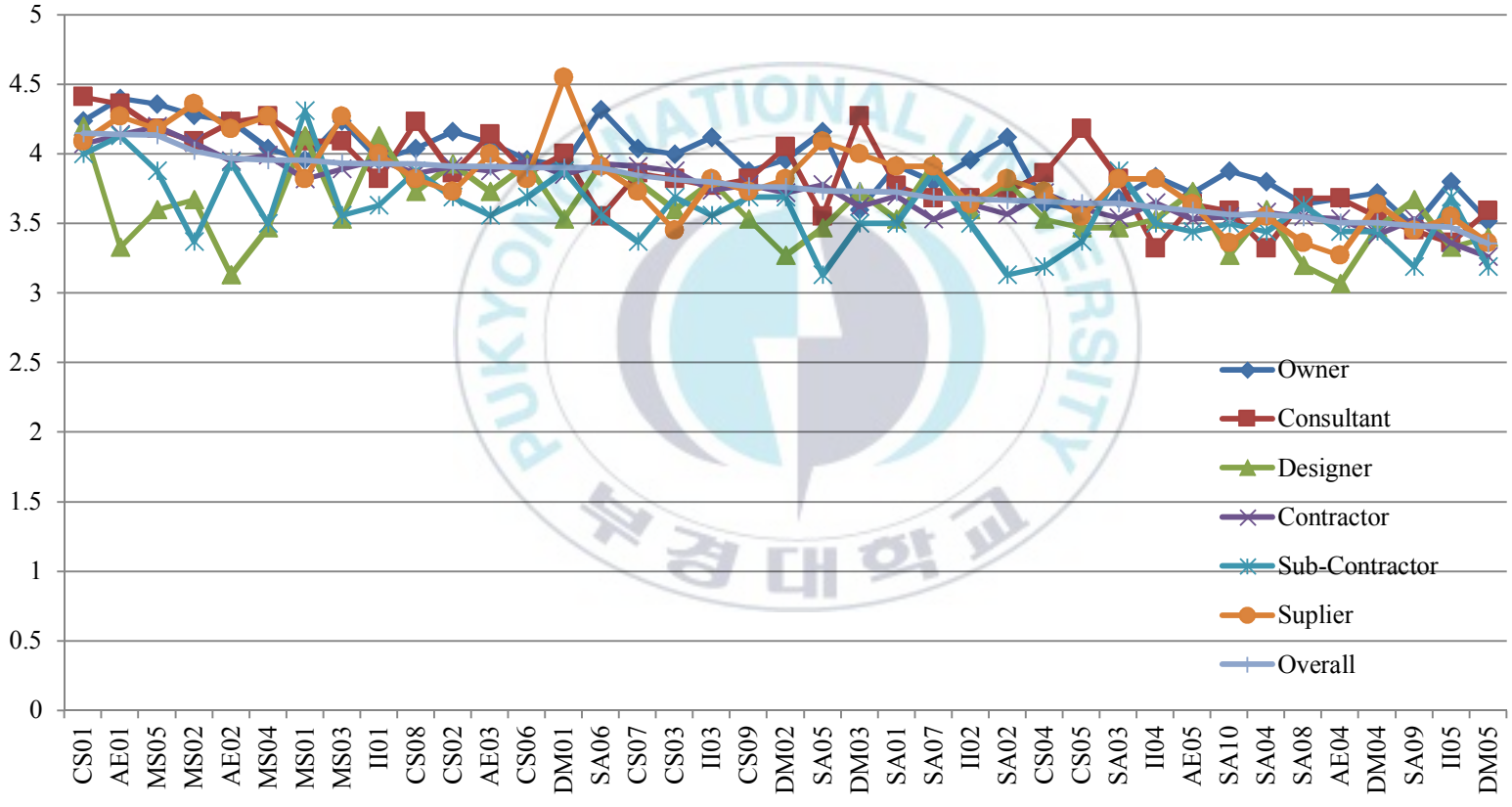
Factor's code	Overall		Owner		Consultant		Designer		Contractor		Sub-Contractor		Supplier	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
CS01	4.15	1	4.24	5	4.41	1	4.2	1	4.07	4	4	3	4.09	8
AE01	4.14	2	4.40	1	4.36	2	3.33	33	4.14	2	4.13	2	4.27	3
MS05	4.13	3	4.36	2	4.18	7	3.60	17	4.20	1	3.88	5	4.18	6
MS02	4.02	4	4.28	4	4.09	10	3.67	15	4.08	3	3.37	32	4.36	2
AE02	3.97	5	4.24	5	4.23	5	3.13	38	3.95	7	3.94	4	4.18	6
MS04	3.96	6	4.04	13	4.27	3	3.47	27	3.99	5	3.5	22	4.27	3
MS01	3.96	7	3.96	17	4.09	10	4.13	2	3.82	17	4.31	1	3.82	16
MS03	3.93	8	4.24	5	4.09	10	3.53	21	3.89	12	3.56	18	4.27	3
II01	3.93	9	3.96	17	3.82	19	4.13	2	3.96	6	3.63	16	4	10
CS08	3.93	10	4.04	13	4.23	5	3.73	11	3.86	15	3.88	5	3.82	16
CS02	3.91	11	4.16	8	3.86	15	3.93	4	3.91	10	3.69	10	3.73	24
AE03	3.91	12	4.08	12	4.14	9	3.73	11	3.88	13	3.56	18	4	10
CS06	3.90	13	3.96	17	3.86	15	3.93	4	3.95	7	3.69	10	3.82	16
DM01	3.90	13	3.92	22	4.00	14	3.53	21	3.85	16	3.88	5	4.55	1
SA06	3.90	15	4.32	3	3.55	33	3.93	4	3.93	9	3.56	18	3.91	13
CS07	3.85	16	4.04	13	3.86	15	3.80	8	3.91	10	3.37	32	3.73	24
CS03	3.82	17	4.00	16	3.82	19	3.60	17	3.88	13	3.69	10	3.45	34
II03	3.80	18	4.12	10	3.77	23	3.80	8	3.74	20	3.56	18	3.82	16
CS09	3.77	19	3.88	24	3.82	19	3.53	21	3.78	18	3.69	10	3.73	24
DM02	3.76	20	3.96	17	4.05	13	3.27	35	3.72	21	3.69	10	3.82	16

Table 4.10 Kendall's Coefficient of Concordance of all factors

Table 4.10 Kendall's Coefficient of Concordance of all factors (continued)

Factor's code	Overall		Owner		Consultant		Designer		Contractor		Sub-Contractor		Supplier	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
SA05	3.74	21	4.16	8	3.55	33	3.47	27	3.78	18	3.13	38	4.09	8
DM03	3.73	22	3.60	36	4.27	3	3.73	11	3.62	26	3.5	22	4	10
SA01	3.72	23	3.92	22	3.77	23	3.53	21	3.70	23	3.5	22	3.91	13
SA07	3.69	24	3.80	27	3.68	26	3.93	4	3.53	33	3.87	9	3.91	13
II02	3.67	25	3.96	17	3.68	26	3.60	17	3.64	25	3.5	22	3.64	28
SA02	3.67	26	4.12	10	3.73	25	3.80	8	3.57	29	3.13	38	3.82	16
CS04	3.66	27	3.64	34	3.86	15	3.53	21	3.72	21	3.19	35	3.73	24
CS05	3.64	28	3.60	36	4.18	7	3.47	27	3.61	27	3.37	32	3.55	31
SA03	3.64	29	3.68	32	3.82	19	3.47	27	3.54	32	3.88	5	3.82	16
II04	3.62	30	3.84	26	3.32	38	3.53	21	3.65	24	3.5	22	3.82	16
AE05	3.59	31	3.72	30	3.64	30	3.73	11	3.53	33	3.44	28	3.64	28
SA10	3.56	32	3.88	24	3.59	31	3.27	35	3.55	30	3.5	22	3.36	36
SA04	3.56	33	3.80	27	3.32	38	3.60	17	3.58	28	3.44	28	3.55	31
SA08	3.55	34	3.64	34	3.68	26	3.20	37	3.55	30	3.63	16	3.36	36
AE04	3.50	35	3.68	32	3.68	26	3.07	39	3.53	33	3.44	28	3.27	39
DM04	3.50	36	3.72	30	3.55	33	3.47	27	3.42	37	3.44	28	3.64	28
SA09	3.48	37	3.48	39	3.45	36	3.67	15	3.53	33	3.19	35	3.45	34
II05	3.47	38	3.80	27	3.36	37	3.33	33	3.36	38	3.69	10	3.55	31
DM05	3.36	39	3.52	38	3.59	31	3.40	32	3.26	39	3.19	35	3.36	36
N	163		25		22		15		74		16		11	
Kendall's W[a]	0.069		.106		.149		.113		.091		0.102		0.135	
Chi-Square	429.671		100.48		124.70		64.51		255.51		62.20		56.51	
df	38		38		38		38		38		38		38	
Asymp. Sig.	.000		.000		.000		.005		.000		0.008		0.027	

Table 4.10 A cross-comparison among six groups and overall



4.2.2 Spearman rank correlation test

The correlation between the rank orders of all groups was initially checked by Spearman's rank correlation test. The result can be seen at the table 4.11.

Table 4.11 Result of Spearman rank correlation test among sub-groups

	Owner	**Consultant**	**Designer**	**Contractor**	**Sub - Contractor**	**Sup -plier**
Owner	1.000					
Consultant	0.43** .006	1.000				
Designer	.287 .077	.131 .425	1.000			
Contractor	.817** .000	.673** .000	.334* .038	1.000		
Sub-Contractor	.353* .028	.463** .003	.118 .476	.414** .009	1.000	
Supplier	.659** .000	.591** .000	.232 .155	.702** .000	.358* .025	1.000

***. Correlation is significant at the 0.01 level (2-tailed).*

**. Correlation is significant at the 0.05 level (2-tailed).*

The table of result and conclusion 4.12 shows that there is significant agreement on the rank of each pair group with 99% and 95% confidence. However, the Designer group does not agree with the Owner, Consultant, Sub-contractor, and Supplier in the ranking result. Because this test does not suggest specifically whether an individual difference among these groups, the next task will be conducted by ANOVA and Tukey Post-hoc test.

Table 4.12 Conclusion of Spearman rank correlation test

Comparison on the ranking	r_s	Sig	Conclusion
Owner - Consultant	0.43**	.006	Reject Ho
Owner - Design	.287	.077	Accept Ho
Owner - Contractor	.817**	.000	Reject Ho
Owner – Sub-Contractor	.353*	.028	Reject Ho
Owner-Supplier	.659**	.000	Reject Ho
Consultant - Design	.131	.425	Accept Ho
Consultant - Contractor	.673**	.000	Reject Ho
Consultant – Sub-Contractor	.463**	.003	Reject Ho
Consultant - Supplier	.591**	.000	Reject Ho
Designer - Contractor	.334*	.038	Reject Ho
Designer – Sub-Contractor	.118	.476	Accept Ho
Designer - Supplier	.232	.155	Accept Ho
Contractor - Sub-Contractor	.414**	.009	Reject Ho
Contractor - Supplier	.702**	.000	Reject Ho
Sub-Contractor - Supplier	.358*	.025	Accept Ho

***. Significant agreement at the 0.01 level (2-tailed).*

**. Significant agreement at the 0.05 level (2-tailed).*

4.2.3 ANOVA test

First of all, the test of homogeneity of variances (Levene test) was carried out to test the violation of equality of variance assumption. The table result 4.13 shows that p-value of MS02, MS04, MS05, II01, CS03 factors are less than 0.05. However, based on the result Kruskal Wallis test (table 4.14), the hypothesis of these five factors were rejected and 39 factors would be then checked by ANOVA test (Field, 2009).

