THE OVERSEAS EXPANSION OF INDONESIAN CONTRACTORS: MOTIVATIONS, ENTRY MODES CHOICE AND A NEURO FUZZY BASED DECISION SUPPORT SYSTEM

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CERTIFICATE OF ORIGINALITY

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Wahyudi Putra UTAMA

DEDICATION

I dedicate this dissertation to my beloved parents – Nasrul & Darmisuarti,

my lovely wife – Fitri Yelli and my entire family members for their endless

love, prayers and supports.

ABSTRACT

The participation of Indonesian construction enterprises in overseas marketplaces has indicated a high significant progression in recent decade. However, this contribution is relatively scanty if it is compared to other emerging economies. Similarly, there are only a few studies discussed internationalization of construction enterprises in developing markets, such as in Indonesia. Thus, this study aims to provide an empirical investigation of this phenomenon from the perspective of Indonesian construction enterprises and to design a decision-making model for supporting their overseas expansion attempts. The objectives of study are (1) to investigate the motivations encouraging the Indonesian contractors to expand operation in overseas markets, (2) to investigate the preferred choice of entry modes adopted by the Indonesian contractors to enter overseas construction markets, (3) to determine the significant international factors influencing the go/no go decision making of the Indonesian contractors on overseas construction projects, and (4) to develop a decision support system-based go/no go decision making of Indonesian contractors on overseas construction projects. An empirical approach integrating quantitative and qualitative techniques was adopted to address the objectives of this study. The primary data were collected through questionnaire sheets distributed to Indonesian large contractors. Descriptive statistical method and relative importance index were employed for data analysis. In the discussion, the survey results were triangulated with the case study and the interview findings.

The results indicated that the overseas expansion of Indonesian contractors was mostly motivated by multiple motives instead of a single motive. Those main motivations were to increase profitability, to benefit competitive advantage, to expand business, to capitalize on globalization/free trade region, to respond project sponsor's invitation and to gain the international experience. Related to strategy to enter a foreign market, the results exposed that the preferred choice of modes constituted a combination of five main strategies. They are including Joint Venture Project, Branch Office, Representative Office, Sole Venture Project and Local Agent depending on the host market conditions. Meanwhile, a two-round Delphi survey

was adopted to reach an experts' concensus on the important factors and the probability of risk occurance related to the international factors in OCPs. Based on the Delphi results, a significant index was used to determine the criticalty of the factors. From 31 selected factors harvested from a systematic literature review, the results indicated that there are 21 factors classified as critical factors. The top five ranking factors are: (1) quality and clarity of contract condition, (2) project scale/size, (3) complexity of project, (4) financial capability and support, and (5) types of contract.

In developing the decision model, this research adopted an integration of fuzzy system and neural network, namely Adaptive Neuro-Fuzzy Inference System (ANFIS). In order to generate the model, 110 simulation cases of OCPs obtained from an evaluation involving 11 experienced examiners were used as a data set. Each case was presented in an evaluation form containing five input criteria (project, contract, owner, host country and market) and one output criterion (go/not go). The examiners judged the score of each input (ranging from 1-the lowest to 9-the highest) and selected the output based on randomly given parameter (fuzzy number) on the 21 international factors. From 110 pairs of input-output data, 70% cases were set for training and the rest for testing (20%) and checking (10%). To measure the optimization of ANFIS model, Root Mean Square Error (RMSE) and Correlation Coefficient (R) were utilized. The result indicated that the optimum network of the model was developed via ANFIS parameters i.e. two inputs, Gaussian (*gaussmf*) and hybrid representing the number of membership function, type of membership function and optimization method respectively. The accuracy of this model was very good when predicting the decision on nine-real OCP cases with 88.89% accuracy. This model was also compared with another machine learning, namely General Feedforward Neural Network (GFNN). The results of GFNN validated the proposed model and evidenced some degree of primacy in terms of prediction performance and applicability. Finally, this study suggested several important issues to enhance the next researches.

LIST OF RESEARCH PUBLICATIONS

Journal articles

1. **Utama, W.P.**, Chan, A.P.C., Zahoor, H. and Gao, R. (2016). "Review of research trend in international construction projects: a bibliometric analysis", *Construction Economics and Building*, 16(2), 71-82.

2. **Utama, W.P.**, Chan, A.P.C., Gao, R. and Zahoor, H. (2018). "Making international expansion decision for construction enterprises with multiple criteria: a literature review approach", *International Journal of Construction Management*, 18(3), 221-231.

Submitted article (under review)

1. **Utama, W.P.**, Chan, A.P.C., Zahoor, H., Gao, R. and Sesmiwati, S ( ). An overview of the generic motivations for the International construction enterprises. *(Submitted to International Journal of Technology, Paper ID: CVE-1558).*

2. **Utama, W.P.**, Chan, A.P.C., Zahoor, H., Gao, R. and Peli, M. ( ). Exploring the strategic motivations of internationalization: Indonesian contractors' viewpoint. *(Submitted to Construction Economic and Building, Paper ID5899).*

3. **Utama, W.P.**, Chan, A.P.C., Zahoor, H., Gao, R.. and Jumas, D.Y. ( ). Making decision toward overseas construction projects: An application based on adaptive neuro fuzzy system. *(Submitted to Engineering, Construction and Architectural Management, Paper IDECAM-01-2018-0016).*

4. **Utama, W.P.**, Chan, A.P.C., Zahoor, H., Gao, R.. and Zulherman, Z. ( ). Preferred choice and transformation of Indonesian contractors' strategy to enter overseas markets. *(Submitted to Journal of Construction in Developing Countries, Paper IDJCDC-OA-02180021)*

Conference papers (Published in Proceeding)

1. **Utama, W.P.**, Chan, A.P.C., Zahoor, H. and Gao, R. (2014). Indonesian contractors in overseas construction projects: Southeast Asia, the Middle East and Africa. In Wang, Y., Ye, H., Shen, Q.P. and Bai, Y. (Eds.), *ICCREM 2014:*

Smart Construction and Management in the Context of New Technology, September 27-28, 2014 (pp. 535-546). Kunming, China: American Sociaty of Civil Engineers.

2. **Utama, W.P.**, Chan, A.P.C., Zahoor, H. and Gao, R. (2015). International expansion of Indonesian contractors: Motivations and entry strategies. In *COBRA AUBEA 2015, Sydney July 8-10.* UK: Royal Institute of Chartered Surveyors.

3. **Utama, W.P.**, Chan, A.P.C., Zulherman, Zahoor, H., Gao, R. and Jumas, D.Y. (2017). ANFIS Multi criteria decision making for overseas construction projects: a methodology. *IOP Conference Series: Earth and Environmental Science,* 117(1), 012043.

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LIST OF ABBREVIATIONS

Abbr.	English	Indonesian term
AHP	Analytical Hierarchy Process	
AKI	Indonesian Contractors Association	Asosiasi Kontraktor Indonesia
ANFIS	Adaptive Neuro Fuzz Inference System	
ANN/NN	Artificial Neural Network	
ANP	Analytical Network Process	
ASEAN	Association of South East Asian Nations	
BO	Branch Office	
BOT	Build Operate Transfer	
BPS	Center of Statistical Bureau	Badan Pusat Statistik
BUMN	State Owned Enterprise	Badan Usaha Milik Negara
CBR	Case Based Reasoning	
CIA	Cross Impact Analysis	
CM	Construction Management	
FIS	Fuzzy Inference System	
FL	Fuzzy Logic	
FNN	Fuzzy Neural Network	
FS	Fuzzy System	
GAPENSI	Indonesian National Builders Association	Gabungan Pelaksana Konstruksi Nasional Indonesia
GDP	Gross Domestic Product	
ICP	International construction project	
JVC	Joint Venture Company	
JVP	Joint Venture Project	
LA	Local Agent	
MAUT	Multi Attribute Utility Theory	
MCDM	Multi-criteria Decision Making	
OCP	Overseas construction project	
PROMETHEE	Preference Ranking Organization Method for Enrichment Evaluation	
RII	Relative Important Index	
RMSE	Root Mean Square Error	
RO	Representative Office	
SA	Strategic Alliance	
SVC	Sole Venture Company	
SVP	Sole Venture Project	

Chapter 1

INTRODUCTION

1.1   Introduction

The main purpose of the work described in this chapter is to support and to strengthen the rationale behind this research, thereby opening more channels leading to further improvements. In this chapter, the research background highlights the empirical foundation of this thesis including the research gap. Afterward, it describes the research statements and questions, followed by the research aim and objectives, and the significance of the research. This chapter briefly elucidates the research method and subsequently defines the research scope in the following part. At the end of this chapter, the thesis organization describes how this thesis arranged.

1.2   Research Background

International construction industry is one of strategic sectors leading to global economics. This sector involves a broad scope of construction projects linked to human needs such as accommodation, transportation, energy, water supply, and further social and commercial infrastructures around the world. In order to perform the development all over the world, the expenditures of this industry were estimated to have hits around US$8.5 trillion in 2015, it increases from US$7.5 trillion in 2010 (Timetric's Construction Intelligence Center, 2016). Interestingly, a study forecasted in 2025 shows that the value of the industry will be over USD 15.0 trillion, it increases around13.5% of world's Gross Domestic Product (Global Construction Perspectives and Oxford Economics, 2015). These facts indicate that in the next couple of years, the worldwide construction projects will keep growing and offering many more opportunities to globally expand business for construction enterprises

Large size, escalating, fractured, regionally changeable, assorted, risky and very competitive are the market characteristics of the international construction (Chen, 2005; Li et al., 2013). These typical properties are then perfectly nourished by some non-technical issues such as politics, social-culture, legal and economic financial (Gunhan and Arditi, 2005a). Such a complex combination of variables

results in the creation of international construction projects (ICPs) strong contrast with those of domestic ones (Ling and Hoang, 2010). On the other hand, through this kind of projects, local construction firms have ample opportunities for diversifying growth and taking advantage of other companies' expertise and experience (Chen and Mesnerr, 2011).

Over the years, trends to operate a business outside of homeland jurisdiction has been remaining. These business trends swiftly flourish in the era of globalization, marked by world trade organization, regional economic agreements, global standards and the rapidity of communication and transportation development (Han and Diekmann, 2001; Chen and Messner, 2009). As a result of globalization factors, internationalization has become a global entity alongside companies, it is once locally centered, and it is having branches worldwide now. Moreover, opportunities for construction companies to obtain projects from cross-national boundary markets has evolved.

In a perspective of business and marketing, numerous clear motives behind a vision to build an internationally-oriented company have been justified. Czikota and Ronakainen (2004) identify motives encouraging companies to pursue overseas markets, while Contractor (2012) revealed the rationales as to why multinational companies exist. Based on construction industry's point of view, numerous studies have discovered sufficient reasons for construction enterprises to encourage themselves to venture beyond the established home market. Factors to motivate companies' expansion must be different each other.

Meanwhile, entering foreign markets constitutes a monumental leap for local firms. A mature consideration in choosing strategies to enter the markets is one of the important matters (Gunhan, 2003). Similarly, a comprehensive analysis of all the international aspects should be carried out by companies before considering expansion (Tan and Ghazali, 2011). A prime consideration is the integration of the specific nature of the construction industry and overseas construction project (OCP) environment, although this is not an easy work.

Researchers argued that a critical part when a company is targeting a foreign market is how to make a better decision in connection with potential project selection (Han and Diekmann, 2001; Lin and Chen, 2004; Ozorhon et al., 2006; Kim et al., 2013). In making a decision, experiences and business intuition of company's management are valuable assets. However, since different attributes of information

are often incomplete, imprecise and ill-defined in overseas projects selection, the process of decision making by relying on the experiences and intuition is a risky action. Hence, several approaches such as Analytical Hierarchy Process (Hastak and Shaked, 2000), Cross Impact Analysis (Han et al., 2005) and Analytical Network Process (Bu-Qammaz et al., 2009) have been adopted to solve the decision making problem in the realm of OCPs.

Recent international construction business still witnesses developing country's markets monopolized by advanced industrial economies. Some developed nations have dominated and established a strong position in marketplaces of developing and less developing countries over decades (Raftery et al., 1998; Ofori, 2000). Interestingly, Chinese companies have become a strong competitor in pursuing cross-nation projects among the hegemony of developed economies.

Statistically, central to the most study of ICPs is advanced industrial economies (Utama et al., 2016), while research activities have unheeded the involvement of developing markets in international construction business up to the present. This tendency is understandable because the research outputs reflect the condition of the related industry in specific countries (Hu et al., 2013). However, other developing economies have begun to pay significant attention to international construction business transactions. Of interest in the latest phenomenon is the growth and intensive involvement of Indonesian contractors in the worldwide market over the last decade.

As a matter of facts, Indonesia coined the operation of its construction enterprise overseas around two decades ago. This activity is, however, becoming serious over the last ten years. The first record of foreign market penetration of Indonesian contractors was in the 1990s by a state-owned enterprise which successfully undertook a highway and flyover road projects in Malaysia (1990-1993) and the Philippines (1996-1999) respectively. Nowadays, the market expansion has penetrated not only the region of Southeast Asia but also in the Middle East and North Africa (Utama et al., 2014). Based on the initial investigation carried out by tracing the record of the contractors' involvement in OCPs, most of the works are one-off projects. However, this expansions are still relatively scanty, even compared to other neighboring countries, such as Singapore and Malaysia.

Related to the facts explained above, in term of research activities, there are only few scholars have paid attention to a study engaging with the international

construction in a view of Indonesian construction enterprises. Consequently, the research literature in this context is a scarcity of reference sources. Hence, the research presented in this dissertation attempts to curb the gaps and makes significant contributions to the growing area of transnational construction studies.

1.3   Research Statements and Questions

In a business' point of view, developing an internationally-oriented company is a manifesto of visionary firms. Regarding the motivation to enter foreign markets, a business in the construction industry is not particularly different from other industries, such as manufacturing. The same reasons as those applied to other industries can evoke the motivations (Abdul-Aziz, 1994). Nonetheless, the factors motivating companies' expansion can be different from each other, even in a similar industry.

Furthermore, entering a foreign construction market, particularly at the first time, needs a mature decision in allocating limited resources. Problems exist due to the business regulation, host country protection on the market and technical barriers to entry (Xu and Greenwood, 2006). Since the overseas market penetration impacts on company's profitability and growth, the decision on choosing a strategy is equally important (Chen and Messner, 2009). Each entry strategy has specific characteristic influencing the objective of the overseas expansion.

As stated earlier, the foreign projects are widely different from domestic development on the project atmosphere. The existence of the environment can derive from the internal and the external circle of the company as a result of domestic and international issues as well as the nature of the project itself. Hastak and Shaked (2000) advise conducting a comprehensive analysis of the risks, benefits and potency of the target market in the future. The result of the analysis may influence management in making decision on which project or market will be concentrated.

In line with the statement above, making decisions to go or not to go and to bid or not to bid on overseas contracts will substantially affect the companies' business strategies. In this situation, company executives are frequently faced by a limited-time frame for making a decision, while the information required for the execution sometimes are incomplete and imprecise. Such a state of uncertainty could be eliminated by the development of a model, with the aim of aiding a company to make a better decision.

Through the four statements above, Indonesian contractors recognize the value in pursuing foreign construction projects and some of those local Indonesian enterprises have an enormous potency at global competitiveness. They have acquired enough valuable experiences in conducting overseas projects. Meanwhile, the Indonesian government puts a concentrated effort in encouraging national contractors to enter foreign markets, particularly neighboring countries.

In dealing with the background above, four critical issues have risen. They are: what are the underlying strategic motivations of Indonesian enterprises encouraging them to expand market overseas? What entry strategies do they prefer to adopt to enter foreign markets? What are the key factors in considering overseas project selection? Based on the factors, how to design a model for supporting overseas project decision making?

1.4 Research Aim and Objectives

This research is part of a large area of international construction discipline. The aim of this research contains two purposes. First, this study aims to provide an empirical investigation of this phenomenon from the perspective of Indonesian construction enterprises. Second, it aims to design a decision-making model for supporting their overseas expansion attempts. To achieve the research aims, the specific objectives of this research are drawn up as follows.

1. To investigate the motivations encouraging the Indonesian contractors to expand operation in overseas markets.
2. To investigate the preferred choice of entry modes adopted by the Indonesian contractors to enter overseas construction markets.
3. To determine the significant international factors influencing the go/no go decision making of the Indonesian contractors on overseas construction projects.
4. To develop a decision support system-based go/no go decision making of Indonesian contractors on overseas construction projects.

1.5 Significance and Values

In the history of the global development economics, the international construction has been thought of as a crucial component. It is a key instrument for triggering the increase in other economic sectors. One of the important current

discussions in this context is the involvement of developing and emerging construction industries.

Having the internationalization phenomenon, there has exhibited a positive trend of the Indonesian contractors to expand their traditional market to overseas over the last decade. In point of fact, there are few, if not none, empirical studies relating to this issue. Hence, it is important to undertake research to bridge this gap area. The aim of this research is to investigate the motivations, the entry strategy and the international factors and to develop a decision support system.

A good knowledge on the motivations and entry modes could comprehend companies' reasons to explore foreign construction markets and their preferred strategy to enter the markets. This is also to validate that each nation has different specific motives and strategy. In respect to international factors in OCPs, this study attempts to clarify the most significant once of a dozen of international factors identified in previous studies. They play an important role in developing a decision model for OCPs. The model framework may be adopted by company's management to support their decision-making process on OCPs.

1.6   Methodology Approach

To attain the objectives, this research employs the integration of qualitative and quantitative methods (triangulation). According to Johnson and Turner (2003) and supported by Abdul-Aziz and Law (2012), a mixed method provides a better validity of results. A combined technique sustains the assessment of findings from various sources for generalization and at the same time brings the actual horizon of the subject matter to be revealed (Greene, 2008).

At the beginning of the study, a review of the literature was conducted to provide a foundation in the context of theories, concepts, and principles. It supplies secondary data for this research as a result of past studies. The main sources of literature review are scientific journals. Other sources are dissertations, conference papers, textbooks, professional magazines, laws and regulations, official statistical and government agency reports, company profiles and reports, as well as credible online media.

Quantitatively, this research applied survey questionnaires and the Delphi method. An open-ended questionnaire was designed based on the literature review and mostly employed to accomplish the first three objectives. A pilot survey was

carried out before conducting the real survey. Qualitatively, a series of interviews with selected informants having experience in OCPs was conducted after analyzing the data from questionnaires. Open structured interview technique was used to enrich the data and to provide insight to the concerned issues.

This research also employed a case study to enhance invetisgation toward the participation of Indonesian contractors in foreign markets. Since the number of Indonesian contractors performing overseas projects relatively scant, the case study method is very relevant. In addition, a two-round Delphi survey was performed to minimize the level of bias of information gathered from expert panels. This survey aims to scrutinize the international factors influencing the decision makers for making decision on OCPs. Selected experts consisting of academia, practitioners, and government officers were invited to assess the international factors.

Finally, to develop a decision-making framework for selecting an overseas project, this research applies an integration of fuzzy and neural network techniques, namely Adaptive Neuro Fuzz Inference System (ANFIS). Deciding in construction business involves multiple variables and decision makers. On one side, the variables are sometimes incomplete, imprecise and vague. On the other side, the decision makers may be ambiguous, subjective, inconsistence and emotion when examining the variables. Thus, it is required for an approach to deal with this overwhelming dilemma. Amalgamation of fuzzy logic and neural network have been convincingly proven to cater this kind of issue. Overall research methodology is shown in Table 1.1, while Figure 1.1 shows how the objectives are mapped to related chapters and their relation with research methodology.

Table 1.1 Summary of research approach

Research objectives	Methodology
To investigate the motivations encouraging the Indonesian contractors to expand operation in overseas markets.	Literature review, questionnaire, interview, case study.
To investigate the preferred choice of entry modes adopted to enter overseas markets.	Literature review, questionnaire, interview, case study.
To determine the significant international factors influencing the go/no go decision making of the Indonesian contractors on overseas construction projects.	Literature review, Delphi survey.
To develop a decision support system-based go/no go decision making of Indonesian contractors on overseas construction projects	Model development using ANFIS
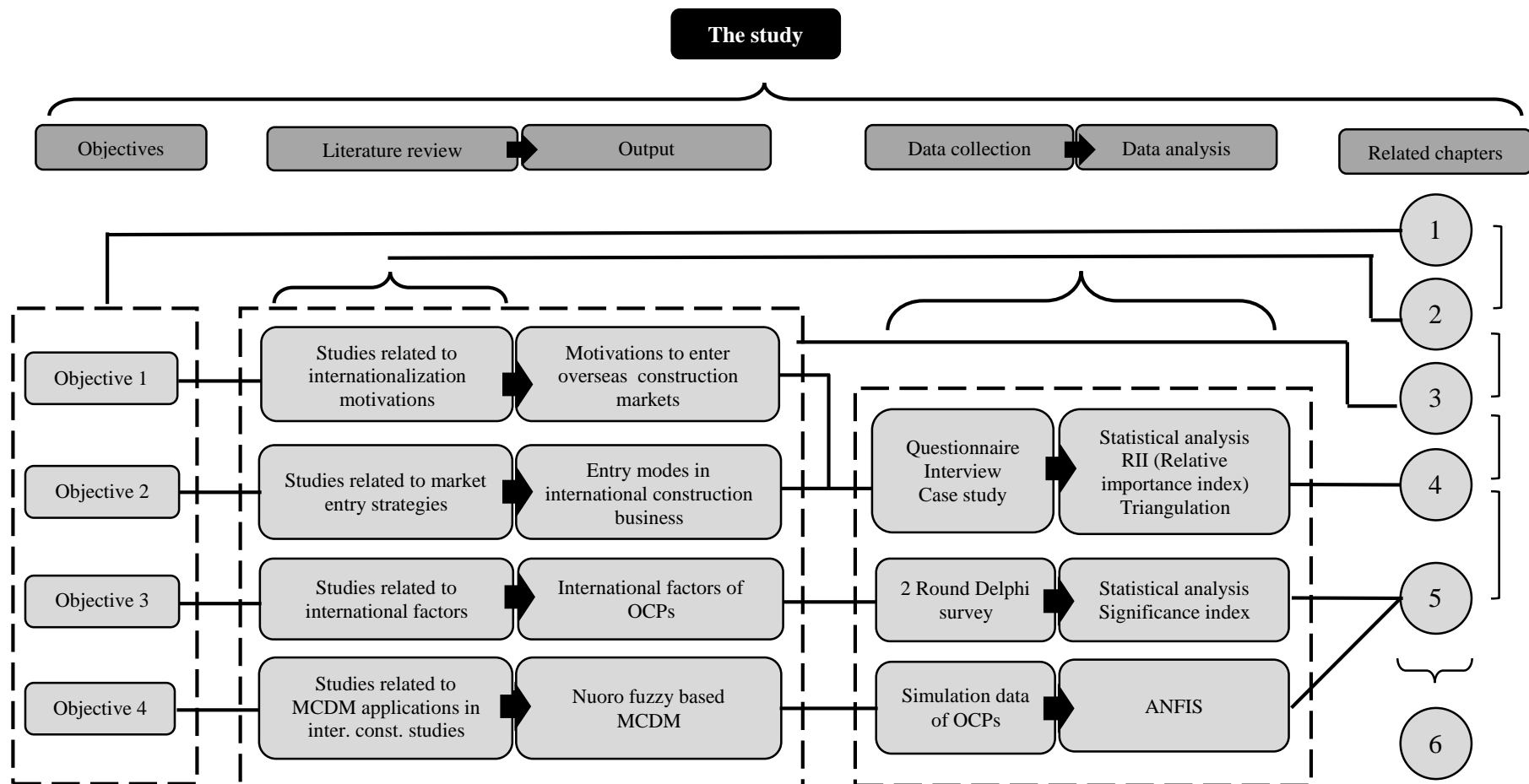
Figure 1.1 The relation of research objectives and related chapters

1.7   Research Scope

The international construction project constitutes the general discussion in this dissertation. The central issue is the Indonesian contractors' view on exporting construction expertise abroad. In terms of terminology, the words "overseas", "international", "global", "foreign", "cross-national" construction projects and so forth refer to all construction works conducted outside Indonesian territory. Indonesian firms refer to those owned by the government or fully private firms owned by a group of Indonesian citizens who have home bases in Indonesia. In addition, this study briefly covers the development of Indonesian construction industry in the preceding decade.

Theoretically, this research covers issues as regards the motivation behind the business expansion, the entry market strategies and the international factors in OCPs. Such subject matters have extensively discussed in the context of global business and strategy. For the sake of this research interest, the construction management related studies have dominated most of the literature underlying these contexts. Conversely, this research does not discuss the issues hampering the expansion of construction firms to penetrate into foreign markets. Also, it does not pertain subjects from the perspective of classical organizational theories such as "stage growth theory" (Johanson and Vahlne, 1977), "eclectic paradigm" (Dunning, 1988), and "Porter's diamond concept" (Porter, 1990) which have comprehensively discussed the internationalization strategy. Other theories covered in the literature review are multi-criteria decision making (MCDM) applications particularly applied in international construction studies. A little more detail on the techniques, the theories of fuzzy logic and the neural network present the basic concept only.

Through literature review, this research identified five main topics in the study of decision making in international construction. They consist of internationalization decision, market selection, entry mode selection, project selection/bidding decision and other related decision-making. The topics occasioanally overlap each other, but they have different scopes in substance. Thus, in identifying the considered factors in overseas project decision making, those factors are relatively alike in the criteria for opting foreign market or entry mode choice.

Regarding the newness of information, this research attempted to present and to engage related secondary data published up to 2015. All primary data obtained and analyzed in this thesis were collected in 2015, while the proposed model was developed based on the perspective of Indonesian practitioners.

1.8 Thesis Organization

This thesis consists of six chapters embracing an introductory part (Chapter 1), a literature review (Chapter 2), a section of research methodology (Chapter 3), analysis and discussion (Chapter 4), model development (Chapter 5), and conclusion part (Chapter 6). Briefly, this thesis is structured as described below.

Following the Chapter 1, Chapter 2 presents research methodology which provides phases and procedures in conducting this study. This chapter, in the beginning, reveals the research design and the selection of research methods which explains the research process and corroborate the rationale behind adopting particular methods respectively. Then, it describes the process and techniques of data collection and data analysis methods. Lastly, this chapter presents the development process of decision-making model of OCPs which covers the adaptive neuro-fuzzy system and its application for making decision process.

Chapter 3 delineates a wide-ranging literature review covering three main subjects in international construction and one topic about multi criteria decision making (MCDM) methods and applications. The discussion begins with a section explaining definition and characteristics of international construction projects. Three main subjects comprising expansion motivations, market entry modes and international factors in considering OCPs are then described in the next sections. The first part reveals the motivations triggering construction companies to perform works outside of their national jurisdictions. The second part describes the mode of entry which are the strategies commonly adopted to penetrate foreign markets in the construction business. The third part elucidates the international factors redounding to OCPs. The last section provides a literature review of MCDM and applications particularly in international construction studies as well as a theoretical concept of adaptive neuro fuzzy as a supporting decision-making tool.

Chapter 4 particularly addresses the first two objectives of this research. This chapter poses analysis of results obtained from questionnaires and interviews. To in-depth investigation of Indonesian contractors' participation in OCPs, a case study is

presented. Interpretation and elaboration of the results is separated into two discussion parts consisting of the motivations of expansion and the preferred choice of entry mode.

Chapter 5 deals with the development of decision-making model which is objective 4 of the research. Before discussion on the model, initially, the result of Delphi survey is presented. The result determines the main international factors (objective 3) as input variables of decision making in OCPs. Afterwards, the Adaptive Neuro-Fuzzy Inference System (ANFIS) based model is described covering ANFIS tool box, preparation of simulation cases dataset, ANFIS model and validation method.

Chapter 6 concludes this dissertation. It provides the general conclusion by reviewing back the objectives of the research. Then, the statement of research significance and contributions and limitations are presented, followed by the recommendations for future studies.

1.9   Chapter Summary

This chapter presents important facts, statements, and arguments, which empirically underlie the exploration of this research topic. Four problem statements and questions have been raised to describe the issues to be addressed clearly. Based on the study, the investigation of Indonesian contractors' involvement in overseas markets appears not to have been fully investigated, and research findings are thus limited. A limited body of knowledge has been recorded as regards decision making in transnational projects. This research aims, thus, to explore this phenomenon from the perspective of Indonesian contractors and at the same time proposed a decision-making model for supporting their overseas expansion.

This research methodologically applied both qualitative and quantitative approaches. In order to focus on the objectives, several issues were defined as the research scope. It is believed that this research has theoretical and practical implications and significant contributions to body knowledge. The next chapter comprehensively discusses the research method utilized to address the four research objectives.

Chapter 2
RESEARCH METHODOLOGY

2.1 Introduction

Research methodology is a systematic and logical ways on the basis of scientific procedure to find answers to questions or hypothesis, problems or issues (Fellows and Liu, 2008). The aim of this chapter is to explain the research process in achieving research objectives. This chapter is divided into two parts. The first part is designed to puzzle out the first three objectives of this research. It discusses the methods applied, followed by a description of the research process, methods of data collection and analysis. The second part is projected to address the fourth objective. It describes the development process of decision-making framework combining fuzzy logic and neural network, called as Adaptive Neuro Fuzzy Inference System (ANFIS). Prior to describing the process of model development, a clarification of the rationale behind the approach choice is explained. The utilization of MATLAB software as an aid tool for modeling the decision is presented, followed by the procedure to reach an optimum model. At the end of this chapter, the validation and generalization methods of the model are prepared to corroborate the final model.

2.2 Research Design

The research design is a coherent process to bridge the distance of a set of empirical data to the desired objectives of the study and conveys them to the conclusions (Yin, 2003; Akadiri, 2011). It should explain the generic process of how the research objective will be addressed along with the justification of selecting a specific method and its application (Saunders et al., 2009). According to Creswell (2007), there are three foundations in formulating the research design: the attributes of the research problem, the expertise of investigators in conducting the research, and for whom the research is undertaken. He adds that the characteristic of the research, its goal, objectives and the existence of the source concretely affirm its design. In the process of conducting the current research, an overall research process containing four phases was designed as illustrated in Figure 2.1.
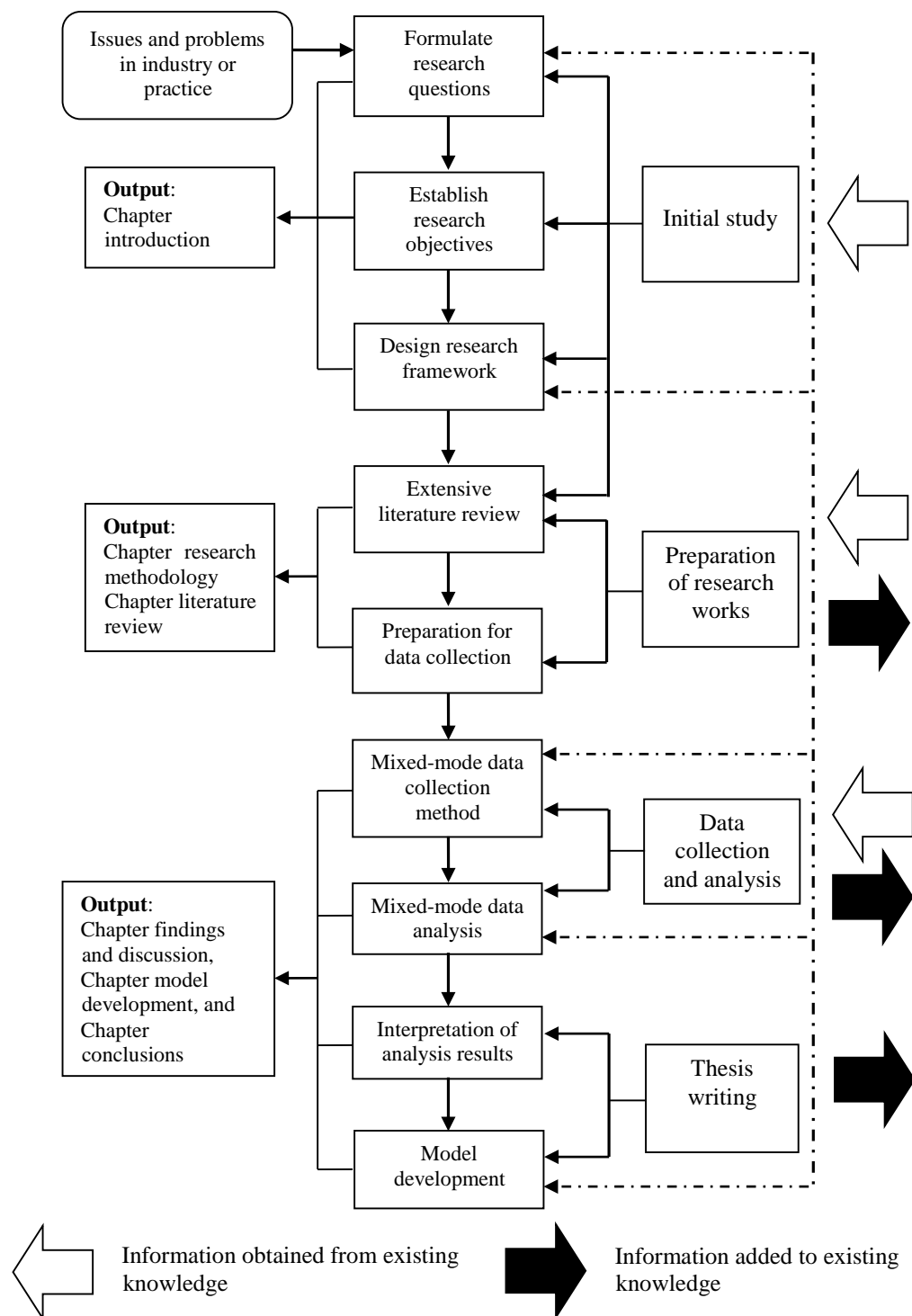
Figure 2.1 Overall research plan (modified from Fellows and Liu, 2008)

The first phase is an initial study carried out to observe some growing issues or problems in the industry or practices, to define the research questions, to establish the research objectives and to design the research framework. The activity undertaken in this phase was a preliminary review of several scientific publications.