Table 4.13 Result of Homogeneity of Variances test

Code	Items	Levene	p-value
MS01	Commitment	2.044	.075
MS02	Allocating resources efficiently	3.213	.009
MS03	Well-organized project team members	2.212	.056
MS04	Flexible project organization	3.364	.006
MS05	Project manager competencies	2.787	.019
II01	Well-defined project objectives	4.317	.001
II02	Identifying and listing stakeholders	1.907	.096
II03	Exploring stakeholder's experiences	.822	.535
II04	Understanding stakeholder's needs and expectations	2.048	.075
II05	Understanding stakeholder's working style	1.383	.233
SA01	Assessing and determining stakeholder’s power	.434	.824
SA02	Assessing and determining stakeholder’s legitimacy	.974	.436
SA03	Assessing and determining stakeholder’s urgency	.367	.871
SA04	Assessing and determining stakeholder’s proximity	1.302	.266
SA05	Assessing and determining stakeholder’s knowledge	1.056	.387
SA06	Identifying and understanding stakeholder's attitudes	1.966	.087
SA07	Identifying and exploring stakeholder's areas of	.576	.718
SA08	Identifying and predicting stakeholder's influence each	.928	.464
SA09	Identifying possible coalitions/conflicts among	.714	.614
SA10	Identifying stakeholder's strengths and restraints	.641	.668
DM01	Clear and transparent decisions	.928	.465
DM02	Evaluating alternative solutions based on the	1.097	.364
DM03	Stakeholder’s involvement in decision-making process	.536	.749
DM04	Predicting the influence of decisions on stakeholders	.814	.541
DM05	Predicting stakeholder's reactions in implementing	.759	.581
AE01	Implementing strategies based on schedule plans	.364	.873
AE02	Implementing appropriate strategies to manage	1.189	.317
AE03	Flexibility in handling stakeholder’s reactions	.973	.436
AE04	Compromising conflicts among stakeholders	1.540	.180
AE05	Evaluating stakeholder’s satisfaction in achieving	1.421	.220
CS01	Communicating with stakeholders	.413	.839
CS02	Maintaining good relationships with stakeholders	1.746	.127
CS03	Promoting trust and respect each other	2.820	.018
CS04	Building knowledge and experience sharing working	2.123	.065
CS05	Reducing uncertainty	1.326	.256
CS06	Making alignment to achieve mutual project objectives	.723	.607
CS07	Promoting positive relationships among stakeholders	.893	.487
CS08	Top management support	.463	.803
CS09	Continuing analyze the change of stakeholders	1.854	.106

Table 4.14 Kruskal Wallis test result

	MS02	MS04	MS05	II01	CS03
Chi-	10.807	12.33	7.830	1.738	3.449
df	5	5	5	5	5
Asymp.	.055	.051	.166	.884	.631

In accordance with the result of ANOVA test (see table 4.15), the hypothesis of the factors of MS02, SA02, SA05, AE01, AE02 are rejected at the significance level of 5%. It means that there is statistically difference about mean rating on these five factors. The post-hoc ANOVA test (Tukey HSD) will be next conducted to find out the discrepancies across sub-groups.

Table 4.15 Result of ANOVA test on 39 factors

Code	Stakeholder management factors	F	Sig.
MS01	Commitment	1.167	.328
MS02	Allocating resources efficiently	3.063	.011
MS03	Well-organized project team members	2.379	.041
MS04	Flexible project organization	2.782	.019
MS05	Project manager competencies	1.877	.101
II01	Well-defined project objectives	.679	.640
II02	Identifying and listing stakeholders	.619	.686
II03	Exploring stakeholder's experiences	.881	.495
II04	Understanding stakeholder's needs and expectations	.919	.470
II05	Understanding stakeholder's working style	.894	.487
SA01	Assessing and determining stakeholder’s power	.573	.720
SA02	Assessing and determining stakeholder’s legitimacy	2.676	.024
SA03	Assessing and determining stakeholder’s urgency	.797	.554
SA04	Assessing and determining stakeholder’s proximity	.747	.589
SA05	Assessing and determining stakeholder’s knowledge	3.217	.009
SA06	Identifying and understanding stakeholder's attitudes	2.110	.067
SA07	Identifying and exploring stakeholder's areas of interests	1.138	.343
SA08	Identifying and predicting stakeholder's influence each other	.642	.668
SA09	Identifying possible coalitions/conflicts among stakeholders	.391	.855
SA10	Identifying stakeholder's strengths and restraints	.925	.466

Table 4.15 Result of ANOVA test on 39 factors (continued)

Code	Stakeholder management factors	F	Sig.
DM01	Clear and transparent decisions	1.814	.113
DM02	Evaluating alternative solutions based on the stakeholder's concerns	2.086	.070
DM03	Stakeholder's involvement in decision-making process	1.796	.117
DM04	Predicting the influence of decisions on stakeholders	.458	.807
DM05	Predicting stakeholder's reactions in implementing decisions	.656	.657
AE01	Implementing strategies based on schedule plans	3.673	.004
AE02	Implementing appropriate strategies to manage stakeholders	3.502	.005
AE03	Flexibility in handling stakeholder's reactions	1.182	.320
AE04	Compromising conflicts among stakeholders	1.468	.203
AE05	Evaluating stakeholder's satisfaction in achieving preset goals	.419	.835
CS01	Communicating with stakeholders	.748	.589
CS02	Maintaining good relationships with stakeholders	.817	.540
CS03	Promoting trust and respect each other	.949	.451
CS04	Building knowledge and experience sharing working environment	1.111	.357
CS05	Reducing uncertainty	2.249	.052
CS06	Making alignment to achieve mutual project objectives	.272	.928
CS07	Promoting positive relationships among stakeholders	1.270	.279
CS08	Top management support	.769	.574
CS09	Continuing analyze the change of stakeholders	.350	.882

Table 4.16 Results of Tukey post-hoc test for the five violated factors

Code	Group	Mean	Group	Mean	Mean Difference	Std. Error	Sig.
MS02	Contractor	4.08	Sub-contractor	3.37	0.706	0.243	0.47
SA02	Owner	4.12	Sub-Contractor	3.13	.995*	.292	.011
SA05	Owner	4.16	Sub-Contractor	3.13	1.035*	.298	.008
AE01	Designer	3.33	Owner	4.40	-1.067*	.272	.002
			Consultant	4.36	-1.030*	.279	.004
			Contractor	4.14	-.802*	.236	.011
AE02	Designer	3.33	Owner	4.24	-1.107*	.295	.003
			Consultant	4.23	-1.094*	.303	.005
			Contractor	3.95	-.813*	.256	.022
			Supplier	4.18	-1.048*	.359	.046

Post-hoc test for measuring the five factors (MS02, SA02, SA05, AE01, AE02) are showed in the table 4.16. The results point out that there are significant differences (sig < 0.05) among six groups. Specifically, while SA02 and SA05 are ranked higher in the Owner group than in the Sub-contractor group, the Designer group evaluated AE01 and AE02 significantly lower than in the Owner, the Consultant, the Contractor, and the Supplier group. However, because these five factors are perceived considerably important in the Sub-contractor and the Designer group (their mean score are larger than 3), the differences between group's perception will be skipped and a whole of 39 factors will be used for the further factor analysis.

4.3 Result of Factor Analysis

4.3.1 Data reliability test

After data descriptive analysis, the study evaluated the reliability of the given dataset by checking Cronbach's alpha coefficient. As a result, the values of 6 groups computed are greater than 0.7 and none of 39 factors are lower than 0.3, the reliability of this measurement, therefore, is accepted at the 5% significance level and all of them are attained for further factor analysis (Hair, 2010).

Table 4.17 Cronbach's Alpha values of 39 items

Code	Items	(1)	(2)
		Group 1 - Cronbach's Alpha:	**0.701**
MS01	Commitment	.311	.704
MS02	Allocating resources efficiently	.538	.606
MS03	Well-organized project team members	.443	.648
MS04	Flexible project organization	.501	.623
MS05	Project manager competencies	.461	.640
		Group 2 - Cronbach's Alpha:	**0.748**
II01	Well-defined project objectives	.439	.728
II02	Identifying and listing stakeholders	.557	.687
II03	Exploring stakeholder's experiences	.545	.691
II04	Understanding stakeholder's needs and expectations	.626	.660
II05	Understanding stakeholder's working style	.412	.745

Table 4.17 Cronbach's Alpha values of 39 items (continued)

Code	Items	(1)	(2)
	Group 3 - Cronbach's Alpha		**0.862**
SA01	Assessing and determining stakeholder's power	.523	.853
SA02	Assessing and determining stakeholder's legitimacy	.588	.847
SA03	Assessing and determining stakeholder's urgency	.559	.850
SA04	Assessing and determining stakeholder's proximity	.582	.848
SA05	Assessing and determining stakeholder's knowledge	.603	.846
SA06	Identifying and understanding stakeholder's attitudes	.653	.842
SA07	Identifying and exploring stakeholder's areas of interests	.503	.854
SA08	Identifying and predicting stakeholder's influence each other	.569	.849
SA09	Identifying possible coalitions/conflicts among stakeholders	.542	.852
SA10	Identifying stakeholder's strengths and restraints	.598	.847
	Group 4 - Cronbach's Alpha		**0.739**
DM01	Clear and transparent decisions	.472	.705
DM02	Evaluating alternative solutions based on the stakeholder's concerns	.500	.696
DM03	Stakeholder's involvement in decision-making process	.485	.703
DM04	Predicting the influence of decisions on stakeholders	.546	.677
DM05	Predicting stakeholder's reactions in implementing decisions	.515	.688
	Group 5 - Cronbach's Alpha		**0.783**
AE01	Implementing strategies based on schedule plans	.618	.723
AE02	Implementing appropriate strategies to manage stakeholders	.627	.718
AE03	Flexibility in handling stakeholder's reactions	.589	.732
AE04	Compromising conflicts among stakeholders	.560	.742
AE05	Evaluating stakeholder's satisfaction in achieving preset goals	.403	.790
	Group 6 - Cronbach's Alpha		**0.882**
CS01	Communicating with stakeholders	.523	.878
CS02	Maintaining good relationships with stakeholders	.665	.866
CS03	Promoting trust and respect each other	.689	.864
CS04	Building knowledge and experience sharing working environment	.605	0.87
CS05	Reducing uncertainty	.586	.873
CS06	Making alignment to achieve mutual project objectives	.749	.859
CS07	Promoting positive relationships among stakeholders	.711	.862
CS08	Top management support	.598	.872
CS09	Continuing analyze the change of stakeholders	.540	.877

Note: *(1) Corrected Item – Total correlation*
(2) Cronbach's alpha if Item deleted

4.3.2 Exploratory Factor Analysis (EFA)

EFA is then used to reduce information of all attributes in the dataset but still retain most information of observed attributes (Tabachnick and Fidell, 2007). In this study, factor analysis via principal axis factoring with promax oblique rotation is employed because its result reflects more accurately than orthogonal solution such as varimax (Hair et al., 2010). KMO and Barlett's Test is also applied to examine whether observed attributes are mutually correlated or not. Because the KMO coefficient is equal to 0.899 (higher than 0.6), Bartlett's test is statistically significantly with p-value at 0.000, these attributes are mutually correlated (see as table 4.18).

Table 4.18 KMO and Bartlett's test results

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.899
Bartlett's Test of Sphericity	Approx. Chi-Square	2045.359
	df	351
	Sig.	.000

Based on the characteristics and underlying relationships among the factors, six components have been identified and re-named accordingly: (i) Work Environment (WE); (ii) Management Activity (MA); (iii) Stakeholder Information (SI); (iv) Project Organization (PO); (v) Stakeholder Characteristic (SC); (vi) Prediction (PD). Their Cronbach's alpha coefficients which are in turn 0.873, 0.844, 0.748, 0.773, 0.742, 0.709 are highly reliable. The eigenvalue is 1.038 (greater than 1.0) and explained exceed 50% of the total variance (accounted for 51.661%) which reflect their statistical significance (Field, 2009; Hair et al., 2010). Simultaneously, disparity among factor loading coefficients of an attribute loading on factors are greater than 0.3, the distinct value among factors have been ensured (Tabachnick and Fidell, 2007). The result of factor analysis shows at the table 4.19 and 4.20.

Table 4.19 Principal components analysis results

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumu-lative%	Total	% of Variance	Cumu-lative %	Total
1	9.841	36.447	36.447	9.371	34.706	34.706	7.386
2	1.836	6.799	43.246	1.368	5.066	39.771	7.002
3	1.548	5.734	48.980	1.119	4.143	43.915	5.390
4	1.281	4.745	53.725	.821	3.042	46.956	3.773
5	1.095	4.054	57.779	.730	2.703	49.659	5.561
6	1.038	3.846	61.625	.541	2.002	51.661	5.263

Extraction Method: Principal Axis Factoring.

Table 4.20 Pattern matrix of six components

Component	Items	Code	1	2	3	4	5	6
Work Environment (WE)	Making alignment to achieve mutual project objectives	CS06	.914					
	Promoting positive relationships among stakeholders	CS07	.838					
	Promoting trust and respect on each other	CS03	.614					
	Maintaining good relationships with stakeholders	CS02	.584					
	Building knowledge and experience sharing working environment	CS04	.561					
	Reducing uncertainty	CS05	.537					
	Top management support	CS08	.483					
Management Action (MA)	Implementing strategies based on schedule plans	AE01		.884				
	Clear and transparent decisions	DM01		.701				
	Implementing appropriate strategies to manage stakeholders	AE02		.671				
	Communicating with stakeholders	CS01		.602				
	Evaluating alternative solutions based on the stakeholder's concerns	DM02		.558				
	Flexibility in handling stakeholder’s reactions	AE03		.497				
Stakeholder Information (SI)	Understanding stakeholder's needs and expectations	II04			.895			
	Identifying and listing stakeholders	II02			.534			
	Assessing and determining stakeholder’s urgency	SA03			.401			
	Exploring stakeholder's experiences	II03			.369			

Table 4.20 Pattern matrix of six components (continued)

Component	Items	Code	1	2	3	4	5	6
Project Organization (PO)	Allocating resources efficiently	MS02				.665		
	Flexible project organization	MS04				.431		
	Well-organized project team members	MS03				.367		
	Well-defined project objectives	II01				.334		
Stakeholder Characteristic (SC)	Identifying and understanding stakeholder's attitudes	SA06					.860	
	Assessing and determining stakeholder’s knowledge	SA05					.546	
	Identifying and understanding stakeholder's working style	II05					.340	
Prediction (PD)	Predicting the influence of decisions on stakeholders	DM04						.663
	Predicting stakeholder's reactions in implementing decisions	DM05						.594
	Identifying and predicting stakeholder's influence on each other	SA08						.481

Extraction Method: Principal Axis Factoring.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 7 iterations.