Fellows and Liu (2008) believe that the initial study is an indispensable stage or starting point in identifying how far the research within the specific interest has been done and what investigations are needed further. All information gathered during this stage derived from existing knowledge. This phase contributed to this thesis as an introduction chapter.

The second phase constitutes the preparation of research works. This stage involved two major activities, an extensive literature review (a comprehensive review of the relevant studies) and a preparation of data collection (e.g. design research instrument, pilot study, and the identification of respondent. The comprehensive review of relevant publications makes the foundation of theory and methodology more consistent. The vast majority of the information was obtained from existing knowledge, at the same time, this effort contributed to the existing body of knowledge. Activities in this phase are transfigured into four chapters, a chapter of research methodology and three chapters of literature review.

The third phase is data collection and data analysis. In this phase, questionnaires were distributed to certain respondents. In-depth interviews with some competent people were also arranged. The schedule was organized as effective as possible in distributing the questionnaires. These schedules include when the questionnaires were distributed, how long it should be waited for, when the interviews were conducted, and when collecting data was completed. The next step after completing the data was data analysis. This research utilized a Statistical Package for the Social Sciences (SPSS) as a data analysis tool. The concept of enhancing and obtaining information in this phase are similar to the concept in the third phase.

The final phase is thesis writing. The results of the data analysis were interpreted and elaborated. It were indicated to response the first three objectives of the research. The selection model was also developed by referring to the process which has been described in Section 2.6 of this chapter. This stage contains three chapters: finding and discussion, selection model development, and conclusion. All the information is expected to enrich the existing body of knowledge.

2.3 Selection of Research Methods

Before selecting any research method, several issues should be explained clearly (Veal, 2005; Pamulu, 2010). The research questions or hypothesis, previous

studies, accessibility and availability of data, resources, validity and reliability, ethics and uses or users of the findings are among the issues. The different approaches influence data collection and analysis instead of a critical observation of theory and literature (Fellows and Liu, 2008).

According to Hallowell and Gambatese (2010), the study in construction engineering and management is quite challenging because of the characteristics of its practices. Love et al, (2002) opine that research methodology in Construction Management (CM) studies is still debatable regarding the selection of the best method dealing with the industry's research issues. Since there is no a shortcut to opt a research method and there is no ideal research method found, the selection of research approach is immensely influenced by the intention of the research objectives and the kinds of data required for the research (Yin, 2003; Akadiri, 2011). Despite of the inexistence of a perfect methodology, Yin (2003) develops a matrix mapping some research approaches against some conditions as shown in Table 2.1. He advises that selecting a compatible method should be started from the type of research questions, the needs of investigator control, and the nature of the event.

Table 2.1 Relevant situation for selecting research strategies (Yin 2003)

Strategies	Type of research question	Required control over behavior events	Focus on contemporary events
Action research	Who, what, why, how many, how much	Yes/No	Yes
Case study	How, why	No	Yes
Survey	Who, what, where, how many, how much	No	Yes
Archival analysis	Who, what, where, how many, how much	No	Yes/No
History	How, why	No	No
Modeling	Who, what, how many, how much	No	Yes/No
Experiment	How, why?	Yes	Yes

Instead of using a single method, Abowitz and Toole (2009) advocate the combination of qualitative and quantitative approaches in the construction industry research because this can intensify the validity and reliability of the research. Sekaran and Bougie (2009) believe that gathering data from the plural methods might reduce potential biases that accompany a specific data collection method. The mixed method is also ascertained more robust than a single approach (Moffatt et al., 2006) and very effective (Lee, 1991). This combination allows the use of both open-

ended and close-ended questions, gather various types of data, and carry out statistical and text analysis and cross-interpretation (Creswell, 2007).

The present research promoted the merging of research approaches, well-known as triangulation. One of the reasons was that a stand-alone research method has a weakness in giving a clear description about the overseas expansion phenomenon. This decision was also taken the requirements of the research strategy features into consideration. For instance, according to Fellows and Liu (2008), "what?" in a research question could be approached appropriately by survey method, otherwise "how?" was regarded to the interviews. Referring to Table 2.1 and the study by Fellows and Liu (2008), the combination of research methods, both quantitative and qualitative fits to the research questions.

Additionally, in choosing the methods for tackling the present research, few more aspects are considered; such as the objectives, the form, and availability of data needed, the expertise of the investigator, financial support, and time allocation for data collection. The use of mixing methods can also help to facilitate a deeper understanding. The research methods include data collection, analysis, and interpretation of the findings. The way of the research approaches correspond with the research objectives is described in Table 2.2.

2.4 Data Collection Methods

Collecting data has a major goal that functions to maximize the sum and the exactness of information from the sources to the researcher. According to Fellows and Liu (2008), the chosen methods and the ability of researcher in applying the methods influence the result of data collection. Another essential point is they mentioned that the choice of the resource is a critical part. Therefore, four modes of the data collection were utilized to support the present research, including the literature review, questionnaire, interview and case study. The Delphi technique was specifically employed to seek for an agreement on a number of effecting variables in developing a decision model.

Table 2.2 The integration of research methods and research objectives

Research objectives	Data collection methods					Data analysis methods				
	LR	QS	IN	CS	DS	DA	RII	ST	SI	MD
1. To investigate the motivating factors encouraging Indonesian contractors to expand operation in overseas markets	√	√	√	√		√	√	√		
2. To investigate the preferred choice of entry modes adopted to enter overseas construction markets	√	√	√	√		√	√	√		
3. To determine the significant international factors influencing the go/no go decision making of the Indonesian contractors on overseas construction projects	√				√	√		√	√	
4. To develop a decision support system-based go/no go decision making of Indonesian contractors on overseas construction projects	√									√

Note:
LR = Literature review DA = Descriptive analysis
QS = Questionnaire survey RII = Relative important index
CS = Case study ST = Statistical test
IN = Interview SI = Significant index
DS = Delphi survey MD = Model development (ANFIS based)

2.4.1 Literature Review

This research performed an empirical work on academic publications. It consisted of two research phases, initial study and preparation of research works (see Figure 2.1). In the preliminary phase, a review on several periodicals was conducted randomly to find the latest issues in construction industry practices. The publication sources mostly originated from local conference proceedings, magazines, newspapers and government's reports. Numerous academic journals were also referred to sight the issue globally. Thus, the objectives of the study could be established.

In the second phase, reviewing of literature was carried out extensively. This activity aimed at exploring the research developments in the area of interest. This effort helped to identify the gaps in previous studies. Through a comprehensive literature review of scientific journals, dissertations and textbooks, theoretical concepts and definitions of each issues (motivations, entry modes, international factors and decision support system were summarized. The results of the conducted literature review were elaborated in Chapter 3 which is primarily separated into four sections.

2.4.2 Questionnaire Survey

A survey is defined as a structured process to gather primary data from a predefined sample to generate the conclusion on the targeted population (Tan, 2002; Tjandra, 2004). This process needs a reliable instrument to assert the collected data. The questionnaire was utilized as an effective instrument for data collection. This tool was considered as an effective in which the research involves a large population (McQueen and Knussen, 2002). The processes in this questionnaire survey comprised designing questionnaire, conducting a pilot study, measuring the number of sample size and administering the questionnaires.

2.4.2.1 Questionnaire Design

All of the questions in the questionnaire were drawn from the literature review. The type of the questions in this questionnaire was closed-ended and the answer set was provided. The question format was well arranged, so the participants can easily answer the questions based on their knowledge and experience judgment. Moreover, the subjective measurement was employed based on an unbalanced

itemized rating scale. Likert scale whose seven-point's opinion was used, 1 of them was needless and the rest of them were fully necessary. This scale is more reliable and valid than the shorter or longer scales (Krosnick and Fabrigar, 1997; Tjandra, 2004). The scale has two advantages: furnishing such data that suit a variety of statistical analysis methods and mitigating the declination of the respondents on ordinal scales (Chan and Tam, 2000).

There are two types of questionnaires used in this research. First, they were distributed to the respondents (contractor enterprises) and second, they were sent to Delphi expert panelists. The first questionnaire (Appendix A1/A2) consists of three parts. Part A contains a list of questions about the respondents' and participating firms' profile. The questions in part B cover the motivations of the companies. In this part, the respondents are questioned about the most common motivations encouraging their companies to compete in OCPs. From 19 sorts of motivations derived from the literature review, 17 motives were adapted to the questionnaire. The rest of these two motives which are "to diversify market activity" and "to generate economies of scale" were excluded because they were found in one publication only. Lastly, part C encloses the primary types of the entry modes, which are preferred to increase a prospect of success in gaining and sustaining the OCPs. This questionnaire was designed to address Objective 1 and Objective 2 of this research.

The second questionnaire (Appendix B1/B2) was prepared for the Delphi study and dispatched to define experts. This questionnaire consists of two parts distributed in the first round. Similar to the first questionnaire, Part A deals with a profile of the Delphi panelists. In Part B, the panelists were asked to rate the importance of international factors in OCPs and the frequency level of the risk occurrence related to the factors. A seven Likert scale was also used, 1 is to depict "very rare" and 7 is to illustrate "very often". Following the first round, the questionnaire in Appendix C1/C2 was distributed to the same panelists. The difference is the part B questionnaire only split into two questions and extended with the result and panelists' choice of the first round. Further explanation of the Delphi survey was elucidated in section 2.4.5. This questionnaire was developed to engage the Objective 3 of this research.

2.4.2.2 Pilot Study

An evaluation of the lucidity and comprehensiveness to design a fully intelligible questioner is needed. According to Walker (1997), a pilot study is hardly imperative as focus mechanism to establish the research direction more clearly, while Munn and Drever (1990) argue that it is necessary to establish the methodological rigor of a survey. A pilot survey was employed to test the suitability of the identified motivating factors, entry mode choice and international factors in OCPs. At the same time, the respondents were invoked to add new variables if it is necessary. The pilot questionnaire in Indonesian language (Bahasa Indonesia) was distributed through postal service to a small number of respondents consisting of 25 selected contractors and academia. Eight of 25 respondents represented a response rate of 32% returned the questionnaires. This result compares favorably with the 20% response rate obtained in the pilot survey reported in Xiao (2002), while study by Akadiri (2011) was slightly higher with 33% responses.

A revision was made regarding the result to improve questionnaire suitability for the main survey. There was not major input received from respondents related to the variables. However, several feedbacks were given as follows:

1. The cover letter should contain the background, the objective, and the importance of the research.
2. Instruction about how to answer the questions should be stated clearly.
3. Likert scale employed should be represented by the lowest (1) and the highest rate (7), it should have words in Indonesian language to represent the unstable and unequal scale.
4. Technical terms should be accompanied by English if it is necessary and possible.
5. The average time spent to complete a questionnaire were advised around 15 to 20 minutes.

2.4.2.3 Sample Size

Sampling is very important because it represents and reflects the population. Due to the limitation of time and cost in conducting this research, sampling is recommended as argued by Babbie (1990) as reflected by Willard (2013). Furthermore, selection of survey location is also important. According to BPS (2014), the number of contracting companies in Indonesia was 141,959 firms. They

are divided into three group qualifications; large, medium and small contractors. From 141,959 companies, only 3% or 3939 companies were recognized as large firms. Due to the nature of the overseas operation and several factors influencing OCPs as reviewed in Chapter 4, the right population of this research was Indonesian large contractor enterprises. The sampling method is practical to collect data so that the survey can be maintained. The following formula was applied to decide the number of sampling. This formula was also used by Czaja and Blair (1996) and Akadiri (2011).

$$SS = \frac{z^2 \cdot p(1-p)}{c^2}$$ (2.1)

Where *ss* is sample size, *z* is standardized variable, *p* is percentage picking a choice (expressed as a decimal), and *c* is confidence interval (expressed as a decimal).

A confidence level of 95% was assumed like other commmon researches (Munn and Drever, 1990; Akadiri, 2011). For 95% confidence level or significance level of 0.05, *z* value is 1.96. A confidence interval (*c*) was assumed at ± 10% to seek a balance between the level of accuracy, resources availability, and practicality of the findings (Maisel and Persell, 1996). Another assumption, the worst-case percentage picking a choice (*p*), was made at 50% or 0.5 for determining the sample size based on a given level of accuracy. Based on these assumptions, the sample size (*ss*) was 96.04. This sample size however still needs an extra adjustment for finite populations less than 50,000 which is given by following equation (Czaja and Blair, 1996; Akadiri, 2011):

$$new\ ss = \frac{ss}{1 + \frac{ss-1}{pop}}$$ (2.2)

where *pop* is a number of population.

Using the new equation, the sample size remains nearly 95. Fellow and Liu (2008) emphasized that in construction related research, the percentage of response rate being regarded as tolerable in the postal survey is ranging from 25% to 35%. Based on this reasoning, again the sample size was adjusted to accommodate non-response sampling. A response rate of 30% was considered as a basic assumption. Thus, the sample size survey is calculated as follows:

$$survey\ ss = \frac{new\ ss}{0.30}$$ (2.3)

2.4.2.4 Administering the Questionnaires

Using equation (2.3), the sample size of research is 317 respondents or participants. The large contractors were listed and obtained from Indonesian Contractors Association (*Asosiasi Kontraktor Indonesia* – AKI) to select the participant candidates. AKI is the only one company association that represents Indonesian contractor firms in international scene. AKI is the member of International Federation of Asian and Western Pacific Contractors Association (IFAWPCA) and ASEAN Contractors Association. The AKI members are the top largest contractor companies in Indonesia, and some of them have international experiences. Among, 131 AKI's members, 19 companies were identified as foreign subsidiaries and joint venture companies between foreign and local groups, while five firms were not classified as Grade 6 and 7 (large firms). Thus, the questionnaire sheets were distributed to the rest (107 firms).

The number of samples from AKI did not cater the required sample size. Another well-known contractors' association, Indonesian National Builders Association (Gabungan Pelaksana Konstruksi Nasional Indonesia – Gapensi) was considered. A similar standard for determining respondents in which the companies should be large firms and be owned by local people or non-foreign subsidiaries was implemented. Two hundred and ten companies were selected to fulfill the number of sample size. Overall, 317 questionnaires were distributed to target contractor companies.