4.3.3 Discussions

1) Work Environment (WE)

It is widely confirmed that harmonious working conditions always play a vital role to promote people doing their best. From the result, the "working environment" component has explained the greatest variance of the factors, accounted for 34.71% in total which comprises "Making alignment to achieve mutual project objectives", "Promoting positive relationships among stakeholders", "promoting trust and respect for each other", "Maintaining good relationships with stakeholders", "Building knowledge and experience sharing working environment", "Reducing uncertainty" and "Top management support". A construction project which comprises the risk and uncertainty combine with the varied-concerns of the stakeholders participated, is the potential resource of controversial issues and adversarial relationships. These constitutions make the construction working environment in Vietnam is getting more complicated (Nguyen, 2005; Tam and Hadikusumo, 2015). Therefore, a favorite working atmosphere which is the guarantee of cooperative relationship among construction stakeholders must be built and maintained. To achieve it, the alignment of common project goals needs to be set and become the direction so that the parties focus on rather than their own objectives. The healthy bonds between project management team and other stakeholders as well as among stakeholders should also be built because the trust among them will be improved for mitigating certainty and willingness for sharing their resources, data and knowledge together to ensure a successful project (Pinto, et al., 2009; Tam and Hadikusumo, 2015). In addition, Cheung and Rowlinson (2007) have concluded that top senior support has significantly contributed to the relationship management culture, without them, the harmonious working environments would not be existed (Long et al., 2004).

2) Management Activity (MA)

Effective management actions of a project manager and his/her team is the central role of managing project stakeholders. The importance of these managerial activities is showed at 5.01% in total variance it explained. All of the six sub-factors which are “Implementing strategies based on schedule plans”, “Clear and transparent decisions”, “Implementing appropriate strategies to manage stakeholders”, “Communicating with stakeholders”, “Evaluating alternative solutions based on the stakeholder's concerns”, “Flexibility in handling stakeholder’s reactions” relate to the strategic plans and activities in managing stakeholders. In other words, this is the interacting action between project management team and their partners. The proper planning which requires project teams to utilize appropriate management techniques is one of important factors affecting on any organization success (Long et al., 2004; Nguyen and Chileshe, 2015). In addition, because of the involvement of parties or individuals who play decisive actors in running projects smoothly (Long et al., 2004), effectively interacting with stakeholders by communicating, taking care of their concerns, resolving their problems and flexibility in managing them are the prerequisites. Through interactions, not only individual bonds could be strengthened but also the process of information exchange among them can be ensured (Tam and Hadikusumo, 2015), and increase the chance for achieving project success (Kim and Huynh, 2008). Clear and transparency of managerial decisions and timely resolve their reactions should be implemented to motivate them to behave thoughtfully and unwilling attitudes, thus, can be get rid of to get a better performance because when their concerns are resolved completely, collaborative attitudes among parties will be established.

3) Stakeholder Information (SI)

In order to work effectively with stakeholders, the information is an indispensable factor that must be paid enough attention. In this study, the

information of stakeholder includes “Understanding stakeholder's needs and expectations”, “Identifying and listing stakeholders”, “Assessing and determining stakeholder’s urgency”, “Exploring stakeholder's experiences” which has explained 4.14% total variance. Obviously, one of difficulties in coordinating with stakeholders is the misunderstanding among them. Thus, understanding and determining their information is the precondition for the project team to manage them well. In this regard, they must determine stakeholder’s desires and analyze their level of urgency to adapt accordingly. Based on the basic information input, the list of stakeholders should be listed and classified carefully. This action is the precondition of project success. Furthermore, in the VCI, because crises of any organizations happen frequently, real capability must be emphasized while evaluating the trust of partner. However, an important yardstick in assessing them is their reputation and experience which is performed in their existing projects because reputation shows their ability to work for a long time, it is a time-consuming process and a costly asset (Tam and Hadikusumo, 2015).

4) Project Organization (PO)

This component comprises four factors which are: “Allocating resources efficiently”, “Flexible project organization”, “Well-organized project team members”, and “Well-defined project goals and objectives” have explained 3.4% total variance in the data-set. The result has reflected the significance of project organization’s role in achieving project success. A project organization which ensures the clear regulation and flexible administrative procedures will create the ideal condition for the project team performs. Moreover, if the responsibility and authority of a project team are assigned specifically and systematically, their roles are clearly determined, they have more opportunity to perform and contribute more positively (Kim and Huynh, 2008). Similarly, goals and objectives of a project should be formulated well because it is one of the popular risks leads to unexpected changes during the construction stage and the conflicts between

stakeholders (Long et al., 2004). One more important thing in this component is the effective distribution resource of project organization. In this study, “resources” are not only money, time or man-power in managing stakeholders, but also it consists of the efforts and leadership which is the continuing involvements of project managers and seniors to ensure the existence of general agreements and keep projects running smoothly.

5) Stakeholder Characteristic (SC)

“Identifying and understanding stakeholder's attitudes”, “Assessing and determining stakeholder’s knowledge” “Identifying and understanding stakeholder's working style” are the sub-factor in this factor which explained 2.7% of the total variance. In Vietnam, the lack of professional work attitude and the low personal culture standard at sites have become one of the most concern issue in both of local and foreign organization (Ling and Bui, 2010; Hung and Wang, 2016). If they meet the requirement in both of technical and managerial skills, without the right “attitude” they will not perform their work effectively (Nguyen and Hadikusumo, 2017). However, these adversarial behaviors could be reduced by a process of sharing and learning each other’s goodwill, the working style of stakeholders, therefore, should be taken into account while acquainting and understanding them (Nguyen and Rose, 2009). In the construction industry, begin a project with a newcomer is harder than collaborate with an experienced-partner because of the lack experience and knowledge they accumulated in the past (Tam and Hadikusumo, 2015). The more project-related knowledge of a stakeholder, the chance for them to achieve their objectives increases.

6) Prediction (PD)

The last group is the “prediction-related factors” in managing stakeholders. Although this factor has explained only 2.002% of the variance, “predicting the influence of decisions on stakeholders”, “predicting stakeholder’s reactions in implementing decisions”, and “identifying and predicting stakeholder’s influence

on each other" should be considered adequately by project manager. In this industry, both of tangible and intangible things simultaneously exist which require a lot efforts of any project management teams to apprehend. If the reaction of stakeholders could be estimated well during decision-making process, they would be able to prepare themselves to adjust the strategy to handle with stakeholder's concern. The disagreement among stakeholders, therefore, could be compromised so that right decisions will be made (Oppong et al., 2017). Contrarily, the influence of decision on stakeholders as well as interactive influence among stakeholders is so elusive that requires lot efforts to evaluate. These managerial actions play important role to plan and execute sufficiently the process of stakeholder management. Because of its intensity could be estimated well, problematic situations may be prevented and motivated to a successful project (Bourne and Walker, 2005).

4.4 Results of SEM

4.4.1 Measurement Model (CFA)

1) Model identification

Through EFA stage, the six-dimensional structure of stakeholder management factors have been extracted and then validated during Confirmatory Factor Analysis stage. The figure 4.1 below shows the conceptual model and proposed relationships among these six factors:

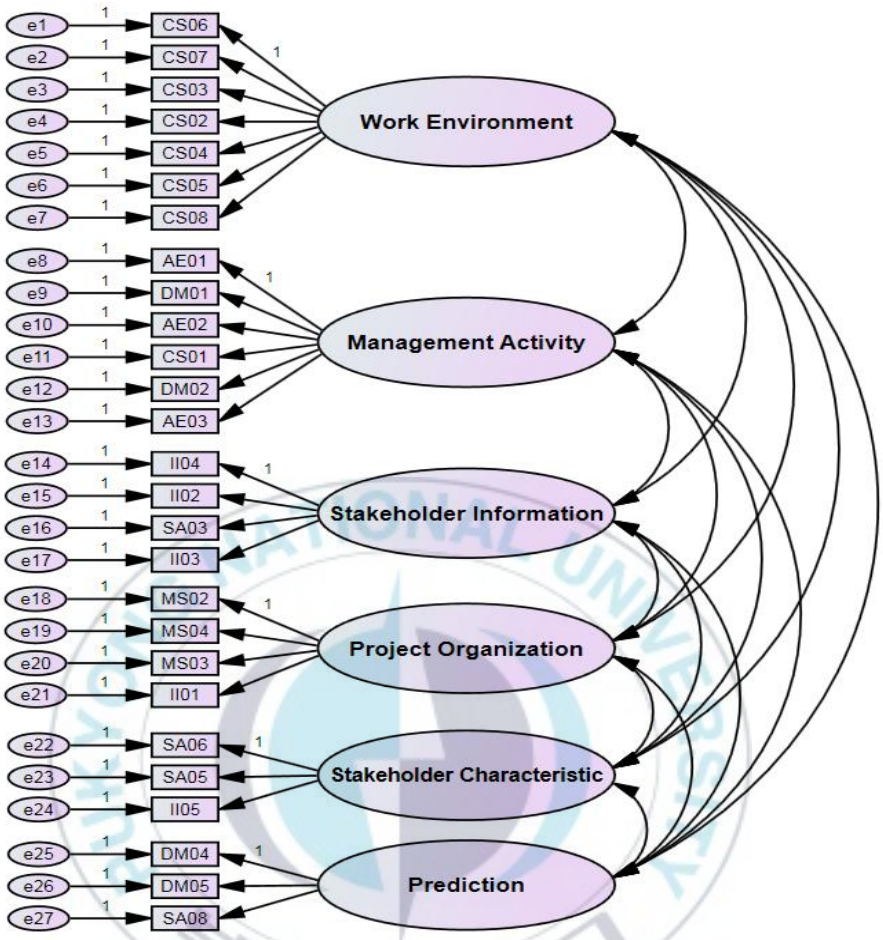


Figure 4.1 Conceptual measurement model

In conceptual model, the suitability and intensity of relationships between observed and latent variables will be evaluated by computing in IBM AMOS Software version 22. The obtained outputs are then assessed according to five main Goodness of Fit (GOF) indices including: Ratio of minimum discrepancy to the degrees of freedom (CMIN/DF); and root mean square error of approximation (RMSEA); comparative fit index (CFI), Tucker-Lewis index (TLI), goodness of fit index (GFI) (Kline, 2015). The details of these fit indices are showed as follow:

Table 4.21 GOF indices of the conceptual model

Criteria	Threshold	Conceptual model
Chi-square/DF (CMIN/DF)	1 (very good) – 2 (threshold)	1.570
RMSEA	< 0.05 (very good) – 1 (threshold)	0.059
CFI	0 (no fit) – 1 (best fit)	0.904
TLI	0 (no fit) – 1 (best fit)	0.891
GFI	0 (no fit) – 1 (best fit)	0.828

It can be stated that the indices are acceptable level, however this conceptual model need to be improved to attain a better-fit model.

2) Model modification

Referred as the table 4.22 below, the factor loadings which range from 0.569 to 0.809 indicated that all of them are acceptable and will be kept for the next steps (Kline, 2015).

Table 4.22 Standardized Regression Weights between constructs and indicators

Relationship			Estimate	Relationship			Estimate
CS06	<---	WE	0.809	II04	<---	SI	0.66
CS07	<---	WE	0.782	II02	<---	SI	0.711
CS03	<---	WE	0.728	SA03	<---	SI	0.584
CS02	<---	WE	0.698	II03	<---	SI	0.661
CS04	<---	WE	0.687	MS02	<---	PO	0.611
CS05	<---	WE	0.638	MS04	<---	PO	0.651
CS08	<---	WE	0.617	MS03	<---	PO	0.624
AE01	<---	MA	0.776	II01	<---	PO	0.651
DM01	<---	MA	0.614	SA06	<---	SC	0.841
AE02	<---	MA	0.752	SA05	<---	SC	0.755
CS01	<---	MA	0.626	II05	<---	SC	0.569
DM02	<---	MA	0.711	DM04	<---	PD	0.669
AE03	<---	MA	0.665	DM05	<---	PD	0.671
				SA08	<---	PD	0.668

Secondly, detect the co-variances relationship among observed variables within each construct. By this way, co-variances which has high modification indices (MI>4), relationships between them will be made. According to the table 4.23, the links which represent as two-way arrows between e1-e2; e5-e6, e8-e9, e23-e24 have been executed in the conceptual model.

Table 4.23 Modification indices (MI) among observed variables

Co-variances			M.I.	Par Change
e23	<-->	e24	5.945	-0.119
e8	<-->	e9	4.078	0.069
e5	<-->	e6	7.634	0.108
e1	<-->	e2	24.708	0.132

Lastly, in accordance with the standardized residual correlation matrix table (referred as table 4.24), an observed variable which highly correlates with the others will be removed. As a consequence, factors of SA03, CS08, CS02 were get rid of the dataset.

Table 4.24 Standardized Residual Co-variances of constructs

	II05	SA05	SA06	II01	II04	AE03	DM02	CS01	AE02
SA03	2.633	0.149	0.303	0.743	-0.172	0.293	0.547	0.394	1.936
CS08	0.561	0.002	-0.066	1.913	0.133	1.961	0.675	2.26	0.997
CS02	0.652	1.143	2.268	1.243	-1.146	0.877	1.434	2.888	0.987

Through model modification, the measurement model has been adjusted. The next task is to evaluate and check the validity and reliability of the constructs.

a. Construct validity

Table 4.25 Validation of the six constructs

Item	Standardized regression weights						SMC	CR	AVE
	WE	MA	SI	PO	SC	PD			
CS06	0.754						0.57		
CS07	0.714						0.51		
CS03	0.728						0.53	0.838	0.509
CS04	0.719						0.52		
CS05	0.647						0.42		
AE01		0.761					0.58		
AE02		0.767					0.59		
CS01		0.611					0.37	0.803	.507
DM02		0.694					0.48		
AE03		0.682					0.47		
II04			0.673				0.45		
II02			0.701				0.49	0.723	0.465
II03			0.672				0.45		
MS02				0.623			0.38		
MS04				0.663			0.43	0.729	0.403
MS03				0.623			0.39		
II01				0.627			0.41		
SA06					0.799		0.64		
SA05					0.808		0.65	0.795	0.566
II05					0.636		0.40		
DM04						0.677	0.46		
DM05						0.674	0.45	0.71	0.449
SA08						0.658	0.43		

The standardized path coefficients, Squared Multiple Correlations (SMCs), Composite Reliability (CR) and Average Variance Extracted (AVE) of the constructs in the measurement model have been showed in the Table 4.25. The strength of relationship between constructs and their indicators reflect by the standardized regression weights. For examples: the CS06 indicator has the highest relation with WE construct. Similarly, AE02, MS04, SA05, and DM04 more

strongly related to MA, SI, PO, SC, and PD respectively compared to the other manifests within each un-observed variable.

Although the AVE value of a half of latent factors are below 0.5 (AVE value of the SI, PO, PD construct are equal to 0.465; 0.403; 0.449 respectively, see table 4.26), their composite reliability (CR) all are higher than 0.7 (0.723; 0.729; 0.795 respectively), the convergent validity of these construct are still adequate (Fornell and Larcker, 1981).

Table 4.26 Discriminant test result

	WE	MA	SI	PO	SC	PD
WE	0.493					
MA	0.477	0.475				
SI	0.482	0.43	0.429			
PO	0.506	0.588	0.364	0.402		
SC	0.362	0.342	0.462	0.396	0.566	
PD	0.566	0.366	0.573	0.307	0.441	0.448

The result of measurement model of "project success" criteria has also been validated and is showed at the table 4.27. Accordingly, the validity of this construct is acceptable.

Table 4.27 Validation result of "Project Success" constructs

Construct	Observed variable's name	Code	SRW	CR	AVE
Project success (PS)	Timely completion	PS01	0.794	0.824	0.546
	Within budget	PS02	0.552		
	Quality achievement	PS03	0.864		
	Stakeholder satisfaction	PS04	0.708		

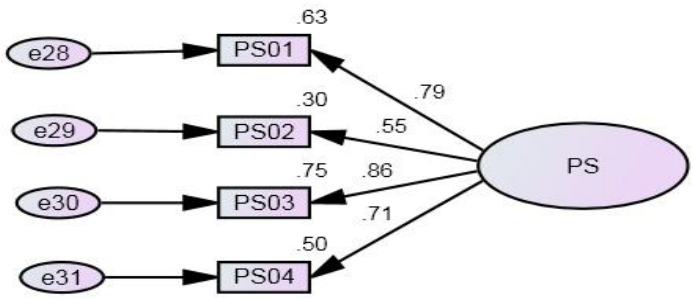


Figure 4.2 Measurement model of "Project success" construct

b. Reliability test

From the table 4.28, it is indicated that all of GOF indices of the better-fit measurement model has increased and are accepted as "Excellent" level, except for GFI Index (Kline, 2015).

Table 4.28 GOF indices of better-fit measurement model

Criteria	Threshold	Better-fit	Assessment
Chi-square/DF (CMIN/DF)	1 (very good) – 2 (threshold)	1.239	Excellent
RMSEA	< 0.05 (very good) – 1 (threshold)	0.038	Excellent
CFI	0 (no fit) – 1 (best fit)	0.966	Excellent
TLI	0 (no fit) – 1 (best fit)	0.959	Excellent
GFI	0 (no fit) – 1 (best fit)	0.880	Acceptable

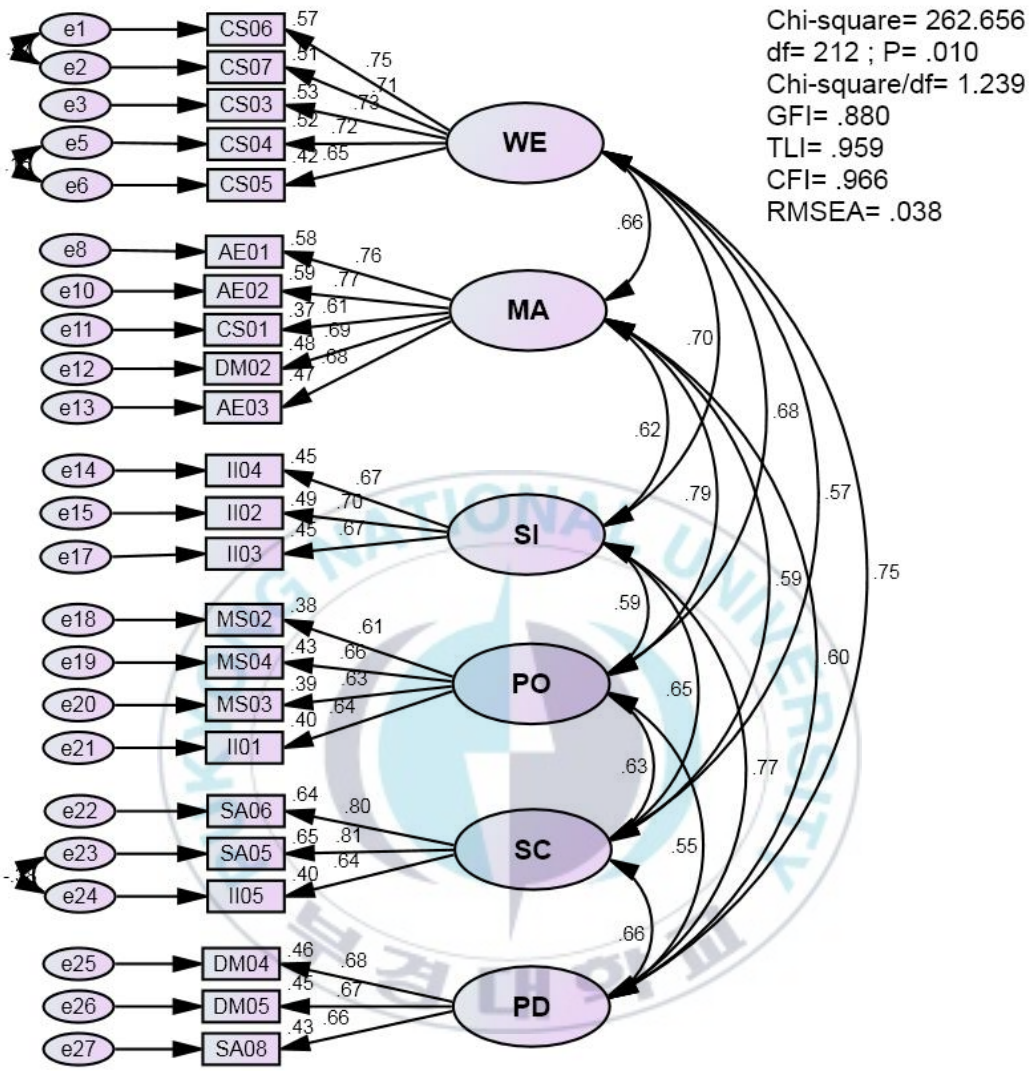


Figure 4.3 Better-fit measurement model

4.4.2 Structural model

1) Model identification

Based on theoretical knowledge and previous works, hypothesized relationships are proposed as the following table (table 4.29)

Table 4.29 Hypothesized relationship among constructs

No	Hypothesized relationship among constructs		
H1	Stakeholder Characteristic (SC)	<---	Stakeholder Information (SI)
H2	Project Organization (PO)	<---	Stakeholder Information (SI)
H3	Prediction (PD)	<---	Stakeholder Characteristic (SC)
H4	Work Environment (WE)	<---	Prediction (PD)
H5	Management Activity (MA)	<---	Prediction (PD)
H6	Management Activity (MA)	<---	Project Organization (PO)
H7	Work Environment (WE)	<---	Project Organization (PO)
H8	Project Success (PS)	<---	Project Organization (PO)
H9	Project Success (PS)	<---	Work Environment (WE)
H10	Project Success (PS)	<---	Management Activity (MA)

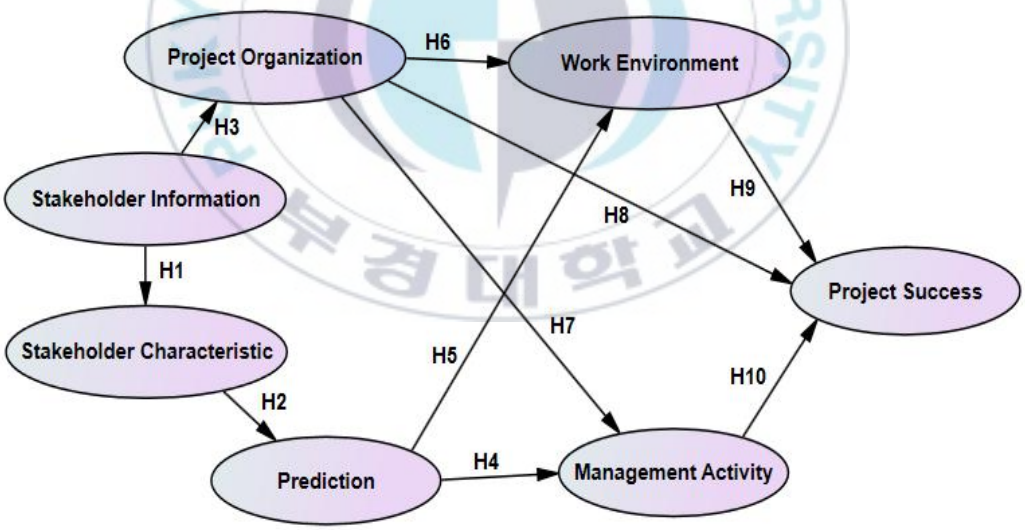


Figure 4.4 Initial structural model

2) Model assessment

Table 4.30 Hypothesized relationship result

Hypothesis				Estimate	S.E.	C.R.	P	Interpretation
H1	SC	<---	SI	0.945	0.148	6.38	***	Supported
H2	PO	<---	SI	0.645	0.122	5.285	***	Supported
H3	PD	<---	SC	0.611	0.095	6.405	***	Supported
H4	MA	<---	PD	0.272	0.096	2.832	0.005	Supported
H5	WE	<---	PD	0.544	0.113	4.818	***	Supported
H6	WE	<---	PO	0.527	0.123	4.299	***	Supported
H7	MA	<---	PO	0.795	0.144	5.512	***	Supported
H8	***PS***	***<---***	***PO***	***0.174***	***0.217***	***0.801***	***0.423***	***Not Supported***
H9	PS	<---	WE	0.383	0.133	2.888	0.004	Supported
H10	PS	<---	MA	0.367	0.172	2.13	0.033	Supported

The table 4.30 indicates whether the hypothesized relationship among constructs which are supported or not by evaluating the values of critical ratios (CR), standard errors (SE) and their level of statistical significance (P value). It can be seen that only the relationship between PO and PS construct is not accepted because of the low value of CR (equal 0.801) with p value exceed of 0.05 (p = 0.423). It is excluded out of the model.

After deleting the hypothesis between PO and PS construct, the model has been changed. The improvement of the GOF indices of the better-fit structural model compare to conceptual model is presented as the below table (table 4.31).