Referring to the previous study conducted by Willard (2013), the distribution of the questionnaires by hand-delivery or mail was better than by electronic forms. Regarding postal questionnaire, researchers reminded that the low response rate, inadequate questions explanation, and less motivation to complete it are among the barriers of this method (Willard, 2013). Of 317 questionnaires dispatched to selected samples, 103 responses (32.50%) were received after intensifying multiple efforts including repeated calls and emails and using internal links and colleague networking.

It was a pleasing result since many studies in the context of CM found the rate in the range of 20% to 30% such as Ofori and Chan (2001) with 26% response rate, Vidogah and Ndekugri (1998) and Shash (1993) with 27% and 28.3% response rate respectively. Slightly below the response rate of this research, the returned questionnaires of study by Abdul-Aziz and Law (2012) was 31%. It was believed

that hand delivery method and multiple efforts to obtain the response as factors affecting the increase in response rate. Results of questionnaire analysis were then supported by the interviews.

2.4.3 Interview

The qualitative information captured during interview improves the data by extending the insights (Sandelowski, 2000). Yin (2003) infers that interview is one of the important methods to generate information in research. In conducting an interview, Baker (1997, p. 131), as quoted by Fellows and Liu (2008), suggests that interviewer "asks respondents to reveal, describe, report on their interiors, or their external world as they know it." Abdul Aziz and Wong (2012) stress on the purpose of the interview to provide soliciting clarification and elaboration. This statement implies that an interview is functioned to apprehend the issues from respondents' point of view.

The utilization of interview in the studies of construction engineering and management is not a new approach (Fellows and Liu, 2008; Ming, 2015). It can be performed in the kind of structured (Chan et al. 2004; Lam et al. 2007), semi-structured (Xia and Chan 2010; Hon et al. 2010), and unstructured interviews (Rooke et al. 2004; Luu et al. 2008). In this research, the interview aims to explore the company's perspective deeply on the OCPs. The expected results of this activity are some principle issues in connection with the motivations and entry modes in OCPs.

According to Moleong (2010), unstructured interview aims to explore unstandardized or single information and it is characterized by less interruptions. The interview findings highlight the singularity, nonconformity, unusual interpretations, reinterpretations, new approaches, expert's viewpoints or individual perspective. The unstructured interview is usually carried out in the following conditions:

(1)   If the interviewee is an important person,

(2)   If the interviewer wants an exhaustive information,

(3)   If the research is directed to an invention,

(4)   If the research is addressed to investigate an uncommon issue of a case,

(5)   If the interviewer wishes to unveil an intention, motivations or respondent's explanations,

(6)   If the research aims to reveal the perceptivity of a case, the environment or a circumstance.

Considering the above state of affairs, especially for number (1), (2), (5) and (6), an unstructured interview approach was adopted in this study. The interview was undertaken after completing data analysis obtained from questionnaires. The interview was attempted to involve personnel who directly experienced in OCPs, academia and governmental officer. The expected results of experienced personnel are their companies' perspective on OCP. Otherwise, the opinions from academia and governmental officer were needed to seek different views of the phenomenon in theoretical and bureaucratic perspective respectively.

2.4.4 Case Study

Yin (2003) defined case study as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used." Naoum (2012) added that it facilitates a researcher to develop a robust argument supported by deep analysis of an individual, a group of people, an organization or a particular project. A case study brings about an in-depth investigation during collecting limited data due to the small number of subjects of interest (Zainal, 2007).

A case study is not designed to recognize a minimum or a maximum number of cases. In applying this method, it can be either sole or multiple cases. It is conducted to generalize theory and not to infer population. Therefore, it is more selective, and it is concentrated over few (one or two) critical issues. Multiple cases may reinforce the results to enhance the confidence in theory robustness. However, due to short time allocation in research, the cases should also be selected carefully (Yin, 1994; Tellis, 1997).

This method was utilized to deeply investigate the current issues of the Indonesian contractors' expansion in overseas markets, especially the strategic motives and potential market entry modes in supporting the penetration. Since only a few of Indonesian contractors involved in OCPs, the case study method is more relevant. According to Tellis (1997), a case study may derive from six sources including documents, archival records, interviews, direct observation, participant-observation, and physical artifacts. In the current research, the case study was based on relevant archival records such as company profile, working papers, newspaper, magazine and credible online sources.

2.4.5 Delphi Survey Method

As stated in section 2.4.2.1, a questionnaire was designed for the Delphi survey in order to achieve Objective 3. The Delphi technique constitutes a systematic approach in minimizing the level of bias of information gathered from expert panels and it enables to elicit expert's opinions and judgments in dealing with a complex problem (Chan et al., 2001; Yeung et al., 2007; Matthew and Gambatese, 2010). It can be marked as a method to build up a consensus toward a complex issue from a series of communication consisted of individual experts (Chan et al., 2001).

Many studies have been conducted at PhD level adopting the Delphi approach such as risk management related construction safety and health (Hallowell, 2008), partnering performance index for construction projects (Yeung, 2007) and modelling of risk allocation for public-private partnership (Ameyaw, 2014). It can also be found in numerous articles with different topics such as procurement methods selection (Chan et al., 2001); construction sustainability (Manoliadis et al., 2006), measuring complexity of building projects (Xia and Chan, 2012), risk assessment of PPP projects (Yeung et al., 2010) and effect of culture on dispute resolution choice in ICPs (Gad and Shane, 2012).

The primary reason using this method in this research is to obtain experts' consensus on determining dominant international factors in making decision of OCP for Indonesian contractors. The Delphi method was employed as an instrument of empirical data collection for locating unbiased judgements of industry specialists on the importance of international factors in OCPs and the frequency level of risk occurrence related to the factors. As cited by Ameyaw (2014) from Martino (1973), among the advantages of Delphi technique are panelist's agreement achieved through repetitive survey and suitable for studies in the absence of adequate past data for application of other approaches. In the context of this research, as argued by Utama et al (2014), the information of the Indonesian contractors' involvement in OCPs is scanty. Consequently, the quality and the abundance of data needed are less. The application of the Delphi technique for achieving one of the research objectives is therefore appropriate. The technique is able to minimize the biases resulting from dominant panelist, unrelated conversation and group insistence (Yeung et al., 2010; Ameyaw, 2015). Above arguments reinforce the use of the Delphi as a compatible data collection technique for the current study.

Despite of the advantages, this technique is not fully free from difficulties such as determining the appropriate number of panelist, reaching and maintaining a high level of response, and in reaching a consensus (Hsu and Sandford, 2007). In carrying out a Delphi survey, Manoliadis et al. (2006) and Ameyaw et al. (2015) highlight four critical issues: the requirement of panelists, number of panelists, iterative procedure and, controlled and anonymous feedback and measures of agreement.

The selection of the panelist is an initial step of the Delphi technique which was conducted by defining the criteria and identifying the expert. This stage is very decisive over the success of the method (Chan et al., 2001) and normally determined by the experts' fields in specific domain of study (Ameyaw, 2014). In defining the panelists for this research, the selection of experts should meet the following criteria, (1) they have extensive working experience in Indonesian construction sector, (2) they already involved in OCPs, and (3) they are senior or top management in the company.

Regardless of the panelist's criteria, the size of experts involved is still disagreement or debatable. For instance, eight panelists were used by Hallowell and Gambatese (2010) while Chan et al. (2010) selected ten experts in their study. Surprisingly, studies conducted by Ameyaw (2014) found a large number of the Delphi panelists involved 80, 93, and 1,685 experts. The researchers such as Chan et al. (2001), Powell (2003), and Hallowell and Gambatese (2010) argue that the number of expert panel can vary among each study due to five factors. The factors are to wit the scope of issue, the availability of experts, the investigator's capability, the distribution of experts geographically and resources readiness (time and money).

The next step in a Delphi survey is deploying a set of questionnaires to selected experts. The Delphi survey should be administered within a multi-iteration to reduce variance (reaching convergence) and increase precision regarding expert's opinions (Hallowell and Gambatese, 2010). Two to seven rounds are usually applied (Rowe and Wright, 1999; Asnan and Morledge, 2003). However, the most thoroughness of the result of the Delphi will be solicited in the second round as compared to the subsequent rounds (Dalkey et al., 1970). This research, therefore, administered the Delphi survey in two rounds.

In the first round, through questionnaire as enclosed in Appendix B1/B2, the experts were asked to rank the important level and to rate the frequency level of risk

occurrence associated with the international factors in OCPs. The results of the first round were then analyzed using mean score ranking to specify the relative ranking of the factors. The second round was conducted by sending the same questionnaire by attaching the analysis result of the first round (Appendix C1/C2). This process aimed at furnishing an opportunity for experts to consider their original opinion according to the result given. The result of the second round was then analyzed by using factor significance index (see section 2.5.6) as input variables for the proposed model. Since the key goal of the Delphi survey is group opinion consensus instead of individual agreement, the study should also ensure the consistency of the expert's opinions (Chan et al., 2010).

2.5 Data Analysis and Test Methods

The following sub-sections describe the methods employed to analyze and to test the results. Three types of analysis methods were used, including descriptive statistical analysis and relative important index. Statistical test methods including Cronbach Alpha coefficient of concordance was employed for data reliability. Kruskal-Wallis and Mann-Whitney U test were conducted to compare data of different groups in ranking. Kendall's coefficient of concordance was used for ranking agreement, and Spearman rank order correlation for assessing correlation among respondents and between groups of respondents. The methods above were used to address the first three objectives. Meanwhile, factor significance index was only applied for analyzing the results of the Delphi study.

2.5.1 Descriptive Analysis

The descriptive analysis aims to exhibit the main figures of the data collection in quantitative forms. The figures are presented in forms of frequencies, percentage, and means. This analysis was mainly employed to describe the demographic of the respondents' profile and to generate the descriptive statistics such as mean, standard deviation, standard errors, skewness, and kurtosis.

2.5.2 Cronbach's Alpha Reliability Test

The internal consistency among attributes should be assigned to ensure validity before carrying out a test for research purposes. It reveals the extent to which the attributes in a test measure the same underlying concept (Lam et al., 2005; Tavakol and Dennick, 2011). Cronbach alpha coefficient was used as a measure of

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the internal consistency of a scale, expressed in a number between 0 (indicate the questionnaire absolutely unreliable) and 1 (indicate the questionnaire impeccably reliable). Additionally, reliability score also indicates that a test has measurement error which is derived from subtracting the square of alpha coefficient from 1.00 (Kline, 1994). Increasing the reliability score means decreasing the measurement error of a test (Nunnally and Bernstein, 1994).

There are various acceptable alpha scores, ranging from 0.70 to 0.95 reported in literature (Bland and Altman, 1997; Stone, 1978; DeVellis, 2003; Netemeyer et al., 2003). Field (2009) opines that a questionnaire is considered when its α-value is equal to or greater than 0.8, while Streiner (2003) recommends a maximum alpha value of 0.90. Unlike Field and Streiner, Hair et al. (2010) argue that 0.70 and above are recommended. In addition, Stone (1978) and Netemeyer et al. (2003) interpret the coefficients as questionable (less than 0.7), marginal (between 0.7 and 0.8), and acceptable (between 0.8 and 1.0).

As point out earlier, the score of alpha correlates with measurement error of a test. For instance, if the alpha score is 0.70, then the measurement error is equal to 0.51 obtained from $1.00 - 0.70^2$. Alpha score below 0.7 increase the amount of measurement error meaning that the validity of attributes is questionable. Therefore, this study set 0.70 as threshold of the alpha score.

2.5.3 Relative Importance Index (RII)

This technique was applied to measure the response related to the rating of each variable. Most of the studies used this method to determine the significance of variables. Generelly, it has been applied in many similar types of surveys in CM research, including bidding factors to bid or not to bid decision (Wanous et al., 2000; Bageis and Fortune, 2009; Enshassi et al., 2010), factors considered in tendering by UK contractors (Shash, 1993), and Subcontractor bidding decision (Shash, 1998). It is also well known as a noted technique for generating scores of the variables (Chinyio et al., 1998; Akadiri, 2011). In this research, the score was used to calculate the importance of each motivation and entry modes as a basis of the ranking list. The score can be calculated by using this following equation.

$$RII = \sum \frac{w}{A.N} \qquad (2.4)$$

where *RII* is the rank index, *w* is the weighting obtaining from total score given by respondent on each variable, *A* is the highest rate (7 in this research) and *N* is the number of respondents.

2.5.4 Kruskal-Wallis and Mann-Whitney U Test

There are several ways to compare data of different groups in ranking. A statistical test to explore the distribution of data across groups of respondents is one-way analysis of variance (ANOVA) which is appropriate to the normally distributed data. Conversely, non parametric statistic (e.g. Independent Sample Kruskal-Wallis and Mann-Whitney U Tests) is applicable for data which are not classified as a normal distribution and measured using an ordinal scale (Love et al., 2004; Chan et al., 2011).

Independent Sample Kruskal-Wallis and Mann-Whitney U test were employed to compare data of different groups for the two profiles of samples, position and experience of respondents. The former was applied to compare more than two groups of samples, while the latter was used to compare between two groups of samples. The results of the tests are shown by sig. value in which for value less than 0.05 indicates that there is not statistically different among the groups of related respondents' profile and vice versa.

2.5.5 Kendall's Coefficient of Concordance (*W*)

This coefficient determines the degree of agreement among the respondents in questionnaire survey towards their rankings. The coefficient provides the consensus on a scale of zero (0), it means that there is no agreement among the respondents or experts, to one (1), it indicates a perfect consensus or concordance. In the Delphi survey, this coefficient marked whether the consensus has been reached among the experts or not. It shows the improvement and the relative weight of the consensus regarding the factor's rankings (Schimidt, 1997; Ameyaw, 2014). The significance of *W* has to be tested to assert that the answers given by respondents or experts did not occur by a chance.

2.5.6 Spearman Rank-Order Correlation Coefficient (r_s)

The Spearman rank-order correlation coefficient (r_s) measures the agreement of two parties on their rankings of the attributes (Lam et al., 2005). In this research, r_s measured the agreement among the paired groups of respondents based on their

position and years' experience such as between Commissioners and Directors; Directors and Heads of department (HoD); HoD and Managers; and respondents with 10-20 years' experience and 21-30 years' experience. These measures aim to observe whether there is any significant inter-group agreement on the ranking of the motivations and entry mode in OCPs or not. In the Delphi study, this test was employed to measure the consistency of the experts on the results of the first and the second-round survey.

Generally, the calculations in statistical analysis are quite complicated and time-consuming if it is carried out manually. Many statistical packages have been developed to settle the complexity of numerical calculation in the statistic. This study, therefore, utilized SPSS program, a powerful software package specially designed to tackle the statistical analysis.

2.5.7 Significance Index

As mentioned above, the Delphi survey was conducted to call for experts' consensus on the international factors in examining OCPs. The result of the survey was then analyzed to find the significance index of each factor. The following equation was adopted by Ke et al. (2011) and Ming (2015) in their studies.

$$IF_{SI} = \frac{\sum_{m=1}^{n} \sqrt{IF_{IR} \times IF_{RO}}}{n} \tag{2.5}$$

Where IF_{SI} is significance index of the international factors, IF_{IR} is the importance rate assessment of the international factors, IF_{RO} is the risk occurrence assessment of the international factors, and n is the number of respondents. The indices determine which essential factors significantly influence the decision makers in evaluating an OCP and are further used to design an evaluation form.

2.6   Model Development

This section particularly addresses the model development process in order to achieve Objective 4 of this study. It pertains the reasons of choosing the method and the steps of the model development. It then describes the optimization procedures in neuro-fuzzy consisting of learning, testing and checking process, and it is ended by validation and verification the developed model.

2.6.1 The Rationale of Approach Choice

The process of making a decision will gain a knotty and arduous problem when the process contains four following properties, multi-criteria, multi-decision makers, the degree of risk and uncertainty, and incomplete information, imprecise data as well as vagueness (Hipel et al., 1993; Singh and Tiong, 2005). Other than the problems, subjectivity and objectivity of decision shade decision makers in choosing options (Teale et al., 2003). The human experts, therefore, contribute to the process of decision making which aims to find a suitable choice among various alternatives (Sutrisna, 2004; Golmohammadi, 2011).