Table 4.31 GOF indices of the better-fit structural model

Criteria	Threshold	Concep -tual model	Better-fit model	Assessment
Chi-square/DF (CMIN/DF)	1 (very good) – 2 (threshold)	1.500	1.371	Excellent
RMSEA	< 0.05 (very good) – 1 (threshold)	0.056	0.048	Excellent
CFI	0 (no fit) – 1 (best fit)	0.914	0.937	Good
TLI	0 (no fit) – 1 (best fit)	0.904	0.929	Good
GFI	0 (no fit) – 1 (best fit)	0.820	0.835	Acceptable

Table 4.32 and figure 4.5 below show the result of hypothesis among constructs with their path coefficients and p-value after getting rid of a hypothesized relationship between Project Organization and Project success (H9).

Table 4.32 Standardized path coefficients of the final structural model

Hypothesized relationship				Path coeff	Estimate	S.E.	C.R.	P	Interpre-tation
H1	SC	<---	SI	0.775	0.940	0.147	6.381	***	Supported
H2	PO	<---	SI	0.711	0.639	0.121	5.268	***	Supported
H3	PD	<---	SC	0.726	0.610	0.095	6.397	***	Supported
H4	WE	<---	PO	0.458	0.538	0.124	4.344	***	Supported
H5	MA	<---	PO	0.683	0.807	0.146	5.530	***	Supported
H6	MA	<---	PD	0.258	0.269	0.096	2.811	0.005	Supported
H7	WE	<---	PD	0.523	0.541	0.113	4.805	***	Supported
H9	PS	<---	WE	0.383	0.427	0.127	3.355	***	Supported
H10	PS	<---	MA	0.417	0.462	0.126	3.675	***	Supported

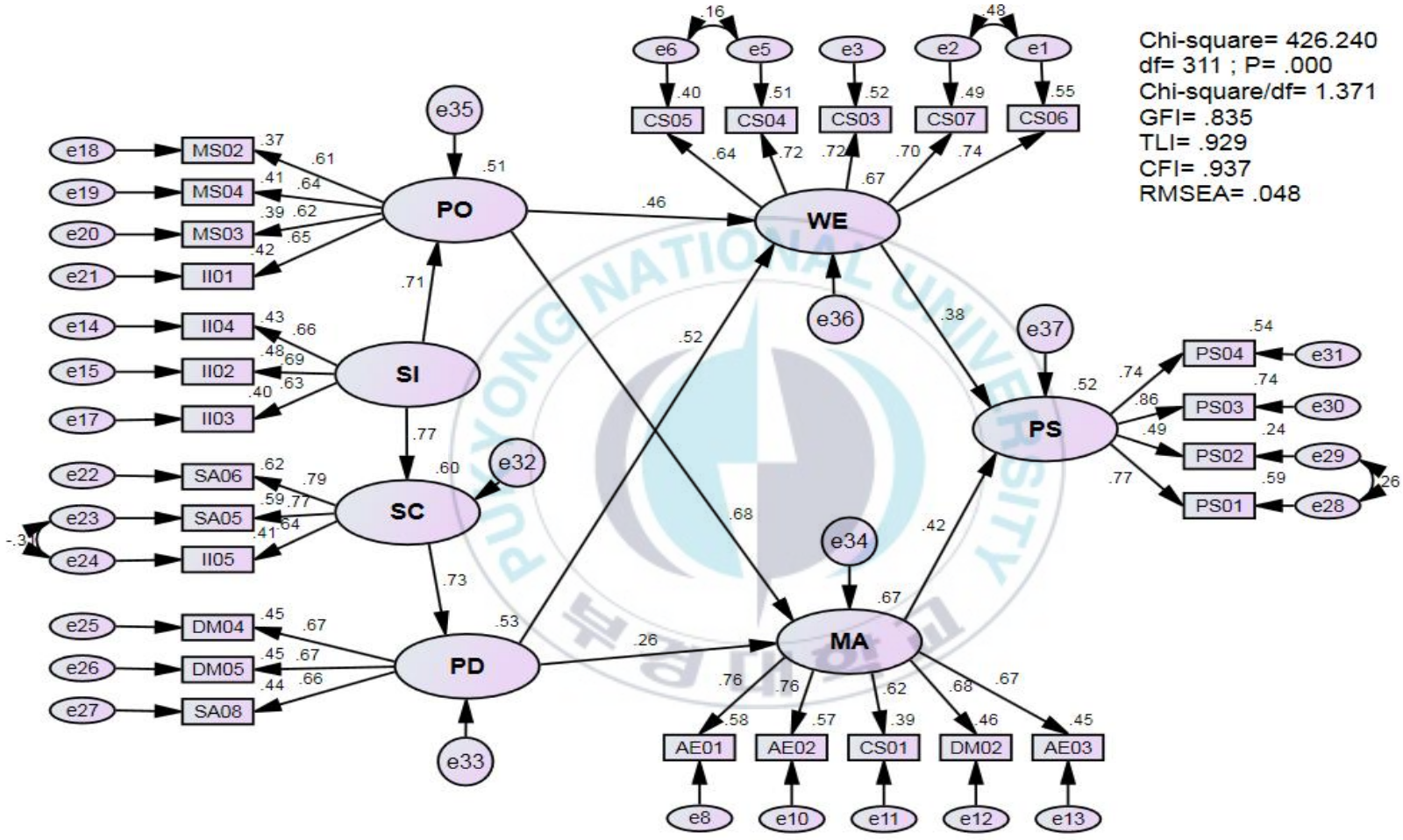


Figure 4.5 Final structural model

From table 4.32 and figure 4.5, it can be seen that in both of MA and WE constructs which have direct impacts on PS construct, the corresponding values of MA factor is higher than WE factor (0.42 compared to 0.36) with 99% confidence (p value < 0.001).

Within MA construct, AE01 and AE02 manifests have the strongest path (0.76 are in both) and the factor loadings of DM02, AE03, CS01 are relatively high, with 0.68; 0.67; and 0.61 respectively. Similarly, the CS06 indicator shows its strongest effect on WE construct (the path coefficient is 0.74), followed by CS04, CS03 (0.72 for both), CS07 (0.70), and CS05 (0.60). Although the four constructs SI, SC, PO and PD do not have significant influence on PS, they can effect on PS in both of direct and indirect way through MA and WE constructs:

PD construct has a high positive relationship with WE and MA construct (the standardized path coefficients are in turn 0.52 and 0.26). In this factor, the factor loadings of three their indicators are seemly equal (0.67 and 0.66).

Similarly, the construct of Project Organization (PO) can influence on both of MA and WE which is portrayed by the values of factor loading (0.68 and 0.46 respectively). The standardized path coefficients between this latent factor and its measure are positive and statistically significant (the values range from 0.61 to 0.65).

Stakeholder Characteristic (SC) construct is strongly related to PD construct which is supported by a high path coefficient of 0.73 and statistical significance (p-value is less than 0.001). Within this construct, while SA06 and SA05 manifests show their higher impact on SC than the others (the standardized path coefficients are 0.79 and 0.77 respectively), the path coefficients of II05 is slightly lower of 0.64

Stakeholder Information (SI) construct strongly impact on both of SC and PO construct by the factor loadings are in turn 0.77; 0.71 and is accepted by a statistical significant value p < 0.001. Inside it, the path coefficient values of three

indicators II02, II04, and II03 are 0.69; 0.66; 0.63 respectively which reflect the high influence on the SI construct.

Within PS construct, interestingly, PS03 is the strongest path (0.86), followed by PS01 (0.77) and PS03. Although PS02 also has a positive relationship on PS, it can influence slightly and proved by a lower factor loading of 0.49.

4.4.3 Discussions

Through the systematical and logical process from data collection to the result and discussion of structural model, the inter-relationship between stakeholder management and project success has been explored entirely. From the initial 39 factors, through EFA stage, 27 factors were extracted and grouped into 6 groups namely: Work Environment (WE), Management Activity (MA), Stakeholder Characteristic (SC), Project Organization (PO), Stakeholder Information (SI), and Prediction (PD). However, the result of SEM indicates that only Work Environment (WE) and Management Activity (MA) can affect directly on the success of construction project with the stronger path between PS and MA (0.42) than with WE (0.38). In the four project success criteria, meeting quality specification (PS03) is influenced strongest (0.86), followed by punctual time completion (PS01, 0.77) and the satisfaction among stakeholders (0.74). With the disappointed performance of almost construction projects during the past time, the authorities need to carry out their managerial actions more effectively included: Implementing strategies based on schedule plans and appropriate strategies to manage stakeholders; evaluating alternative solutions based on stakeholder's concerns; flexibility in handling stakeholder’s reactions, clear and transparent decisions and communicating with stakeholders. Similarly, work environment need to be improved by making alignment to achieve mutual project objectives; promoting trust and respect on each other; building knowledge and experience sharing working environment; promoting positive relationships among stakeholders and reducing uncertainty.

Although Project Organization (PO) construct does not have direct influence on the success of construction projects, it can impact considerably on MA (0.68) and WE (0.46). Obviously, to support managerial decision and improve working environment, an effective project organization need to be built adequately that are: well-defined project goals and objectives, flexible project organization, well-organized project team members and allocating resources efficiently because these factors have considerably impacted on PO constructs in the final model (a range from 0.61 to 0.65 of factor loadings).

Similarly, project manager and his/ her team should estimate and foresee any situations what are happening around them because this kind of action will help them prevent adversarial circumstances so that WE can be enhanced and their decisions will be made more precisely. It is reflected by the relatively high impact on WE but a lower value on MA (0.52 and 0.26 respectively). Therefore, the forecasting actions of predicting the influence of decisions on stakeholders, predicting stakeholder's reactions in implementing decisions and predicting stakeholder's influence on each other should be considered because their effects on the latent factor PD are relatively high (all path coefficients are around 0.67)

From the result, it can be stated that determining the stakeholder information (SI) and stakeholder characteristic (SC) is the precondition of managing stakeholder. Although both of them do not have any direct links on PS, WE and MA construct, the factors of “identifying and listing stakeholders”; exploring stakeholder's needs, expectations and experiences” provide important information inputs for improving project organization (PO). It is represented by the high value of standardized coefficient (0.71) and strongly supported to SC construct which reflect on the biggest path coefficient (0.77) of the model. Through SI, Stakeholder Characteristic influences on Prediction so high that the attitudes, knowledge, and working style of stakeholders must be determined and understood sufficiently.

4.5 Result of Network Analysis

4.5.1 Communication Network

Project A

Table 4.33 Centrality metrics of communication network in project A

	Position	Degree	Closeness	Eigen-vector	Between-ness
1	Owner's representative	0.171	0.7	0.179	0.091
2	Project manager	0.343	0.824	0.217	0.934
3	***Project management team member***	***0.714***	***0.933***	***0.297***	***2.624***
4	Representative of consultancy firm	0.243	0.778	0.215	0.25
5	Consultant team leader	0.6	0.933	0.279	2.618
6	***Supervisor***	***0.757***	***1***	***0.31***	***2.959***
7	Design team leader	0.357	0.824	0.292	1.825
8	Design team member	0.371	0.824	0.283	1.825
9	Site manager	0.557	1	0.234	**4.109**
10	Site management team member	0.614	1	0.286	1.518
11	***Superintendent***	***0.8***	***1***	***0.318***	1.108
12	***Chief of construction group***	0.671	1	0.282	***4.109***
13	***Quality Control***	0.586	1	0.244	***4.109***
14	Sub-Superintendent	0.414	0.778	0.209	0.1
15	Sub-Chief of construction group	0.371	0.778	0.163	0.821