Given the above environment of decision making process, the decision makers need an appropriate and applicable approach to deal with a multi-dimensional circumstance. Responding to this problem, a number of Multi-criteria Decision Making (MCDM) method such as Analytical Hierarchy Process, Analytical Network Process, Case-based Reasoning, and Multi-Attribute Utility Theory have been introduced. However, there are various issues, such as practicability, data availability, efficiency and other limitations encouraged the use of artificial intelligence techniques extensively such as mathematical concepts of Fuzzy Logic (FL) and Artificial Neural Network (ANN).

As a stand-alone method, both Fuzzy System (FS) and Neural Network (NN) constitute a soft computing methodology to mimic expert behavior (Zadeh, 1965 in Nauck, 1997) and are complementary knowledge in the design of intelligent systems (Canuto, 2001). They can imitate how experts' acts to deal with a complex problem, without developing mathematical models. Otherwise, the approaches attempt to take advantage of expert knowledge in the means of observation, instruction or learning (Nauck, 1997).

NN can be used for dealing with a given problem if a set of data sample are available. Learning and computational abilities are the power of the NN (Canuto, 2001). Hence, a mathematical formulation and the previous knowledges are not necessary. The problem is that the solution deriving from the learning process in the networks cannot be interpreted because the character of the neural network seems a black box. On the other hand, the FS can be adopted to settle the problem if there is knowledge about the solution and the system that can be created by using linguistic *if-then* rules. This system does not need training data and a mathematical model of

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the problem of interest (Nauck et al., 1997). The integration of the two systems, NN and FS will bring advantages to existing ones.

Lam et al. (2001) proclaim that this integrated system is a perfect combination of fuzzy reasoning (e.g. ability in tackling uncertainty regarding imperfect information) and neural networks (i.e. ability in learning and generalizing from a prior knowledge) and a formidable approach to many engineering problems. The integration in CM discipline witnessed its application such as to predicting material prices (Marzouk and Amin, 2013), contractor prequalification (Lam et al., 2001), and estimate contractor's markup (Liu and Ling, 2003). Those studies combine FL and NN to solve non-linearity problem of multiple variable, subjectivity of decision makers' judgements and uncertainty information. Given the above narrations, the amalgamation of both techniques was considered to cater issues of decision making in OCPs. The integration form of both systems adopted in this research is the Adaptive Neuro-Fuzzy Inference System (ANFIS) as explained further in section 3.7.

2.6.2 Process of Model Development

The hierarchy structure of the model development for OCP decision making is illustrated in Figure 2.2. It consists of four main steps: determination of attributes, data collection, ANFIS operation, and recommendation. The process begins with a determination of criteria for OCP assessment. These criteria were obtained from data analysis of Delphi survey. Based on the criteria, an evaluation form of OCP was designed as an instrument to build cases database. Each attribute has a unique parameter. Tree types of parameters were considered, ordinal, categorical and numeric as a measurement scale.

The ordinal parameter belongs to the attributes such as project scale/size, the complexity of the project and the client reputation. Conversely, the categorical scale matches with the attributes like types of contract, types of client and duration of contract. Such approach was employed in many neural network studies in CM such as Al-Tabtabai and Alex (2000), Lam et al. (2001), Wanaous et al. (2003), Dikmen and Birgonul, (2004), and Ebrat and Ghodsi (2014).
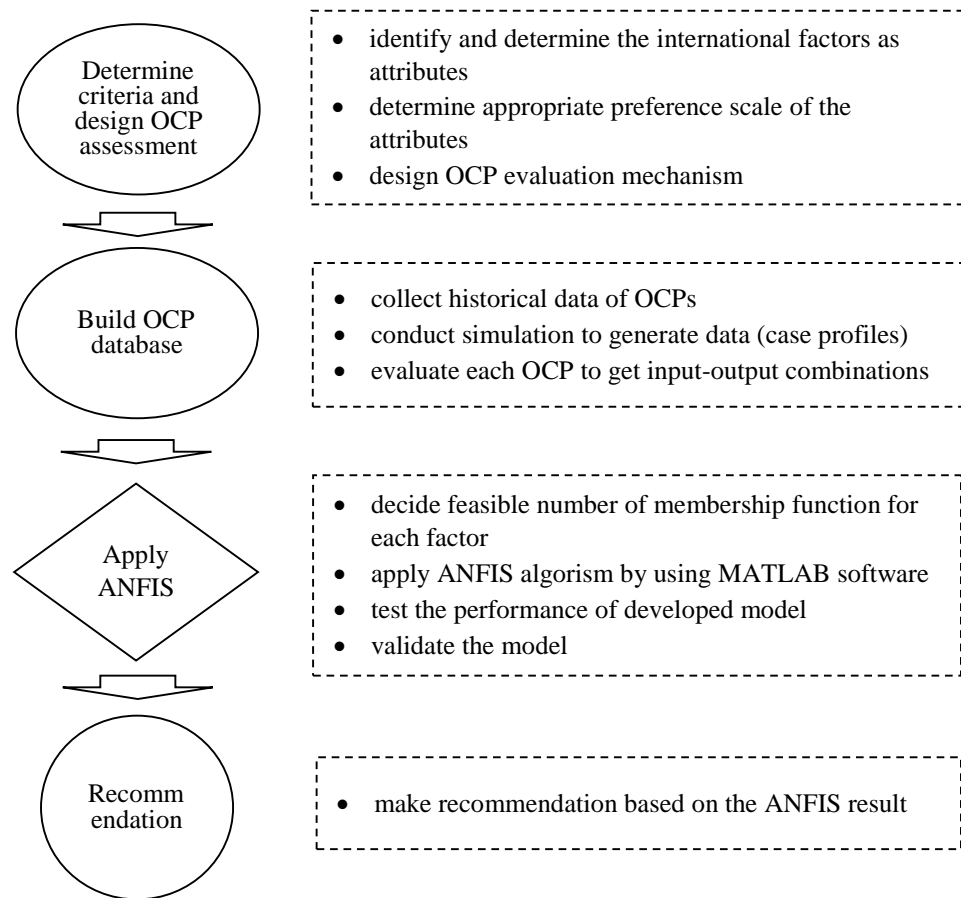
Figure 2.2. Hierarchical structure of model development

Numeric parameter was applied to the main criteria of the international factors. To anticipate plentiful attributes involved in applying ANFIS method, the attributes were grouped into main criteria namely, project, contract, client, host country, and market. The numeric scale ranges from 1 to 9, in which 1 represents the lowest and 9 does the highest. These scales indicate a score of each criterion obtained from judgement of the experts based on their experience and intuition. The last categorical attribute is an expert's decision assigning either "GO" or "NOT GO" based on the highlighted parameters of attributes and scores of the main criteria. The assessment sheets were equipped with an instruction sheet that explains the aim of this study, definitions, and assumptions. The OCP evaluation form is available in Appendix D1/D2.

The evaluation form was then utilized to assess historical data from previous and targeted overseas projects. Unfortunately, to find the data was not a gentle work, as neither the government agencies nor private institutions in Indonesia archived the

OCPs undertaken by Indonesian firms. Moreover, collecting the data from experienced companies one by one was unsuccessful. Through this attempt, there were only nine data obtained

Having the difficulties, there are four sources of data that can be used in training the network (Bailey and Thompson, 1990; Dikmen and Birgonul, 2004). They may be derived from previous works, simulation results, hypothesis results and a set of data prepared by domain experts. In the disciplines like marketing (e.g., Zhang and Qi, 2005; Atsalakis and Valavanis, 2009), education (e.g. Iraji et al., 2012), water engineering (e.g., Sudheer and Mathur, 2010), and manufacturing (e.g., Mastorocostas et al., 2005; Kurnaz et al., 2010), the use of simulation data for neuro-fuzzy operation is common. The simulation data enrich case senarios which are not found in real-life cases.

Another way to generate database is through compiling the expert knowledge as employed by Dikmen and Birgonul (2004). Therefore, a set of simulation data (case profiles) reflecting the real cases and the future scenarios of OCPs were used to get a proper analysis in this research. These cases were then combined with experts' knowledge in evaluating the score and final decision. Al-Tabtabai and Alex (2000) used a set of case scenarios with random parameters and expert judgments for modeling the cost of political risk in OCPs. Further explanation of simulated data and assessment sheet are given in section 5.3.

2.6.3 Learning, Training, and Testing

The generalization performance of a model involving NN should be monitored. It can learn and perform recognition of a pattern, and qualification and disqualification (Lam et al., 2001). To achieve this ability, the network has to be supplied with training data. From generated case scenarios, 70% of them were randomly selected for training data and the rest was considered as checking (20%) and testing data (10%). The nine real cases were used for validation of the model.

Training and testing were performed through a trial and error experiment on ANFIS environment (learning method, the number of input membership function, error tolerance, and epochs) to obtain an optimum model. The experiment iterations were conducted by modifying the environment with different settings whose minimum errors.

2.6.4 Validation and Verification of The Model

To validate and to verify the applicability and the performance of a FNN, the cross-validation method is employed. Leisch et al. (1998) and Lam et al. (2001) believed that this method is an accurate technique for evaluating model performance. Two methods, convergence, and generalization proposed by Refenes (1995) were adapted.

Convergence views the learning mechanism implemented for training data. It indicates the optimum performance of the model and the accuracy. The common indicators to measure the performance are Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE). Regarding its efficiency, the model is indicated by the correlation coefficient (R) and coefficient of determination (R^2). In this research, *RMSE* and *R* were employed.

The *RMSE* (also known as the root mean square deviation, RMSD) is a commonly used gauge of the variance between predicted scores produced by a model and the actual scores observed from the data is being modelled. In ANFIS or NN system, the RMSE or MSE is automatically generated by system and presented as average training error. Once the ANFIS parameters tuned, e.g. type of MF, the system will produce the error score. The *RMSE* for training and test sets should be very similar which indicate a good model and vice versa. Therefore, the ideal score for RMSE is zero, reflecting the model is good fit. *RMSE* is formulated in equation 2.6.

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}(A_i - F_i)^2} \qquad (2.6)$$

R score are frequently used to measure the correlation between actual and predicted scores. It measures the direction and strength of the linear relationship between actual and predicted scores, in this case model output and observed scores. R is result of the covariance of the two variables (actual and calculated scores) divided by their standard deviations. If there are a series n actual scores and n calculated scores, then the R can be used to view the correlation between model (calculated) scores and observations (actual) scores.

R value may be positive or negative; +1 indicates a perfect increasing linear relationship and vice versa. The values between +1 and -1 show the degree of linear relationship between the model and observations. R is equal to zero meaning that

there is no linear relationship between both results (Boody and Smith, 2009). *R* is formulated in equation 2.7

$$R = \frac{\sum_{i=1}^{N}(A_i-\bar{A})(F_i-\bar{F})}{\sqrt{\sum_{i=1}^{N}(A_i-\bar{A})^2 \times \sum_{i=1}^{N}(F_1-\bar{F})^2}} \qquad (2.7)$$

Where A_i, F_i and N are the actual scores, the calculated score produced by model and number of data respectively.

On the other hand, generalization indicates the ability of the network model to pattern recognition when the test samples are tested (Refenes, 1995). Ten percent of cases were provided to check the applicability and the performance of the model. Again, RMSE and R of data checking were captured. The model was then verified with nine real data to view the correctness of result in this model.

Finally, in studies adopting a specific methodology for the purpose of prediction or forecasting, it is a good practice to compare the methodology with others approaches based on their empirical results (Adya and Collopy, 1998; Wanaous et al., 2003). Cross-validation method is a course of action to evaluate a model performance by comparing it with different methodologies that has been adopted in previous studies. Leisch et al. (1998) opine that cross validation is more accurate and trustworthy approach to validate and verify the proposed model. This approach was employed in related ANFIS and ANN studies in construction management. For instance, Lam et al. (2001) developed a fuzzy neural network (FNN) for evaluation of contractor prequalification. They compared the result of developed FNN with the General Feedforward Neural Network (GFNN). Wanous et al. (2003) compared their Neural Network bid/not bid model with a parametric model, and Ebrad and Godsi (2012) utilized multiple regression analysis to compare their ANFIS model for construction project risk assessment. Another ANFIS model was compared with multiple linear regression for supplier selection problem (Guneri et al., 2011). In this current research, the ANFIS model for Go/Not go decision making in OCPs was compared with GFNN.

2.7 Chapter Summary

This chapter has elucidated systematic method to carry out the present research. It has adopted sequential mixed mode research approaches, quantitative and qualitative methods. The selection of the research approaches has considered all aspects to achieve the research objectives. Five modes of collecting data were

exploited comprising the literature review, questionnaire survey, interview, case study and Delphi survey. The descriptive statistical analysis and relative important index (RII) were utilized to analyze the data, while the Cronbach Alpha coefficient of concordance for the data reliability, Kendall's coefficient of concordance for ranking agreement, and Spearman rank order correlation were exploited as the statistical test tools. Additionally, significance index of international factors as the input variable of the proposed model was measured based on the result of Delphi survey.

The last objective of this research is tackled by the utilization of an uncertainty reasoning tool integrating the learning ability of Neural Network and the adaptation proficiency of Fuzzy method on ill-defined information and vagueness of data. Adaptive Neuro-Fuzzy Inference System (ANFIS) was chosen to train the data obtained from simulation cases. The optimization of the model was then measured by using Root Mean Square Error (RMSE) and its coefficient correlation (R) score was estimated to determine the efficiency magnitude.

The next chapter presents a literature review of international construction covering definition of international project, the strategic motivations to pursue project abroad, entry strategies for entering foreign markets, international factors in OCPs and neuro fuzzy based MCDM.

Chapter 3
LITERATURE REVIEW

3.1   Introduction

This chapter aims to provide a theoretical platform to illustrate relevant knowledge dealing with the research setting and objectives. It substantially engages with literature review regarding the needs to understand motivations, entry strategies and international factors in OCPs and multi criteria decision support system. Since the setting of research is a particular country, Indonesia, a short illustration of its current construction industry is provided. The chapter then describes the definition and the characteristics of international construction projects (ICPs). Next, generic expansion motivations are explained to deliver the rationales behind foreign expansion together with a review of construction companies' motivations from specific countries. Afterwards, the discussion goes to the entry modes commonly adopted in construction industry which describes institutional strategies to enter a foreign market. Following the discussion of entry modes, elucidations of international factors affecting decision on an overseas project is given. A literature review of MCDM applications in international construction studies is presented. Based on the review, the knowledge gaps are defined to amplify the rationale of the use of neuro-fuzzy hybrid. The concepts of NN and FL as two bases of ANFIS algorithm are then elucidated together with a review of previous relevant studies applying the both methods in the construction discipline. Lastly, the basic concept of ANFIS algorithm as decision support tool is explained.

3.2   Indonesian Construction Industry

According to World Bank (2016), "Indonesia is one of Asia Pacific's most vibrant democracies and is emerging as a confident middle-income country." Geographically, Indonesia is an archipelago nation spreading over the Indian Ocean and the Pacific Ocean. In geopolitics, Indonesia borders with Malaysia, Singapore, Philippines, Timor Leste, Australia, and Papua New Guinea. Its territory, as shown in

Figure 3.1, encompasses 1,910,931.32 km^2 of land and 6,279,000 km^2 of ocean establishing Indonesia as the world's second country having the longest coastline.

Figure 3.1 Map of Indonesia

Source: http://www.ezilon.com/maps/asia/indonesian-maps.html

Data published by Central Statistical Bureau (Badan Pusat Statistik – BPS) records that Indonesian population in 2014 was 252.2 million, growing around 1.35%. In term of the economic health, the Gross Domestic Product (GDP) of Indonesia as indicated in Figure 3.2 had some fluctuating growth during the period of 2005 to 2014. The year of 2011 booked an impressive record in Indonesian economic growth, but due to the global economic crisis in 2009, the GDP growth rate significantly plunged to below 5%. In the last five years, the stability of Indonesian economy always maintains above 5% (BPS, 2015).
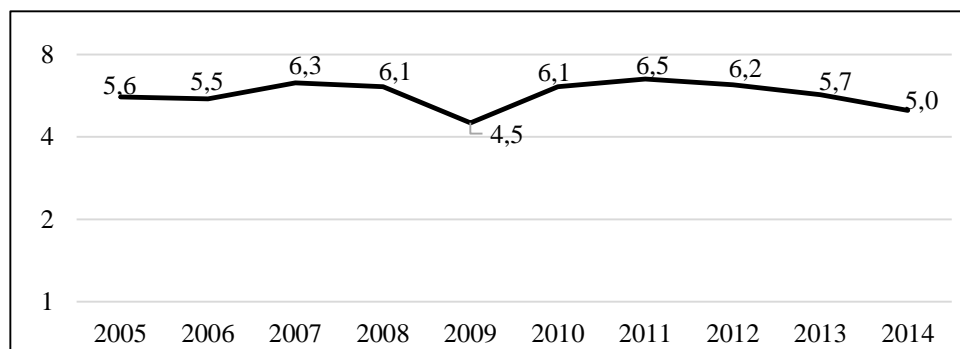
Figure 3.2 Indonesia's GDP 2005 – 2014 (BPS, 2015)

In regard to Indonesian development, the construction sector has significantly contributed to economic development. The importance of construction sector can be

viewed from its contribution to Indonesian GDP as shown in Figure 3.3. The value of construction works in GDP has gradually increased every year, IDR 151.2 trillion in 2004 to IDR 907.3 trillion in 2013. In terms of industry growth, this sector has reached over 10% since 2010. The nominal GDP for construction sector fluctuated in the range of 6.6 to 8.5%, while in constant price basis, this sector contributed between 0.4% and 0.5% (BPS, 2005-2014).
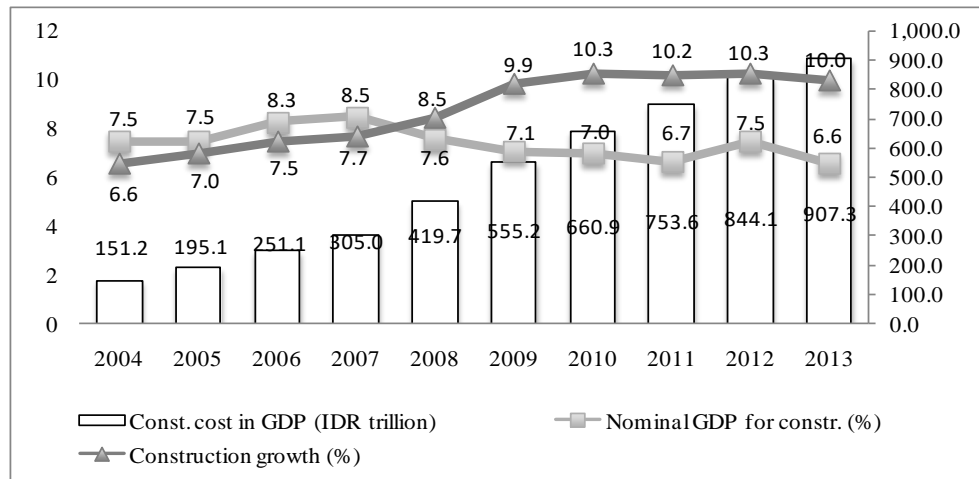
Figure 3.3 Growth of construction sector (BPS, 2005-2014)

Construction projects traditionally are labor-intensive (Edmonds, 1979). This sector approximately absorbs 6 million employees every year, which is about 6% of the total workforce of Indonesia. The workers are however, dominated by unskilled workers. Seventy-six percent of construction workforces are unskilled labor. The rest are skilled workers (20%) and expert (4%). Based on the construction regulation, every personnel who involves in construction projects should have certification, certificate of craftsmanship as a worker and a certificate of expertise as an engineer. In reality, such certificates are owned only by less than 10% workers (Center of Public Communication, 2012).

According to the construction law (UU No. 18 / 1999), construction services in Indonesia are divided into two types; contracting and consulting services. Based on the data released by National Construction Services Development Board (*Lembaga Pengembangan Jasa Konstruksi Nasional* - LPJKN) in 2014, the number of contractor enterprises is 141,959, while consulting firms are 6,418 as summarized in Table 3.1. The majority of the companies are small and middle-sized enterprises and only 3% and 7% are recognized as large-size contractors and large-size consulting enterprises respectively (Suraji, 2014). Both contracting and consulting

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enterprises are categorized into private (local and foreign subsidiaries) and state owned enterprises (BUMN–*Badan Usaha Milik Negara*). BUMN with construction as their core business consists of eight contracting and six consulting firms.

Table 3.1 The number of construction companies

Classification	Contracting company		Consulting company	
	Number	%	Number	%
Large	3,939	3	429	7
Medium	11,322	8	908	14
Small	126,698	89	5,081	79
Total	141,959		6,418	

Studies on Indonesian construction competitiveness indicate that the competitiveness of this industry relatively low. The tendency is caused by many inhibiting factors such as, (1) unsuccessful strategy and policy development; (2) high transaction and execution cost; (3) lack of coordination; (4) management and conflict among parties; (5) low response and adaptation to technology changes; (6) capital and human resource limitation; and (7) unhealthy competition (Budiwibowo et al., 2009; Huda and Wibowo, 2013).

Above figures show that although construction sector is steadily growing and significantly contributes to national development, main issues like certification of construction trades, a large number of unskilled workers, imbalance profile of construction firms and low competitiveness still become big problems which should be resolved soon. Once these hindrances tackled, Indonesian construction enterprises will be able to compete openly against foreign competitors both in domestic and international markets.

3.3 Definition and Characteristic of International Construction Projects

Transnational construction trade is rapidly growing. Of interest is the necessity and difficulty of defining the term "international construction" when used in the international discussion (Mawhinney, 2001). So far, there has not been a standard definition of the term admitted as a consensus among academia or industry experts. Nonetheless, Mawhinney's definition of "international construction" which state that "where one company, resident in one country, performs work in another country" has been referred by several authors such as Gunhan (2003), Ngowi et al.

(2005), Dikmen and Birgonul (2006) and Tan and Ghazali (2011). The foreign construction market is a term used by Arditi and Gutierrez (1991) to refer to projects conducted by contractors outside of their home bases country.

The definitions above have a common thread in context of activity and location. However, the context may generate two questions. First, when a firm, local to one country, but owned by a foreigner, conducts work in that country, can this work be termed international construction? (Thorn et al. in Mawhinney, 2001). Second, if a small project, based on the use of simple technology and sited in one country, but executed by a foreign company, can the work also be termed "international construction"? Momaya and Selby (1998) and Ofori (2003) affirm that for a project to be termed an international construction, it must be domestically sited and also involve overseas companies. Jaafari (1984) adds that there should be two or more nations taking part, in various roles such as owner, financial sponsor, consultant, or contractors in the project.

When the phrase "international construction" is mentioned, a first assumption arisen could be a mega project, involving highly complex technology, a variety of expertise and disciplines, each of which being the contributions of one or more large foreign companies. Neo (1976) and Seymour (1987), from different angle highlight the high-risk level faced by international and domestic construction companies involved in joint large-scale projects. Hence, the hazards of a hostile environment, potentially poor infrastructure, skilled labor shortage, and technology disparity, were brought into the equation.

Jaafari (1984) summarizes characteristics of transnational projects from different studies as follows:
a. The projects are complex regarding technology, location, and logistic supply.
b. The project duration takes longer by even five years, from initiative until the beginning of construction works.
c. The projects are subject to specific time/date pressures (e.g. soft and grand opening) that may critically affect an owner's assumptions or further plans.
d. Unfamiliar internal and external factors can easily provoke unexpected project changes.
e. The projects sometimes require the use of an uncommon technology or may depend on pre-fabricating materials.
f. The projects rely on international supply and procurement.

g. A team consisting of the personnel from various nationalities and backgrounds usually organize the project.

h. The local procurer of the project often insists on the use of domestic resources such as labor, materials, and services.

i. The project organization is structurally complex and not even well defined. In consequence, the project manager sometimes faces problem associated with using his authority.

j. Overlapping coordination in the projects may occur, due to the involvement of government bodies in one hand, and the individual person in the bodies on the other hand.

k. The projects often have a strategic impact either social-economic or environmental concern. Thus, they are sometimes executed for political reasons.

l. They suffer from inertia and are slow to respond to their ever-changing environment. The involvement of the diverse array of agencies often cripples the decision-making process.

The characteristics above comprehensively straighten what composes an international project. To ensure clarity in this thesis and to distinguish whether a work is an international project or simply a project located abroad, the phrase "overseas construction project" (OCP) is used to represent the latter. OCP corresponds to the objectives and it is used throughout this thesis to mean construction activities carried out by a company outside their usual area of business jurisdiction.

3.4 Motivation to Enter the Overseas Construction Markets

Internationalization is a term illustrated as an expanding process of companies' business activities through progressive actions to broaden their participation in transnational markets and to perform cross-national boundary transactions (Ahmad and Kitchen, 2008). This term encompasses attributes of various strategies within multifaceted and multiple dimensional setting (Buckley and Ghauri, 1999). In process of the internationalization, there exists a variety of strategic motivations driving company's decision. In general business and marketing field, some reasons to join international market are included into current important subjects and have been discussed in many previous studies such as Czinkota et al. (2000), Czinkota and Rokainen (2004) and Contractor (2012).

Furthermore, a comprehensive literature search associating with CM studies has found that there are scanty investigations of internationalization motivations in construction enterprises. As fascinatingly argued by Abdul-Aziz (1994), a construction is a business which its motivations to venture overseas are similar with manufacturing sectors. However, even though the underlying reasons are similar, the motives in one industry may create different effects (Ahmad and Kitchen, 2008). Table 3.2 summarizes the internationalization motives of construction industry. Each motivation is explained under four categories; profit-related motives, market-related motives, resource related motives, and promotion related motives.

3.4.1 Profit Related Motives

A major rationale of a business' participation in global markets is to secure their financial aspects (Han et al., 2007). In corresponding to these aspects, motivation to venture overseas market is driven by an eagerness to increase profitability, to increase turnover, to sustain or to balance growth and to maintain shareholder's interests.

3.4.1.1 To Increase Profitability

Profitability is a reason stimulating any action of enterprise's strategies (Czinkota et al., 2000). The pursuit of international profit becomes a global substantial motivation for companies' operation globally (Contractor, 2012). It is believed that conducting projects abroad is more profitable than carrying out the local projects (Fatemi, 1984). Table 2.3 indicates that "To increase company's profitability" is one of the principal motives (supported by 11 studies) encouraging construction firms to export their services. However, not all overseas operations can derive a profit to the company in a short time. According to Abdul-Aziz (1994), Japanese companies preferred to gain a long-term success rather than a short-term profit. These reasons also motivated the UK contractors to go abroad (Crosthwaite, 1998).

Table 3.2. Summary of identified internationalization motivations

	Motivating factors	[1]*	[2]	[3]*	[4]	[5]*	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	Sum
1.	To increase profitability				√		√	√	√		√	√	√	√	√	√		√	11
2.	To balance/sustain growth		√	√	√	√					√	√		√		√	√	√	10
3.	To increase turnover						√	√	√										3
4.	To maintain shareholders' interest	√						√									√		3
5.	To expand business	√	√						√				√				√		5
6.	To diversify market/activities										√								1
7.	To avoid/counter saturation in domestic market			√		√	√	√	√		√		√	√		√	√		10
8.	To capitalize on booming market			√		√				√	√		√				√		6
9.	To capitalize on globalization/free trade											√				√	√		3
10.	To diversify company's risks		√					√	√				√			√	√		6
11.	To optimize use of resources	√	√	√		√	√	√	√				√	√		√		√	11
12.	To benefit competitive advantage		√		√					√	√							√	5
13.	To harness company expertise		√								√	√				√	√	√	6
14.	To actualize company's vision	√										√	√	√					4
15.	To generate economic of scale				√														1
16.	To respond project sponsor invitation													√	√	√			3
17.	To respond home government encouragement			√						√		√		√	√				5
18.	To gain international experience				√					√			√			√	√		5
19.	To be anchor player in host country									√	√		√						3

Source: [1] Neo (1976), [2] Seymour (1987), [3] Quak (1989), [4] Giritli et al. (1990), [5] Kaynak and Dalgic (1992), [6] Abdul-Aziz (1994), [7] Crosthwaite (1998), [8] Abdul-Aziz and Wong (2010), [9] Chen and Orr (2009), [10] Teo et al. (2007), [11] Awil and Abdul-Aziz (2002), [12] Maqsoom et al. (2014), [13] Abdul-Aziz et al (2013), [14] Sui and Hongbin (2003), [15] Mat Isa et al. (2006), [16] Mutti and Flanagan (2008), [17] Gunhan and Arditi (2005).

* Adopted from Awil and Abdul-Aziz (2002).

3.4.1.2 To Balance/Sustain Growth

In economics, "sustainable growth is the realistically attainable growth that a company could maintain without running into problems" (Goswami and Sarkar, 2014). It is not easy to maintain this growth for both small and large companies' businesses. According to Joshi (2009), one day, a company which highly relies on the domestic market may get a trouble when the market gets decline or saturated. For large businesses, operating in small market affects to their investment return. Therefore, combining both domestic and foreign operations can anticipate this kind of business atmosphere.

In Table 3.2., ten studies identify that this motivation is a core reason to expand construction market to abroad. A study of Abdul-Aziz (1994) evidences that this motive was a concrete reason of internationalization done by American and Japanese companies. He states that although the US domestic market is huge, but too many large contractors in the market create saturation due to a finite number of large-scale project. Besides, although this motive was also found in British contractors, but it was not their major concerns (Crosthwaite, 1998). Previously, a similar study on internationalization of British construction firms (Seymour,1987) did not pertain this motive as a factor to carry out overseas projects.

3.4.1.3 To Increase Turnover

According to Oxford online dictionaries, turnover is defined as "the amount of money taken by a business in a particular period," while online Cambridge dictionary defines it as "the amount of money that a company gets from sales during a particular period." Based on those definitions, turnover can be described as the gross income obtained by a company as a result of its business activities in a certain period. Table 3.2 shows that this motive is not a major factor (found in three studies) pushing construction firms to enter foreign markets.

Crosthwaite (1998) proclaims that there is an increase in turnover parallels with the number overseas projects carried out. He observed the overseas operation of British contractors during the period 1990-1996 and found that those companies were enjoying a high overseas turnover for both revenue and shares. Although British firms had increasing returns from overseas operations, they did not acknowledge it as the primary motive to go international. Conversely, Japanese

international contractors confided that overseas projects offer good prospects of increasing turnover (Abdul-Aziz, 1994). In his study, Abdul-Aziz found that most of American and Japanese contractors admit that goal of their trans-national projects is to increase the turnover.

3.4.1.4 To Maintain Shareholders' Interest

Maintaining dividend remittances to the shareholders is a term used by Seymour (1987) to accentuate maintaining shareholder's return. A shareholder is a person or a group who partly belongs to company ownerships by having company's stocks. Shareholders capitalize company operations in the hope of getting a dividend. In other words, they have strategic interest and play an important role in company operation. A study by Neo (1976) identify that maintaining dividend remittances to shareholders constituted one of the main reasons for a global involvement of British construction companies in the 1970s. Crosthwaite (1998) discovers that shareholders have influenced company's decision to invest abroad, and their opinion on giving choice related to overseas markets. Then, he exposes that this motive arises because most of the companies operating overseas were registered in the stock market which subjects to intricate of stock trading. From 20 studies in Table 3.2, it is indicated that this motive is not too dominant as a reason to go abroad.

3.4.2 Market-Related Motives

These strategic motivations correlate with surviving from an unexpected situation, such as over fullness at home market or regional economic turbulences. In addition, this may be an opportunity to explore and to exploit new markets. The overseas expansion means that firms expand and enlarge company's market size at the same time and it is very helpful to counter the occurrence of economic turmoil in their traditional markets (Rocha et al. 1990). These motives include expanding the business, diversifying market/activity, avoiding saturation in the domestic market, capitalizing on booming market and capitalizing on globalization/free trade.