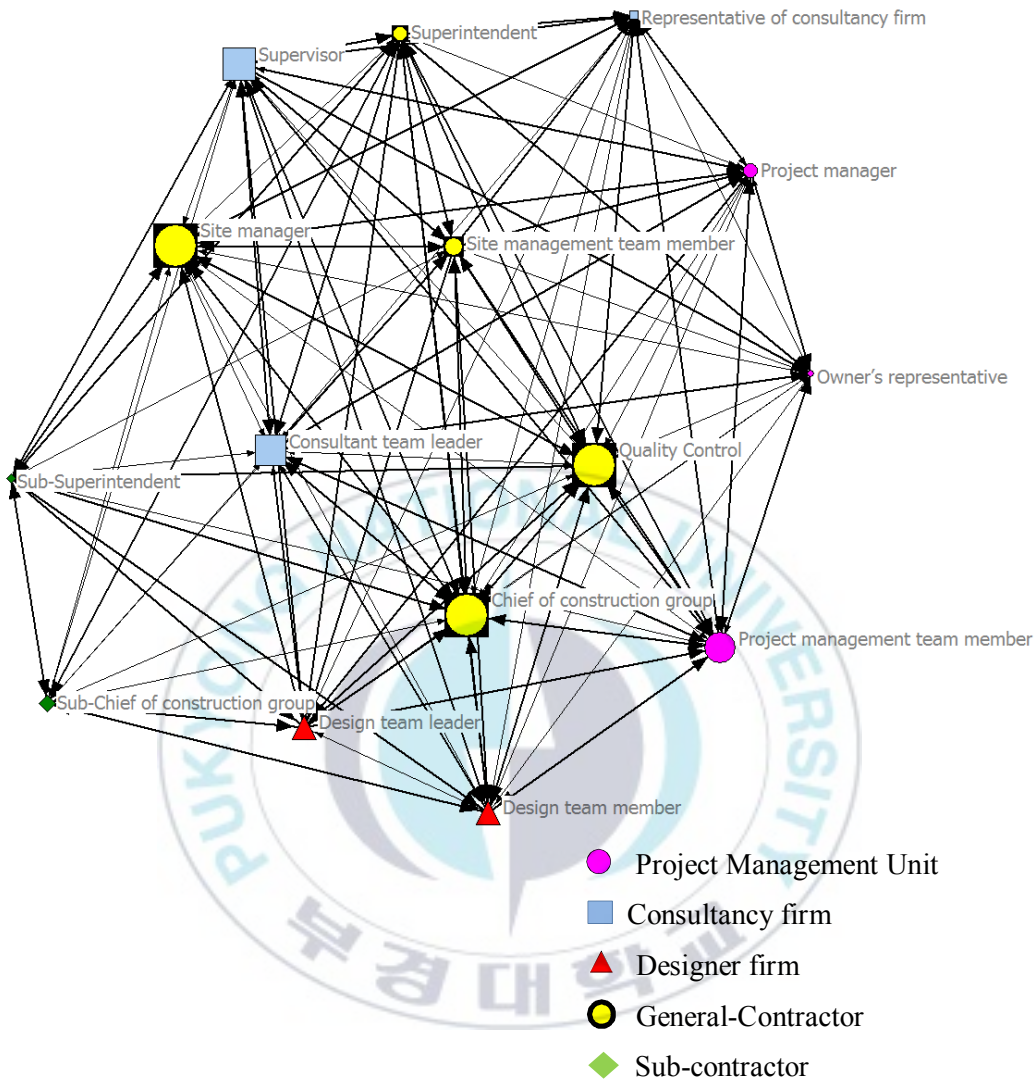


Figure 4.6 Communication Network of Project A

The table 4.33 and figure 4.6 show the highest value in degree, closeness, and eigenvector centrality of "project management team member" (group 1), "supervisor" (group 2), and "superintendent" (group 4). However, three positions in group 4 who are "site manager", "chief of construction group", and "quality control" own the highest betweenness centrality metrics (as same as 4.109).

Project B

Table 4.34 Centrality metrics of communication network in project B

Group	Position	Degree	Closeness	Eigenvector	Between -ness
1	Owner's representative	0.3	0.643	0.217	0.125
	Project manager	0.422	0.75	0.277	9.958
	Project management team member	***0.578***	***0.783***	***0.358***	***14.663***
2	Representative of consultancy firm	0.3	0.643	0.185	7.177
	Consultant team leader	***0.544***	***0.857***	***0.292***	***22.623***
	Supervisor	***0.611***	***0.857***	***0.329***	***24.856***
	Resident architect	0.033	0.486	0.014	0.333
3	Representative of firm	0.411	0.783	0.329	11.977
	Site manager	0.411	0.75	0.277	7.674
	Site management team member	0.467	0.818	0.311	**28.443**
	Superintendent	0.333	0.667	0.221	0.2
	Chief of construction group	0.233	0.6	0.139	4.936
	Quantity surveyor	0.278	0.643	0.18	0.905
4	Representative of firm	0.311	0.72	0.158	4.87
	Site manager	0.433	0.783	0.209	10.891
	Site management	0.311	0.621	0.162	3.011
	Superintendent	0.333	0.667	0.173	2.584
	Chief of construction group	0.2	0.6	0.078	0.792
	Quantity surveyor	0.211	0.621	0.08	0.98

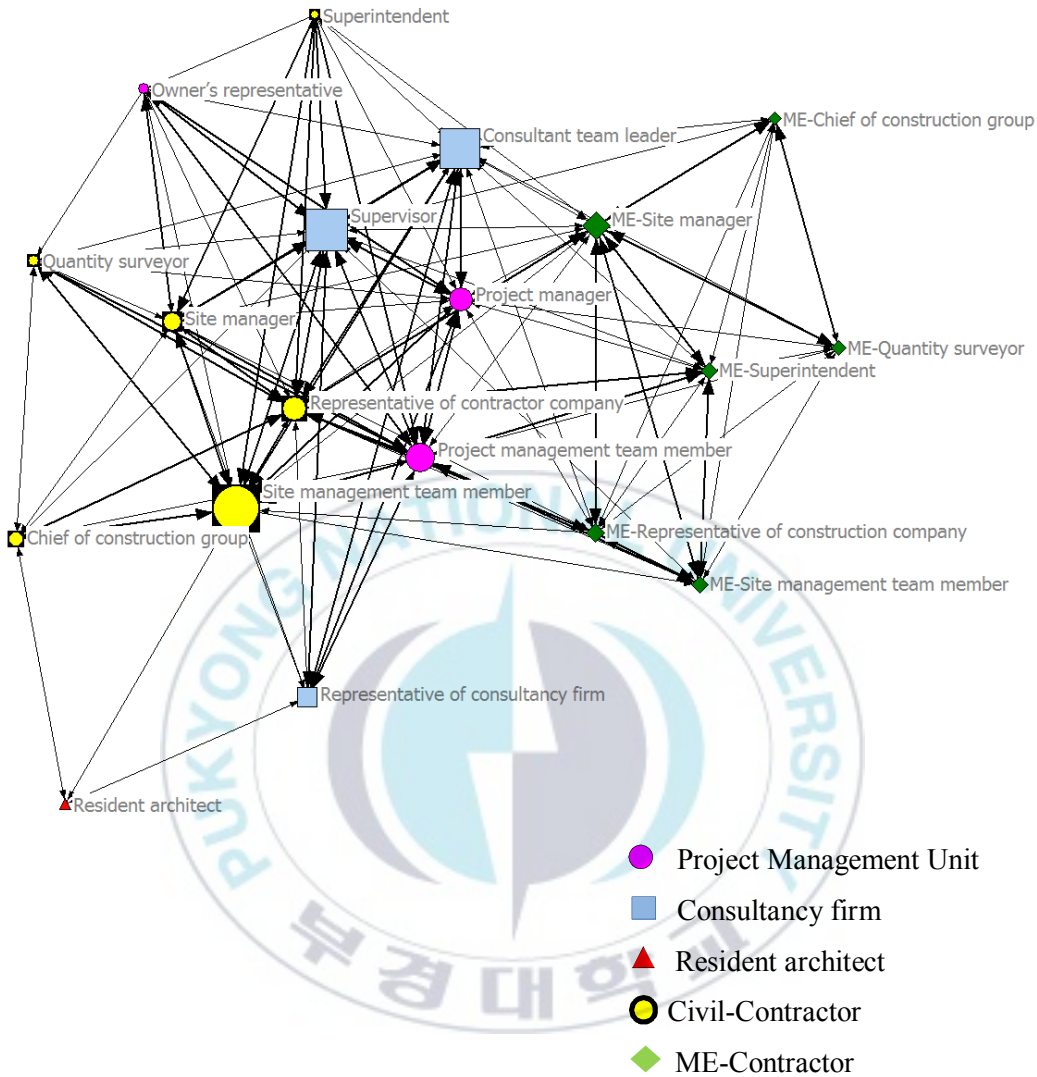


Figure 4.7 Communication network of project B

The important role of "project management team member" (group 1),"consultant team leader", and "supervisor" in group 2 have been indicated by the high values of all the four basic centrality metrics (bold and italic number in the table 4.34). However, interestingly, "site management team member" in group 4 who owns the highest value of betweenness centrality (28.443) show their most latent influential role in the network. The next places are "supervisor" and

consultant team leader" whose values of betweenness centrality are in turn 24.856 and 22.623.

4.5.2 Workflow Network

Project A

Table 4.35 Centrality metrics of workflow in project A

	Position	**Degree**	**Closeness**	**Eigen-vector**	**Between-ness**
1	Owner's representative	0.543	0.933	0.257	0.182
2	Project manager	0.614	0.933	0.278	0.182
3	***Project management team member***	***0.757***	***1***	***0.288***	***2.229***
4	Representative of	0.543	0.933	0.264	0.182
5	***Consultant team leader***	***0.743***	***1***	***0.283***	***2.229***
6	***Supervisor***	***0.829***	***1***	***0.307***	***2.229***
7	Design team leader	0.543	0.933	0.247	0
8	Design team member	0.514	0.933	0.242	0
9	***Site manager***	***0.757***	***1***	***0.286***	***2.229***
10	***Site management team member***	***0.786***	***1***	***0.303***	***2.229***
11	Superintendent	**0.786**	**1**	**0.29**	1.39
12	Chief of construction	0.6	1	0.215	**2.229**
13	Quality Control	0.586	1	0.223	**2.229**
14	Sub-Superintendent	0.371	0.737	0.199	0.458
15	Sub-Chief of construction	0.271	0.7	0.129	0

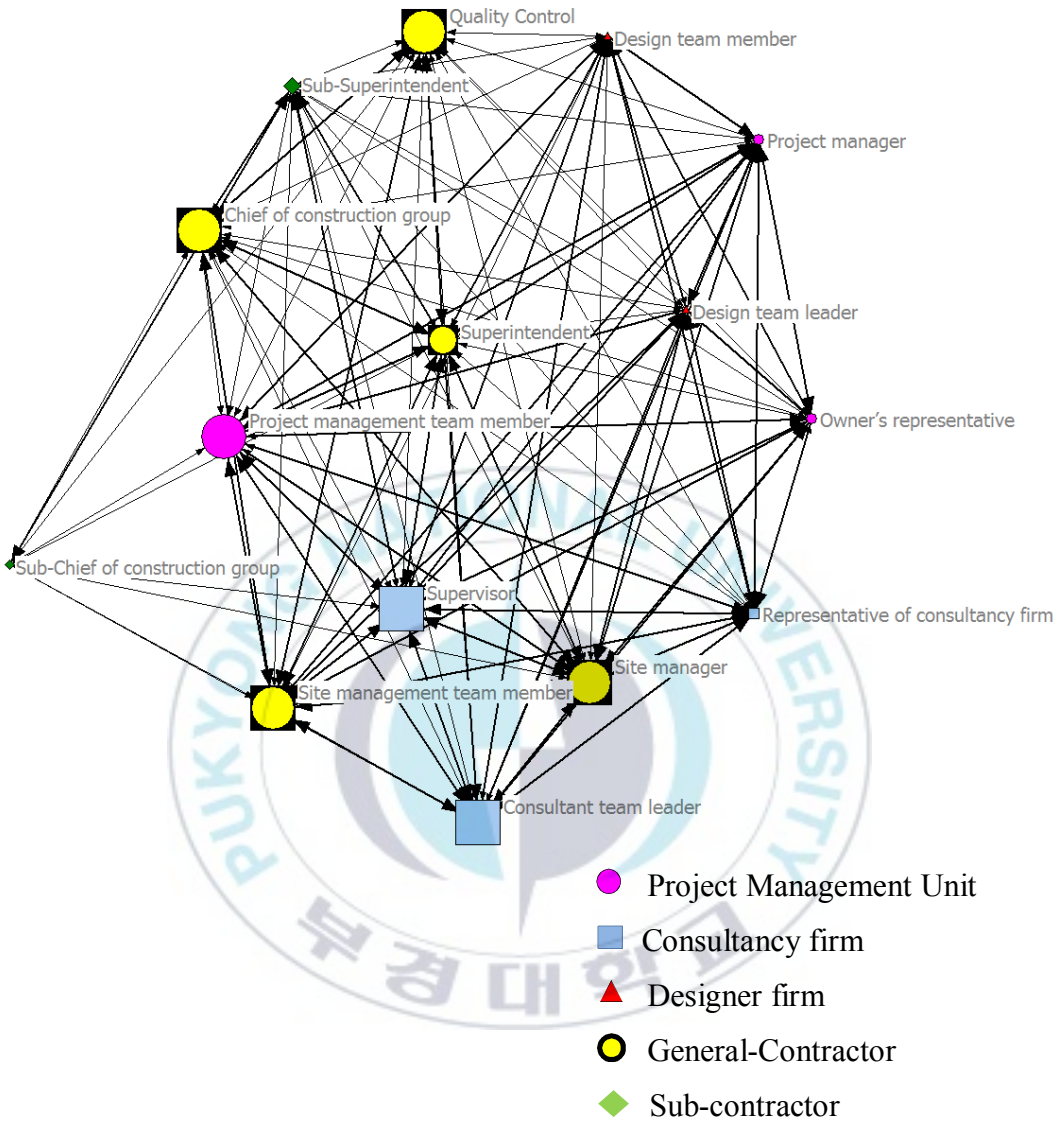


Figure 4.8 Workflow network of project A

In Project A, "supervisor" in group 2 who has the biggest values of four measuring metrics show their strongest influence in the network (the degree, closeness, eigenvector, and betweenness centrality metrics are in turn 0.829; 1; 0.307; 2.229) and similar to "Site management team member; "Superintendent" and "site manager" in group 4.. The lesser influential role of "project management team member" (group 1) and "consultant team leader" (group 2) are presented by

the lower values in degree centrality (0.757 and 0.743 respectively). Interestingly, although the first three metrics of "Chief of construction group" and "Quality Control" are quite low (refer as table 4.36), the indices of betweenness centrality of them are the same as the most influential actors of the network (equal to 2.229).