3.4.2.1 To Expand Business

Finding market overseas is one of the strategies to expand a business when business in the traditional market has been in a stable position. This motive was used by multinational enterprises as a springboard to adduce the company culture and spirit (Luo and Tung, 2007). Business dictionary defines this as an attempt to

introduce a product or service to broader available markets or to other new markets, which are very different in terms of geoposition, population and psychology characters. Actually, this motivation is found in five studies as indicated in Table 3.2, which means that there is a quite moderate reason for venturing overseas projects.

In relation to the construction business, Gunhan (2003) argues that expanding a business is an aggressive strategy which can be performed in three approaches. First, carrying construction related business such as property and equipment rental. Second, expanding the business to a neighbor country, and third, entering the overseas markets by one-off project approach. A study by Neo (1976) and Quak (1989) find this motive as the main factor in internationalization British and Singapore construction firms. Interestingly, this motivation also encourages Pakistani enterprises to get overseas projects (Maqsoom et al., 2014). According to Twarowska and Kakol (2013), a company sometimes faces difficulty when there are earlier competitors established in the market. Thus, one of the market expansion objectives is to precede the competitors to enter the market.

3.4.2.2 To Diversify Market/Activities

Diversification is a strategic option of the company to broaden its main business by varying product markets (Pandya and Rao, 1998). Several benefits of international diversification were identified, such as minimizing insolvency (Shaked, 1986), increasing profitability (Leftwich, 1974), improving performance (Kim and Lyn, 1986), and improving investor's risk-return opportunities (Logue, 1982). According to Jung et al. (2012), diversification motive can be triggered by a decreasing of the profit margin in a contracting market.

Teo et al. (2007) uncover that exporting construction services to abroad motivates to develop a different mix of related activities for small and medium enterprises of Singaporean contractors. On other words, international diversification is a strategic motive which can be adopted to swiftly enter foreign markets by a change in company's core activity. Unfortunately, this reason is only documented in one study as reported in Table 3.2. This implies that this motive is not a main objective of construction enterprises expansion.

3.4.2.3 To Avoid/Counter Saturation in Domestic Market

Market saturation is a situation when the producers cannot sell their product or service because of low demand (Crosthwaite, 1998). When domestic markets are not able to increase firm's income, foreign markets may be possible to do it (Kangari and Lucas, 1997). Table 3.2 shows that among 17 studies, this motive is mentioned in 10 studies, which deliver an idea about this motivation as the major reason.

"Maintain profit at the time of low home demand," a phrase used by Seymour (1987) to indicate market condition, was the second major factor motivating British contractors to find projects in overseas markets. This idea was also supported by Gunhan (2003) who argues that having foreign markets in several areas would be a better option in a stagnant domestic market. Thus, the contractors from relatively small domestic markets (e.g. the Netherland and Sweden) need to consider overseas projects to avoid domestic market saturation (Pheng and Hongbin, 2004). When there is a small demand on domestic construction industry, its revenue which is usually generated from domestic projects, drastically drops and jeopardizes the company's operation perpetuity. Therefore, overseas markets are advocated as a solution for the saturated market.

3.4.2.4 To Capitalize on Booming Market

Economic booming in a foreign market can induce the company to leave its traditional market. For instance, oil lifting price in the 1970s created economic booming in the Middle East and North Africa attracting foreign firms to enter their markets (Ofori, 2003). Raftery et al. (1998), another sample put an emphasis on escalation foreign participant in Asian developing countries as a result of large private sector's contribution in the construction of infrastructures. Table 3.2 illustrates the finding opportunity in a booming market which is supported by six studies.

An investigation toward the goals of internationalization of British construction enterprises affirms that they prioritized a new tapping and booming markets to expansion (Crosthwaite, 1998). The expansion to booming market area when there is downturn in the domestic market can be a right time for enterprises to penetrate into overseas markets. At the same time, they will be able to position themselves among foreign competitors.

3.3.2.5 To Capitalize on Globalization/Free Trade

Explicitly, "to capitalize on globalization" as an expansion motivation can be found in three studies as summarized in Table 3.2. World Trade Organization and Regional Trade Agreements have made pivotal issues that the industry markets are for both in domestic and abroad. Globalization trend as illustrated by Raftery et al. (1998) in Ofori (2000) is the result of the general development of the economic sector and the effect of foreign company's operation in the developing countries. This phenomenon abbreviates international barrier and offers an opportunity to local firms to enter foreign markets (Gunhan and Arditi, 2005).

Related to this phenomenon, taking advantage of the opportunities offered by globalization was a decision on internationalization done by Malaysian contractors (Maznah et al., 2006). Previously, Awil and Abdul-Aziz (2002) reported that the globalization was one of motivation factors determining the internationalization by Malaysian contractors. This result is then strengthened by Ahmad and Kitchen (2008) who investigate the same country. In globalization era, countries' borders are imaginary, and any initiatives declared to exploit the phenomenon will get advantages.

3.3.2.6 To Diversify Company's Risks

"Do not put your all eggs into one basket" is a classic proverb which is represented most on this motivation. According to Griffin (2010), spreading a company's risk across countries gives some exposure to fastest-growing markets and helps the company withstand the shortcoming risks. Construction companies which immensely depend on domestic demands tend to face high risks when a crisis slams the economy. Brazilian contractors, for example, decided to internationally expand their business as a way to spread the company's risk after experiencing an economy crisis at the beginning of the 1980s (Mutti and Flanagan, 2008). Much earlier, Quak (1989) and Crosthwaite (1998) convince that diversification or spreading the company's risk as a critical factor pushing enterprises towards internationalization.

3.3.3 Resource Related Motives

This phrase refers to motivations which the companies perceive their resources as a capital to expand their market abroad. The motives include

optimization of the use of resources, beneficial of competitive advantages, utilization of company's expertise, vision actualization and generating economies of scale.

3.3.3.1 To Optimize the Use of Resources

Company's resources consist of the workforce, machinery or technology, money and other assets. The resources have to be operated or employed in constant workload to optimize the function and productivity (Gunhan, 2003). However, it is difficult to reach and to maintain such constancy in the domestic market where projects on hand are much lower than company's capacity to handle several projects at the same time. In consequence, the company should consider seeking projects abroad to optimize the use of its resources. Motivation to optimize the use of resources by securing project overseas was validated by Abdul Aziz (1994) who studying American and Japanese contractors and Crosthwaite (1998) who investigate British firms. The results of their studies expose that this motive was very important according to American contractors, while Japanese builders indicate moderately important.

3.3.3.2 To Benefit Competitive Advantage

Competitive advantage is a distinctive and superior resource or asset belonging to a company which may not belong to other competitors (Dunning, 2014). Some similarities in religion and culture with the host target countries, for instance, are one form of competitive advantages for the competing firms to allow them to be accepted more easily in the markets (Gunhan, 2003). A study by Gunhan highlights competitive advantages of Turkish, Singaporean and Hong Kong contractors in conjunction with foreign market penetration. Turkish enterprises enjoy entering and conducting projects in Islamic regions such as the Middle East and North Africa. Meanwhile, cultural and language proximity and geographical distance make Singaporean and Hong Kong firms savor working in Chinese market. Those companies were motivated to explore certain markets where they can exploit their competitive advantages. The similarity in religion identity, culture and language are forms of competitive advantages.

3.3.3.3 To Harness Company's Expertise

Similar to asset optimality and competitive advantage, company's expertise or specialization is one of a company's strengths affecting decisions to penetrate

foreign markets (Gunhan and Arditi, 2005). This special proficiency reflects an ability of a company to master advanced technology (Strassmann and Wells, 1988). According to Teo et al. (2007), due to market diversification abroad, contractors were motivated to put their competencies to a greater use, while Awil and Abdul-Aziz (2002) stress on the provision of specialist expertise and technology in their study. In this case, the advancement in management and technology and mastery in information technology enable the developed economies to occupy the markets of less developed economies.

3.3.3.4 To Actualize Company Vision

Vision is defined "as realistic, credible, attractive future for an organization" (Nanus, 1996). Company or top management vision shapes the realistic reason and directs the company's missions (Madu, 2013). Ahmad and Kitchen (2008) opine management vision as a type of self-motivation of a company to extend its business horizon abroad. Therefore, the international vision of company's management, manifests a desire to expand the coverage area of a business. Awil and Abdul-Aziz, (2002) emphasize that a part of the motivation, vision reflects the ambitions of a company's and individual's strategies, resources, and capabilities. Abdul-Aziz and Law (2012) report that a top management decision which is directed by company's mission was a top motivation for internationalization of the companies. For an organization, this vision is an inspiration and motivation to look far ahead of the future prospect.

3.3.3.5 To Generate Economies of Scale.

Enhancing company's market size to abroad indirectly generates *economies of scale* by taking some opportunities on facilities such as bulk-buying, mass production, financial support easiness, marketing cost efficiency and specialty of human resource. As a result, a company may compete for a lower unit price against its competitor. Unfortunately, as reported in Table 3.2, this motive is only supported by one study. This motivation has also encouraged Singaporean (Quak, 1989) to venture to overseas markets, but there was no further explanation how internationalization may benefit from economies of scale in OCPs.

3.3.4 Opportunity Related Motives

In this motive, the companies consider specific markets for business expansion because there are several opportunities in the markets. Those opportunities include invitation from project's sponsor, home government encouragement, international experiences and as a key player in the markets.

3.3.4.1 To Respond Project Sponsor's Invitation

Project invitation from abroad can be initiated by the host government, foreign private sectors and local investors running their businesses in the host countries. In certain situation, clients deliberately invite the foreign companies to execute the projects due to the unavailability of the local expertise (Cattaneo, 2010) or having a good relationship with the companies (Menzies and Orr, 2014). Pheng (1996) supports the argument above that the construction market in developing countries demands on the use of advanced construction technology which can only be provided by developed economies. Furthermore, the governments can offer some projects to the foreign contractors through sharing of beneficial consensuses such as design-build-finance and operate contract (Mawhinney, 2001) or Public Private Partnership schemes (Chan and Cheung, 2014). Several incentives such as tax remission and relief on licenses, permit and official clearance and land utilization often serve this invitation (Cattaneo, 2010). Both the incentives and the beneficial consensus can considerably attract the company to enter a foreign market.

3.3.4.2 To Respond Home Government's Encouragement

Home government plays a strategic role in supporting local companies to compete in overseas markets. Measures can be taken by the home government to back up the overseas expansion of the local firms. The support can be direct and indirect as considered by Seymour (1987). He explains that an indirect support, such as strategic coordination involving several selected industries, might support the local contractors to compete against foreign contractors as a single national entity. On the other hand, direct supports such as reducing taxes, offering subsidies, providing funds, credits, bond, and guarantee, may enhance the competitiveness of national contractors in the foreign market. Both types of supports have been implemented, for instance by the Chinese government (Pheng and Hongbin, 2004; Zhao et al., 2009; Chen and Orr, 2009) to bolster Chinese contractors becoming

major world players. Home government support, therefore, is a vital element in pushing local firms to be the global players.

3.3.4.3 To Gain International Experience

Companies involvement in overseas markets allows the companies to have a greater opportunity to develop foreign strategic networking (Reuber and Fischer, 1997). Past experiences may also enhance company's ability in analyzing potential clients and projects for further bidding decision (Jarkas et al., 2014). Mutti and Flanagan (2008) add that home country might get benefit in the form of knowledge and technology by learning from overseas partners. The motive to gain international experience increases in the initial period of operation abroad and casually drops with concomitant of the learning process of firms in overseas projects (Abdul-Aziz and Wong, 2010).

3.3.4.4 To be an Anchor Player in Host Country

Through the foreign aid schemes for developing infrastructure facilities in many Asian and African countries, Chinese construction companies, for instance, have successfully dominated African market. An insignificant number of Western competitors in African markets also bolster the domination of Chinese contractors (Chen and Orr, 2009). This circumstance gives advantages for Chinese companies to have a role as an anchor player in the markets. The criticality rate of this motivation is, however, considered as moderately important by several researchers such Abdul-Aziz and Wong (2010) and Maqsoom et al. (2014).

3.3.5 Internationalization Motivations from Specific Countries

The contractor's motivations in one country may vary among different countries. Several researchers observed the internationalization motives of specific countries. A part of the studies is discussed below.

The motivation of Chinese contractors draws the attention of Pheng and Hongbin (2003) who classify the motivations based on two historical periods. Before 1979, their motivations were mainly for aiding developing countries initiated by Chinese government. Conversely, since the 1980s, the motivation has been changed to profit-driven after the investment policy was regulated. In other studies, Chen et al. (2007) and Chen and Orr (2009) discover that Chinese government's initiative stimulates the involvement in foreign markets, especially in many African countries.

The significant profit margin which they obtain from African clients also motivates them to enter the African markets.

Malaysian and Pakistani contractors' motivations were investigated by Abdul-Aziz and Wong (2010) and Maqsoom et al. (2014) respectively. Both those researchers used survey method and simple statistical analysis in their studies. Using a five Likert scale, the first mentioned researchers finds 11 important and two moderately important motives. In contrast, the later mentioned discovers that there are four main important motivations, five important motivations, and two moderately important motivations. Regarding identification of the motivations, they agree with eight motivations namely: to expand the business, to optimize the use of resources, to increase the profit, to gain international experience, to diversify the risk, to counter domestic business cycle, to increase market share and to be international anchor player.

Giritli et al. (1990) discuss internationalization from the prospective of Turkish companies. This study describes the journey of Turkish construction development in paving the way international expansion. In Turkey, the initial reason to gain a project abroad was the domestic economic recession in the 70s which made the companies look for a better profit from foreign projects. Kaynak and Dalgic (1992) support the study by Giritli et al. that the Turkish enterprises' penetration was to avoid market shrinkage at home and at the same time took advantages of the booming market in the Middle East in the 80s.

Teo et al. (2007) investigate the reasons standing behind Singaporean small and medium-size contractors' expansion. Thirty contractors' responses were analyzed using factor analysis. The result showed that to increase company's growth in size and profitability placed the top motivation followed by to gain competitive advantage and to create a business in the second ranking. Based on the result of factor analysis, the authors cluster the motivations into three groups: market-oriented motives, risk-oriented motives and growth-oriented motive. In contrast, Quak (1998) investigated 24 Singaporean enterprises and found that the main expansion motives were business expansion and spreading of risk.

The motivation of Brazilian contractors was observed by Mutti and Flanagan (2008). Similar to the reasons of Turkish contractors in the 1970s, low construction activities at home in the beginning of the 1980s caused by the economic crisis, forced contractors to explore project opportunities abroad to maintain their company's

growth. Today, according to Mutti and Flanagan, diversification of risks has become a new reason for Brazilian contractors to take a part of overseas projects.

All the motivations above drive the construction companies to expand their market operation. However, they cannot automatically usher the companies to enter foreign markets. Hence, an expansion relies on the adopted strategies to penetrate the foreign markets, known as entry mode or market entry strategy. Further explanation on this topic is presented in following section.

3.5 Entry Mode in International Construction Business

Entry mode has been discussed in many studies, partly concerning strategic management and general business (Chen and Messner, 2009). In this section, the literature review highlights the definition and classification, types and characteristics of entry modes, commonly adopted in construction service industry.

3.5.1 Definition and Classification

Entry mode is defined as "a form of system arrangement, a way of transferring product, technology, manpower, management experience and other resources into other countries" (Root, 1994 in Li et al., 2013). Similarly, Chen and Messner (2011) define this term as "an institutional arrangement that makes possible entry of a company's products, technology, human skills, management, or other resources into a foreign country." Hence, entry mode is an institutional arrangement to mobilize a company's products and assets, such as expertise, technology, resources and management to set up business activities in foreign markets. Entry mode, entry strategy and market entry are three terms often used interchangeably.

In many literature, strategic management and general international business are the core body of knowledge comprehensively discussed entry mode (Chan and Messner, 2009; 2011). Therefore, the vast majority of theories related to entry strategy were adopted from the context of general international trading. For instance, Ekeledo and Sivakumar (1998), Pan and Tse (2000) and Chen and Mujtaba (2007), all proposes that entry mode constitutes a core issue in the internationalization of company businesses.