Project B

Table 4.36 Centrality metrics of workflow network in project B

Group	Position	Degree	Closeness	Eigen-vector	Between-ness
1	Owner's representative	0.544	0.783	0.226	1.463
	Project manager	0.611	0.857	0.259	6.073
	Project management team member	***0.656***	***1***	***0.288***	***14.786***
2	Representative of firm	0.511	0.857	0.213	3.125
	Consultant team leader	***0.611***	***0.9***	***0.292***	***10.208***
	Supervisor	0.611	0.9	0.281	7.054
	Resident architect	0.178	0.643	0.168	0.748
3	Representative of firm	0.578	0.857	0.287	7.706
	Site manager	0.511	0.818	0.238	3.577
	Site management team member	***0.689***	***1***	***0.312***	***14.786***
	Superintendent	0.389	0.72	0.196	1.569
	Chief of construction group	0.311	0.643	0.175	3.33
	Quantity surveyor	0.333	0.643	0.159	0.501
4	Representative of firm	0.533	0.818	0.223	4.87
	Site manager	0.611	0.9	0.259	7.462
	Site management team member	0.456	0.72	0.194	2.826
	Superintendent	0.489	0.783	0.212	2.406
	Chief of construction group	0.333	0.692	0.141	0.884
	Quantity surveyor	0.267	0.667	0.103	0.626

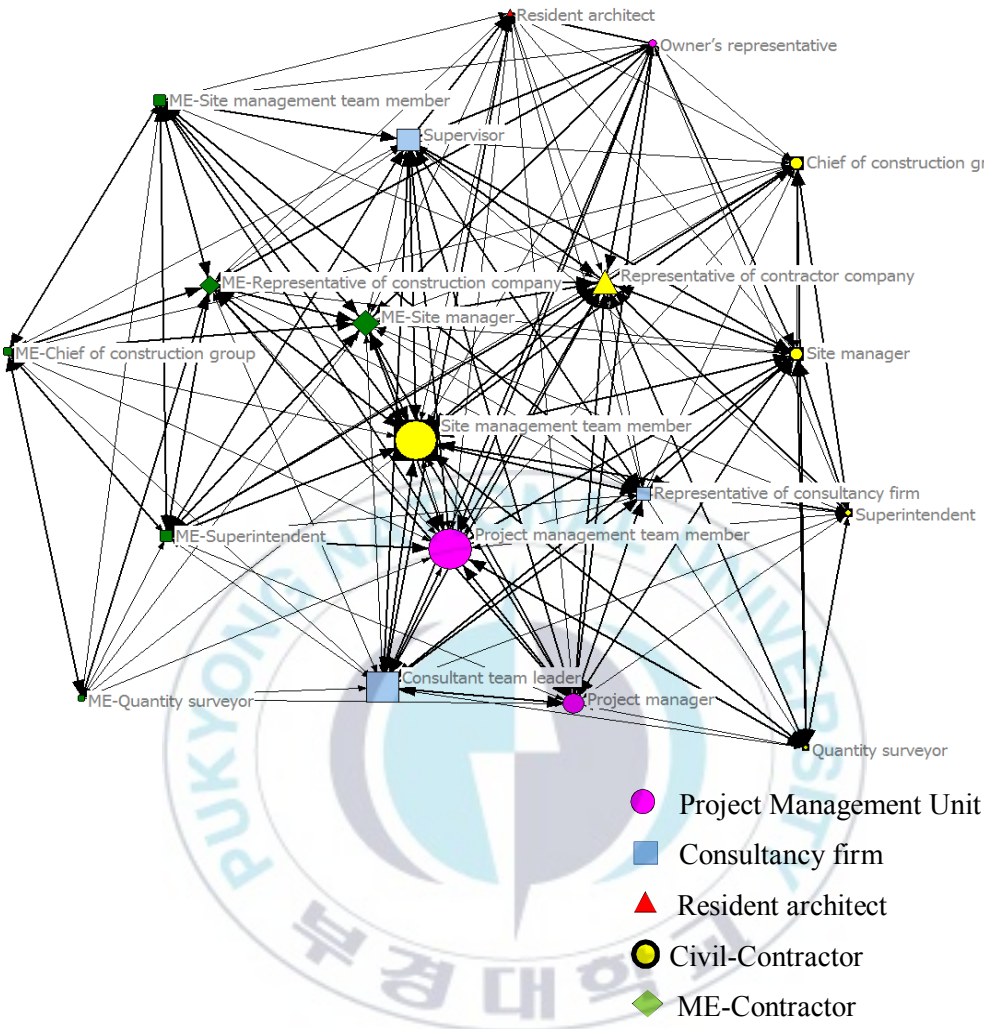


Figure 4.9 Workflow network of project B

The table 4.36 and figure 4.9 represent betweenness-based attributes which show the salient role of "site management team member" (group 4) who has the degree, closeness, eigenvector, betweenness centrality are in turn 0.689; 1; 0.312; 14.786. The next place is followed by "Project management team member" (group 1) who owns the lower degree and eigenvector measures (0.656 and 0.288 respectively). Although the eigenvector values of "consultant team leader" (group 2) higher than "project management team member" (0.292 larger than 0.288), their three remaining indices all are lower (0.611; 0.9; 10.208).

4.5.3 Discussions

From the above sections, it can be seen that SNA is used not only for analyzing data which is very useful in examining the relationship among individual/group, but also for presenting data under sociogram. Thereby, in the communication network, project manager will be aided to structure his/her communication channel to stakeholders so that timely messages could be sent to the relevant stakeholders. In project A, although "project management team member" (group 1), "supervisor" (group 2), and "superintendent" (group 4) are identified as the central actors, project manager must pay enough attention on communicating with "site manager", "chief of construction group", and "quality control" in group 4 because of their own strongest hidden power in the network. Similarly, "site management team member" in group 4, "supervisor" and consultant team leader" in group 2 need to be focused more on so that project manager can enhance structural patterns to taking care these players in project B.

On the other hand, workflow network has pointed out the key players who hold influential capabilities than the others. In project A, the result of communication network indicates the most influential role of "supervisor" in group 2 among all working positions. Meanwhile, "Site management team member"; Superintendent and site manager" in group 4, "project management team member" in group 1 and "consultant team leader" in group 2 also play critical roles that need to be taken care adequately. Interestingly, the workflow networks pointed out the hidden important roles of "Chief of construction group" and "Quality Control" according to their values of betweenness centrality. Similarly, the workflow network of project B witnesses the salience of "site management team member" (group 4), "project management team member" (group 1) and "consultant team leader" (group 2) among the others. Thereby, project managers may find useful ways in shifting salient stakeholders who must be received adequate attention from them.

CHAPTER 5

CONCLUSIONS

5.1 Conclusions

To study about stakeholder management, through data collecting and analysis with statistical tools, the four preset objectives of thesis are generally achieved. This chapter reminds above discussions, conclusions and directions for future work will be then provided accordingly.

5.1.1 An addition of stakeholder management theory for the VCI

In Vietnam, the complexity of managing stakeholders at sites, limited managerial ability of project management team, and traditional project management techniques make a lot of difficulties for attaining desired results and are responsible for many project failures. Hence, the necessity of a more holistic solution for managing construction stakeholders in Vietnam has increasingly important. Among theories, stakeholder management is one of the most promising approaches for the VCI because it is not only the maintenance of favorable working relationship among stakeholders, but also it is a strategy process which covers all stages of a project and all kinds of stakeholders involved (PMI, 2013).

5.1.2 An identification of stakeholder management factors potentially effect on Vietnamese construction project success

Based on an extensive literature review, pilot test with four experts, and tests of statistical analysis, a whole of 39 stakeholder management factors are proved that they are suitable into context of the VCI and possibly influence on Vietnamese construction project success.

5.1.3 The relationship between stakeholder management and project success

From the result of factor analysis, factors which have underlying relationships have been grouped under six clusters namely: (i) Work environment, (ii) Management activity, (iii) Stakeholder information, (iv) Project organization, (v) Stakeholder characteristic and (vi) Prediction. Although the result of Structural Equation Modeling (SEM) shows that only Work Environment and Management Activity related factors can effect directly on the success of construction projects, the four remaining factors highly influence on project success by indirect ways. Hence, it is suggested that to achieve project success, a project management team must conduct their managerial activities and interacting with stakeholders effectively; a well-managed project organization and comfortable working environment should be built and maintained, the stakeholder's information and characteristic need to be explored and their reactions during interacting process should also be estimated. These works would help project management team identify determinants so that they can focuses more on and the better outcomes can eventually be achieved.

5.1.4 A powerful tool of Network Analysis

Because stakeholder management is not paid enough attention on stakeholder's relationships and degree of their influence on each other's decisions which possibly impact on project outcomes (Ki Fiona Cheung and Rowlinson, 2011; Prell et al., 2009), this thesis gives a further introduction of Social Network Analysis approach in supporting stakeholder management at sites. Two case studies have been carried out in Vietnam and the result indicates that SNA is more powerful than those of traditional stakeholder analysis methods. By measuring four basic centrality metrics and present them under sociograms, project manager and his/ her team can easily identify who play the most influential role in the network as well as their hidden power and underlying relationships among them. This approach, therefore, is useful for project management team to manage stakeholders more effectively.

5.2 Limitations and suggestions for further research

Despite of some achievements which may contribute in both of academic and practical perspectives for the VCI, this thesis has also some limitations that need to be improved for later researches.

Firstly, although construction stage is the main time scale of any construction projects which requires a lot of efforts from project management team and other stakeholders, a construction project has other important stages that need to be explored, design stage as an example.

Secondly, internal stakeholders are the main focus on this study due to their close contractual relations with clients however external stakeholders may impact on the success of construction project by various ways that need to pay enough concentration on and should be directed to this aspect in future research.

Next, respondents who are invited in the survey contribute greatly to the result of the study, however similar to other developing countries, Vietnamese construction practitioners still perceive technical issues more important than managerial issues. The role of stakeholder – based management in achieving project success, therefore, does not familiar with them. As a result, they confused among stakeholder management factors and that is why convergent test in SEM stage is not satisfied.

Lastly, due to the geographical distance and limited time, only fifteen and nineteen respondents of two building projects participated in the survey. The recommendation for the further studies is to expand and request more participants in different types of projects to address sufficiently the effects of structural characteristics of internal stakeholder networks on project outcomes.

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APPENDIX 1

Questionnaire No.1

The Influence of Stakeholder Management on the Success of Construction Projects in Vietnam

Dear Sir/Madam,

My name is Ho Chi Han, a master student of Interdiscipline of Construction Engineering and Management, Department of Civil Engineering, Pukyong National University, Busan, Republic of Korea. I am conducting a questionnaire survey to investigate the influence of stakeholder management factors on the success of construction projects in Vietnam. The main purpose of this survey is to collect ideas from practitioners who are rich-of-experience in the construction fields to find out the key factors affecting on the success of construction project in Vietnam so that solutions will be proposed more precisely and efficiently.

From the scope of this research, "stakeholder" would be defined as individuals who are participating in project's activities and possibly impact on or be impacted by the project outcomes and "project success" is known as the attainment of three preset project goals: time – cost - quality and stakeholders' satisfaction.

I hope that Sir/ Madam consider to my request, save your valuable time to share experience and idea which had been accumulated during your past career path by answering the following questions. Your answers will be kept only for academic and research purpose.

I look forward to receiving your responses.

Thank you very much.

For any question/comment/suggestion, please do not hesitate to contact with me via email address: hanhc@ntu.edu.vn

Part 1: General information

1.1 **Type of your organization** in which you are involving						
Owner/ Project management	Consultant	Designer	Contractor	Sub-Contractor	Supplier	Others
☐	☐	☐	☐	☐	☐	☐

1.2 **Project types** of your current project		
Bridge and road	Building projects (residential and industrial)	Others
☐	☐	☐

1.3 **Total investment budget of your current project** (Unit: Billion VND)							
Under 45	From 45 to under 60	From 60 to under	From 120 to under 800	From 800 to under 1,200	From 1,000 to under	From 1,500 to under	Over 2,300
☐	☐	☐	☐	☐	☐	☐	☐

1.4 **Your working experience** in the construction industry				
Under 3 year	From 3 to under 5 year	From 5 to under 10 year	From 10 to under 15 year	Over 15 year
☐	☐	☐	☐	☐

Part 2: Evaluating the influence of stakeholder management factors on construction project success

Based on your experience which had been accumulated before and from your point of view, please rate the level of influence of the following stakeholder management related factors on the success of construction projects. The level of influence is defined as follow:

Very few influential → Slightly influential → Somewhat influential → Very influential → Extremely influential

(1) (2) (3) (4) (5)

Serial No	2.1 Group 1: Management Support	Level of influence				
		1	2	3	4	5
1	Commitment	☐	☐	☐	☐	☐
2	Allocating resources efficiently	☐	☐	☐	☐	☐
3	Well-organized project team members	☐	☐	☐	☐	☐
4	Flexible project organization	☐	☐	☐	☐	☐
5	Project manager competencies	☐	☐	☐	☐	☐
2.2 Group 2: Information Input						
1	Well-defined project objectives	☐	☐	☐	☐	☐
2	Identifying and listing stakeholders	☐	☐	☐	☐	☐
3	Exploring stakeholder's experiences	☐	☐	☐	☐	☐
4	Understanding stakeholder's needs and expectations	☐	☐	☐	☐	☐
5	Understanding stakeholder's working style	☐	☐	☐	☐	☐
2.3 Group 3: Stakeholder Assessment						
1	Assessing and determining stakeholder’s power	☐	☐	☐	☐	☐
2	Assessing and determining stakeholder’s legitimacy	☐	☐	☐	☐	☐

3	Assessing and determining stakeholder's urgency	☐	☐	☐	☐	☐
4	Assessing and determining stakeholder's proximity	☐	☐	☐	☐	☐
5	Assessing and determining stakeholder's knowledge	☐	☐	☐	☐	☐
6	Identifying and understanding stakeholder's attitudes	☐	☐	☐	☐	☐
7	Identifying and exploring stakeholder's areas of interests	☐	☐	☐	☐	☐
8	Identifying and predicting stakeholder's influence each other	☐	☐	☐	☐	☐
9	Identifying possible coalitions/conflicts among stakeholders	☐	☐	☐	☐	☐
10	Identifying stakeholder's strengths and restraints	☐	☐	☐	☐	☐
2.4 Group 4: Decision Making						
1	Clear and transparent decisions	☐	☐	☐	☐	☐
2	Evaluating alternative solutions based on the stakeholder's concerns	☐	☐	☐	☐	☐
3	Stakeholder's involvement in decision-making process	☐	☐	☐	☐	☐
4	Predicting the influence of decisions on stakeholders	☐	☐	☐	☐	☐
5	Predicting stakeholder's reactions in implementing decisions	☐	☐	☐	☐	☐
2.5 Group 5: Action and Evaluation						
1	Implementing strategies based on schedule plans	☐	☐	☐	☐	☐
2	Implementing appropriate strategies to manage stakeholders	☐	☐	☐	☐	☐
3	Flexibility in handling stakeholder's reactions	☐	☐	☐	☐	☐
4	Compromising conflicts among stakeholders	☐	☐	☐	☐	☐
5	Evaluating stakeholder's satisfaction in achieving preset goals	☐	☐	☐	☐	☐
2.6 Group 6: Continuous Support						
1	Communicating with stakeholders	☐	☐	☐	☐	☐
2	Maintaining good relationships with stakeholders	☐	☐	☐	☐	☐

3	Promoting trust and respect each other	☐	☐	☐	☐	☐
4	Building knowledge and experience sharing working environment	☐	☐	☐	☐	☐
5	Reducing uncertainty	☐	☐	☐	☐	☐
6	Making alignment to achieve mutual project objectives	☐	☐	☐	☐	☐
7	Promoting positive relationships among stakeholders	☐	☐	☐	☐	☐
8	Top management support	☐	☐	☐	☐	☐
9	Continuing analyze the change of stakeholders	☐	☐	☐	☐	☐

If project manager and his/her team manage their project according to the above stakeholder management related factors, from your point of view, please rate the level of its influences on project success which is measured by the achievement of three basic criteria time, cost, quality and stakeholder satisfaction.

The level of rating is defined as follow:

Very few influential → Slightly influential → Somewhat influential → Very influential → Extremely influential

(1) (2) (3) (4) (5)

	2.7 Project success	Level of influence				
		1	**2**	**3**	**4**	**5**
1	Timely completion	☐	☐	☐	☐	☐
2	Within budget	☐	☐	☐	☐	☐
3	Quality achievement	☐	☐	☐	☐	☐
4	Stakeholder satisfaction	☐	☐	☐	☐	☐

APPENDIX 2

Questionnaire No.2

An investigation of the Interaction among Internal Stakeholders within Vietnamese Construction Projects

Dear Sir/ Madam,

For many years, due to the lack of communication and coordination among stakeholders, projects do not achieve desired results and un-satisfaction among stakeholders are common and responsible for many project failures.

With the main aim is to support project management team conduct their managerial activities well, i am conducting the survey to investigate the interaction among internal stakeholders in Vietnam Construction projects to find out the appropriate solutions based on an approach of Social Network Analysis. To achieve it, your contribution plays decisive role for the success of this research. Hence, please save your valuable time to response my request by answering the questionnaire below. I promise that your information will be used for research and academic purpose only.

I look forward to welcome your participation.

Thank you very much.

For any inquiry/ comment or suggestion, please contact to the author as the information below:

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Part 1: **Respondent's information**

1.1 Your working experience in the construction industry …… year(s).

1.2 The total time which you participated in your current project …… (months).

1.3 Type of organization involved

Owner/Project management organization	Consultancy firm	Design firm	Main contractor	Sub-Contractor	Supplier	Others

1.4 Please state your designation involved in project (please refer in the part 2 if necessary)

……

Part 2: Investigate the interaction among internal stakeholders within a project

Please indicate your choices by marking corresponding numbers from 1 to 5 which is defined in the box below.

Serial No	Working position		How do their daily work possibly effect on your work?	How often do you communicate with them?
			0: Not at all influence **1**: very few influential **2**: Slightly influential **3**: Somewhat influential **4**: Very influential **5**: Extremely influential	**0:** Not communicate at all **1:** ≤ once/ month **2:** ≤ once/ week **3:** 1 - 2 times/ week **4:** several times/ week **5:** ≥ once/ day
1	**Owner**	Owner/ Owner's representative	…….	…….
2		Project manager	…….	…….
3		Project management team member	…….	…….
4		Others ……	…….	…….
1	**Consul -tant**	Representative of consultant firm/ Directorate	…….	…….

2		Consultant team leader	…….	…….
3		Supervisor	…….	…….
4		Others ……	…….	…….
1	**Designer**	Representative of design firm/ Directorate	…….	…….
2		Design team leader	…….	…….
3		Designer	…….	…….
4		Others ……	…….	…….
1	**Main Contractor**	Representative of construction company/ Directorate	…….	…….
2		Site manager	…….	…….
3		Site management team member	…….	…….
4		Superintendent	…….	…….
5		Chief of construction group	…….	…….
6		Safety Officer	…….	…….

7		Quantity Surveyor	…….	…….
8		Quality Engineer	…….	…….
9		Others ……	…….	…….
1	**Sub-Contractor**	Representative of construction company	…….	…….
2		Superintendent	…….	…….
3		Chief of construction group	…….	…….
4		Safety Officer	…….	…….
5		Quantity Surveyor	…….	…….
6		Quality Engineer	…….	…….
7		Others ……	…….	…….

---------- Thank you very much for your participation ----------

APPENDIX 3

Project A – Matrix of communication network

Code No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1		4	3	4	3	3	4	4	4	1	3	1	3	1	0
2	4		5	5	3	3	4	4	4	3	3	2	2	1	0
3	5	5		4	5	5	3	4	4	5	4	2	3	3	1
4	3	3	2		4	4	4	4	5	1	3	1	3	1	0
5	4	5	4	4		5	4	4	4	4	3	2	3	3	3
6	5	5	4	5	5		4	4	4	5	5	2	3	4	3
7	3	5	4	4	3	3		3	4	1	2	4	4	0	0
8	3	5	4	4	3	3	3		3	1	2	4	4	0	0
9	4	4	3	5	4	4	4	3		5	5	4	3	2	3
10	4	4	4	5	4	4	4	3	5		5	5	4	2	2
11	3	4	4	3	4	4	3	4	5	5		5	4	5	2
12	2	2	2	1	2	2	2	4	4	5	5		5	5	3
13	1	2	3	3	3	3	4	4	3	4	4	5		3	3
14	0	0	1	0	3	3	0	0	3	3	3	3	2		5
15	0	0	1	0	3	3	0	0	2	1	0	2	2	5	

Project A – Matrix of workflow network

Code No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1		2	2	1	0	0	1	1	2	0	0	1	2	0	0
2	3		4	3	1	1	3	1	3	1	0	2	2	0	0
3	5	4		4	5	5	5	5	2	4	3	3	3	2	0
4	1	2	1		1	1	1	1	4	0	0	2	3	0	0
5	3	4	4			5	5	5	2	3	2	4	2	1	2
6	3	5	4	5	5		5	5	2	4	4	4	2	3	2
7	2	1	3	2	1	1		1	3	0	0	4	4	0	3
8	2	2	3	2	1	1	2		2	0	0	4	4	0	3
9	2	3	2	4	2	2	3	2		5	2	5	4	1	2
10	2	3	3	4	2	2	4	4	5		3	4	3	2	2
11	3	2	4	4	4	4	5	5	2	5		5	4	5	4
12	1	2	3	2	4	4	4	4	4	4	5		4	4	2
13	2	2	3	3	2	2	4	4	3	3	4	4		3	2
14	0	0	0	0	2	2	3	3	3	2	5	3	2		4
15	0	0	0	0	2	2	3	3	2	2	4	2	1	5	

Project B – Matrix of communication Network

Code No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1		5	5	0	1	5	0	3	3	3	0	0	2	0	0	0	0	0	0
2	0		5	5	1	5	0	3	3	4	0	0	2	2	3	0	3	0	2
3	0	5		5	5	5	0	5	2	4	0	3	5	1	3	5	4	0	0
4	0	5	5		5	5	1	1	2	3	0	0	0	0	0	0	0	0	0
5	3	5	5	5		5	0	5	5	5	3	0	1	2	1	0	2	1	1
6	5	4	3	5	5		0	5	5	5	3	3	3	0	2	3	2	2	0
7	0	0	0	1	0	0		0	0	1	0	1	0	0	0	0	0	0	0
8	0	2	3	1	1	1	0		2	4	0	2	5	5	5	2	4	0	0
9	4	3	5	2	3	4	0	4		5	0	1	2	2	2	0	0	0	0
10	2	3	3	1	3	5	1	3	5		1	5	4	0	3	3	0	0	0
11	2	1	5	0	1	4	0	5	5	5		0	0	0	2	0	0	0	0
12	0	0	3	0	0	3	1	5	1	5	0		3	0	0	0	0	0	0
13	0	2	5	0	1	3	0	5	2	4	0	3		0	0	0	0	0	0
14	0	2	1	0	2	0	0	3	2	3	0	0	0		4	4	3	2	2
15	0	3	3	0	1	2	0	2	2	3	2	0	0	4		5	4	4	4
16	0	0	5	0	0	3	0	2	0	0	0	0	0	4	5		4	3	2
17	0	2	5	0	1	2	0	3	0	0	0	0	0	3	4	4		3	3
18	0	0	0	0	1	2	0	0	0	0	0	0	0	2	4	3	3		3
19	0	2	1	0	1	0	0	0	0	0	0	0	0	2	4	2	3	4	

Project B – Matrix of workflow Network

Code No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1		5	4	0	5	4	4	4	4	3	2	3	0	4	4	3	0	0	0
2	3		5	4	5	5	3	4	4	3	2	0	3	4	4	0	3	0	3
3	3	4		3	5	4	3	4	3	3	2	3	4	2	4	4	4	2	2
4	0	4	3		5	4	2	2	4	3	2	3	2	2	3	4	3	0	0
5	3	4	3	5		4	4	4	5	4	3	0	3	3	3	0	3	2	2
6	3	4	2	4	5		4	5	4	4	3	3	0	1	3	4	4	2	0
7	0	0	1	0	2	0		2	0	1	0	3	0	2	3	2	0	0	0
8	3	4	3	2	4	2	2		4	5	0	3	5	4	4	3	4	0	0
9	3	4	4	4	4	3	3	4		5	1	1	4	3	3	0	0	0	0
10	3	4	3	4	4	3	1	4	4		2	5	4	4	4	4	4	3	2
11	0	1	3	2	2	3	0	4	4	5		4	4	0	3	0	0	0	0
12	3	0	3	0	0	3	0	4	1	5	4		5	0	0	0	0	0	0
13	0	3	4	0	3	0	0	5	4	4	3	4		0	0	0	0	0	0
14	0	4	2	2	3	1	2	4	3	4	0	0	0		5	5	5	5	3
15	0	4	4	3	3	3	3	4	3	4	3	2	0	4		4	5	4	2
16	0	0	4	4	0	4	2	3	0	4	0	0	0	4	5		4	5	2
17	0	3	4	3	3	4	0	4	0	4	0	2	0	3	4	4		4	2
18	0	0	2	0	2	2	0	0	0	3	0	3	0	4	4	3	3		4
19	0	3	2	0	2	0	0	0	0	2	0	0	0	4	2	2	3	4	

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