The classification of these entry modes in general business studies was described by many researchers such as Caves (1982), Root (1994) and Czinkota et al. (2000). Based on the institutional dimensions, Czinkota et al. categorizes the types of

entry modes as follows: cooperative or competitive, hierarchical levels, contractual or investment, ownership, supportive or main, permanent or mobile, and hierarchy or market. According to Caves (1982), the entering to foreign markets can be undertaken through four principal ways: exporting, licensing or franchising, strategic alliance, and wholly owned subsidiaries. Unlike Caves' study, Root (1994) divides the entry modes into export, contractual and investment entry modes. In connection with construction business studies, Li et al. (2013) agree with the classification of entry modes as mentioned by Root, but Ling et al. (2005) group them into four categories: wholly owned subsidiaries, equity joint venture, project joint venture and other alliances.

The features of entry modes can also be viewed based on strategic effects on company operation. For instance, Chen and Messner (2010) explain that a company prefers to an entry mode which brings them higher returns and low risks. This option is suitable when the company has a big control toward the resources and flexibility of the operation. The option of the strategic effects embraces, risks and returns (Agarwal and Ramaswami, 1992; and Luo, 2001), resource availability and control need (Cespedes, 1988) and flexibility of companies (Chen and Messner, 2011).

3.5.2 Types of Entry Modes

Due to the uniqueness of construction industry as a service business which is considerably distinct from other industries, not all types of market entry strategies are applicable (Pan and Tse, 2000; Chen and Messner, 2011). The construction industry, therefore, needs to modify some concepts adopted from other industries (Chen, 2008). Numerous studies addressed the issue of the foreign entry mode related to the international construction industry. For instance, Ling et al. (2005) identify 13 modes of market entry, while Chen and Messner (2005) structure 10 entry modes in a taxonomy. Although concept by Ling et al. and Chen and Messner are similar, both studies take different perspectives in identifying and structuring market entry modes. The major differences are that Chen and Messner take setting up representative office, nominating local agent, licensing other companies license and BOT into account, whereas Ling et al. do not. In the following section, the entry modes commonly employed in the construction industry are described by referring to Chen and Messner (2009).

3.5.2.1 Strategic Alliance (SA)

SA is an embodiment of the globalization (Oman, 1984; Contractor and Lorange, 1988; Abdul-Aziz, 1994). It is a commitment of inter-corporate coalition to establish long-term mutual benefit cooperation through sharing resources, profits and duties without a contract. According to Tse et al. (1997), SA offers several advantages for entrants such as alleviating risks, improving efficiency, sharing technology, enlarging the scope of work, and strengthening global competitiveness. Additionally, entrants may easily arrange work permits, acquire local standards and market information such as labor, competitor, and material when forming an alliance with a local partner (Badger and Mullian, 1995).

Practically, SA does not pertain directly to a project, instead this mode tends to encourage the creation or establishment of other entry modes, such as Joint Venture Project or Build-Operate-Transfer. It means, after establishing SA, a company needs to adopt other modes to enter target market for which SA's partners may support. SA encourages multi partners or collaboration with owners, suppliers/subcontractors, local contractors, home contractors and international contractors (Chen and Messner, 2009).

3.5.2.2 Local Agent (LA)

LA is a person or organization assisting an entrant in entering a market where the agent domiciles by carrying out special duties. An agent's duty includes supplying related information according to his client's needs and the condition of the host market. LA may help to develop a connection between his partners with local owners or government, suppliers, as well as subcontractors. LA may also assist entrants some administration arrangement such as work permit, visa application, taxes, logistic, and rental (Chen and Messner, 2009).

In contrast to SA, an agreement between the entrant and the agent is tied by a contract. According to Schirmer (1996), in the Middle East, the use of a local agent is mandated when participating in a government tender. He said that the implementation of LA is, however, quite difficult for project-based industry like construction sector. The most important thing is that the entrant has to ensure his agent's honesty and integrity.

3.5.2.3 Licensing

Licensing is a contractual arrangement between licensor (license giver) and license receiver or entrant. The entrant is only given limited right to operate and carry out works in licensor's country. This method is commonly applied when a host country obliges a specific patent or technology within a project (Chen and Messner, 2009). Licensing of patent, transfer of technology and management skills are common forms of licensing in the transnational construction industry.

The licensing mode is recommended by Hill et al. (1990) if a foreign country market is fully unfamiliarity, high risks, uncertainty in demand for future business and inopportune competitive conditions. Conversely, this mode may not gain the best return for the entrant and may alleviate the entrant's management control on the project (Chen and Messner, 2011).

3.5.2.4 Joint Venture Company (JVC)

JVC is a collaboration between two or more companies to establish and run a new business entity, which is split apart managerially by parent companies (Geringer, 1991; Tatoglu and Glaister, 2000). It involves resource synergy of participant companies in achieving their goals. Due to the increasing severity of competition and complexity of international projects, JVC becomes a vital element in enhancing international competitiveness (Ozorhon et al., 2010). International joint venture, forming JVC with foreign partners is the most common entry mode adopted by transnational companies (Mohammed, 2003).

3.5.2.5 Sole Venture Company (SVC)

SVC refers to an entry mode which an entrant establishes a new business entity in a target foreign country. Thus, the entrant takes all legal responsibilities for the new entity's operation. The positive side of this mode is that the entrant has flexibility and full control and protection of the new entity's business. This method practically appears after the entrant has acquired several overseas project experiences through JVP or LA. SVC can be achieved through two methods, newly established, known as greenfield investment and merger or acquisition (Chen and Messner, 2009).

3.5.2.6 Branch Office (BO)

A BO is a representation office of a company in other market locations. A company opens a permanent office in a target country to handle all profit and non-profit activities in business operation as a representative of the parent company. The striking different between BO and SVC is that the parent company still controls and has an obligation to BO's activities. Theoretically, BO does not have any officer who bears upon legal responsibilities of the parent company. Therefore, to improve the flexibility of BO's operation and to reduce unlimited risk claim on the parent office, BO sometimes is converted as the main office overseas (Chen and Messner, 2009).

3.5.2.7 Representative Office (RO)

RO is a parent office representation in handling non-profit business activities on behalf of parent home company. An RO is not directly involved in running the projects, instead it usually conducts the business activities such as promotion, communication, market research, contract administration, and negotiation. The advantages of RO to enter a foreign market lie in its modest and flexibility. Establishing an RO may be faster and easier than opening a BO or an SV, especially in fulfillment of minimum capital requirement (Chen and Messner, 2009).

3.5.2.8 Joint Venture Project (JVP)

JVP is almost identical with JVC. The different is that the collaboration among the parties only embodies in a specific project. Consortium, contractual joint venture and contractual alliance are aliases of JVP. In Indonesian construction industry, this model is sometimes called as Joint Operation. This entry mode is grouped into two models, integrated and nonintegrated JVP. A characteristic of this integrated model is the existence of a new project team built by each personnel of JVP members. Alternatively, the non-integrated model, partners tend to share their responsibility portion of the project. Hence, the profit and loss are also distributed based on the portion (Chen and Messner, 2009).

In many cases, the government of the host country mandatorily obliges a foreign contractor to jointly operate with a local partner. This model provides a short-cut access to the company to penetrate into foreign markets. Besides, JVP can be set along with other contractors from the same home country or region or even different nations. Then, the major advantages of JVP include flexibility in

organization of overseas operation and cost efficiency because of resource shares (Chen and Messner, 2009).

3.5.2.9 Build Operate Transfer (BOT)/Equity Project

BOT is a type of procurement system enabling a private body or a consortium to invest capital in a project, commonly infrastructure projects such as toll road (Shen et al., 2002). The investor finances the project and then operates it for a certain concession period. At the end of concession, the investor hands over the project to the government (Shen et al. 2006). This method has gained success story for over 20 years in facilitating developing countries to build infrastructures. Such arrangement may bridge international contractors to enter foreign markets, especially in the countries having poor infrastructural facilities. In contrast, an equity project is an arrangement model which offers equity ownership of the project to the contractors instead of having the concession grant (Chen and Messner, 2009).

3.5.2.10 Sole Venture Project (SVP)

In business literature, SVP is not categorized as an entry mode. However, Chen and Messner (2009) classify the SVP as a basic entry mode to identify uniqueness of institutional arrangement of all market entry strategies. Then, this mode can be applied in the construction sectors. SVP can be considered as the company's effort to compete directly with other competitors in winning an overseas project without going through entry modes mentioned above.

As previously described, the main purpose of the entry mode is to enter the foreign markets and then to establish the position. Having a thorough understanding of the characteristics of each entry mode is a crucial requirement before selecting and adopting any one of them. The discussion about market entry should be parallel with the internationalization of company which pertains several classical theorems which exclude from the scope of this research.

A proper selection of strategic entry provides a great opportunity for company to establish its market share, not only in the host country but also in the region. The process for reaching the establishment absolutely needs a lot of efforts and takes a couple of years. In the process, many decisions will be made by management including selection of potential project. Making decision, like go or not to go on a project, is not a simple job. Regarding OCPs, many factors should be

taken into consideration before making decision. The factors are discussed in Section 3.6 below.

3.6 International Factors of OCPs

A complex environment in OCPs obviously impacts on the enterprises' operation abroad. Many studies have been undertaken to identify and to analyze the affecting facets from various angles, mostly risk dimensions such as Wang et al. (1999), Hastak and Shaked (2000), Ling and Hong (2010) and Peng and Low (2013). The concerns are then directed to help decision making in this business.

As mentioned early in Section 1.7, an overlapping area in discussing on the international construction from decision-making side is unavoidable. For instance, a topic of entry mode choice and the selection of foreign market or overseas projects could involve similar risks or international factors. Unfortunately, there is not any consensus on these attributes. Each researcher identifies and harnesses different international variables in their studies. Hastak and Shaked (2000) for example identify 73 risk attributes, while Han et al. (2008) and Bu-Qammaz et al. (2009) find 36 and 28 variables respectively. A study by Olcer and Akyol (2014) initially identifies 481 international factors and then was extracted to 297 because of duplication name. Based on the expert's opinions the 297 variables remain 97 items.

Similarly, the scholars have not also reached yet an agreement on the categorization of the factors. From 73 international factors, Hastak and Shaked (2000) group them into three elements; macro, market and project level. Han et al. (2008) divide 36 criteria into five categories which are project characteristics and importance, the level of bid competition and market condition, the degree of potential profit, contractor position and ability to perform and degree of representing risk exposure. From 28 variables, Bu-Qammaz et al. (2009) classify them into the country, intercountry, project team, construction, and contractual categories.

Through an extensive literature review of relevant studies on decision making in OCPs, 131 variables were identified and tallied to view their frequency of occurrences. After scanning the variable list, 56 duplicates and related subjects were then integrated and labeled under 15 new names. Of 90 remaining, 59 variables with the appearance less than four were eliminated. The 31-final list was then classified into four groups: host country and market-related factors, client related factors, project related factors and company related factors as summarized in Table 3.3.

3.6.1 Host Country and Market Related Factors

Undertaking the overseas projects are one of the vulnerable activities to the global issues such as politic, economic, financial, socio-cultural and legal (Gunhan and Arditi, 2005a; Han and Diekmann, 2001). The projects are also distressed by varieties of risks in business, such as currency exchange, interest rate, inflation, and credit (Zhi, 1995; Han, 1999; Han et al., 2004). The global issues and risks are related factors to the host country condition where the project carried out. The attributes listed under this factor are described as follows.

3.6.1.1 Political Stability and Sensitiveness

Internal political stability is a critical capital for a country to embody national development in all sectors. Stabilization of the development directly contributes to national economic growth (Ekeledo and Sivakumar, 1998). Hence, the construction projects can be initiated and executed. Al-Khattab et al. (2007) state that political impacts might become a threat to the continuity of projects if there is an unstable situation. In early 2011, the Middle East was depicted to have disrupted ongoing projects due to the political conflicts and a civil war.

According to Wang et al. (2004), this factor has a strong effect on existence of overseas projects. In fact, political climate does not only affect the construction industry but also all business activities, both macro and micro (Ling and Hoang 2010). Some of the political events on a macro scale are a revolution, civil war, riots, and national wide strikes (Hastak and Shaked, 2000; Al-Tabtabai and Alex, 2000; Han et al., 2007; Olcher and Alkyol, 2014). On a micro scale, the event may change economic policy such as discriminatory taxes and import restriction (Ling and Hoang, 2010). Thus, political condition should not be overlooked when a company is conducting an overseas project (Wang et al., 1999), especially when it is managing a large project (Zhi, 1995). Dramatic change in political environment may indirectly influence company's plans and profit (Kapila and Hendricson, 2001).

Table 3.3. Summary of identified international factors of OCPs

Factors	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]	[25]	[26]
Host country and market related factors																										
Political stability and sensitiveness	X	X	X	X	X	X		X		X	X			X	X	X		X	X	X	X		X	X	X	X
Legal environment	X	X	X	X	X				X	X	X						X	X		X	X		X	X		X
Economic health and stability	X		X	X	X	X	X	X		X	X		X	X	X	X	X	X	X	X	X		X	X	X	X
Cultural, custom and language differences	X		X	X	X	X		X	X		X	X		X		X	X	X	X	X	X		X			
Easiness and attitute toward foreigner business and profit	X	X	X	X	X	X		X	X	X	X	X		X			X	X		X	X	X	X	X	X	X
Climate, weather and other natural condition	X		X	X				X	X														X			
Availability of basic infrastructure	X		X	X				X		X				X						X	X	X				X
Availability of local resources	X	X	X	X	X			X	X	X				X			X	X		X	X				X	X
Importance of market	X		X					X	X	X				X	X	X			X						X	
Hostilities with neighboring country or region	X	X												X										X	X	
Cost of conducting business					X		X	X									X									
Client related factors																										
Client's reputation			X	X				X			X							X		X		X				
Type of client								X									X			X	X				X	
The existance of strict quality requirement				X														X		X						X
Project related factors																										
Project location or distance from home country				X				X	X					X		X		X	X	X	X				X	
Adverse ground/site conditions	X			X														X				X				X
Project desirability to the host country		X	X					X																X		X
Project scale/size			X	X				X								X		X	X	X			X	X		X
Complexity of project			X	X				X								X		X	X	X			X	X		X
Level of competition			X	X	X	X		X	X		X	X			X	X	X		X	X				X		X
Type of project								X								X		X	X				X	X		X
Types of contract	X		X					X								X		X					X		X	
Quality and clarity of contract condition	X			X				X	X	X	X		X			X		X	X	X			X		X	X
Contractual duration			X	X				X	X	X						X		X	X	X			X	X	X	
Strict safety requirement	X			X				X			X							X						X		
Strict environmental regulation														X				X				X				X

Table 3.2. Summary of identified international factors of OCPs decision making (Continued)

Factors	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]	[25]	[26]
Enterprise related factors																										
Relationship to stakeholders in host country	X	X	X	X	X	X			X					X	X		X	X		X	X		X	X	X	X
Current work load or need for work			X	X				X	X																	
Company's tract record and experience			X		X			X	X	X		X		X	X	X	X		X	X	X	X				
Familiarity with host country									X					X						X	X	X				X
Financial capability and support	X		X	X	X		X		X		X	X	X	X			X			X	X			X	X	

Sources:

[1] Hastak and Shaked (2000)
[2] Al-Tabtabai and Alex (2000)
[3] Han et al. (2008)
[4] Han et al. (2007)
[5] Gunhan and Arditi (2005a, 2005b)
[6] Chen (2008)
[7] Kim et al. (2013)
[8] Ozorhon et al. 2006)
[9] Kim et al. (2008)
[10] Cheng et al. (2011)
[11] Olcher and Akyol (2014)
[12] Chen and Messner (2011)
[13] Han et al. (2004)

[14] Han and Diekmann (2001a)
[15] Li et al. (2013)
[16] Dikmen and Birgonul (2004)
[17] Tang et al. (2012)
[18] Bu-Qammaz et al. (2009)
[19] Dikmen et al. (2006)
[20] Dikmen et al. (2007)
[21] Han and Diekmann (2001b)
[22] Sonmez et al. (2007)
[23] Deng and Low (2013)
[24] Ling and Hoang (2010)
[25] Neo (1976)
[26] Eybpoosh et al. (2011)

3.6.1.2 Legal Environment

Legal environment is an international factor refers to all aspects related to official systems and legal aspects, such as law and rule clarity and enforcement, and corruption practice in the host country. Law enforcement for international business is a crucial aspect. This aspect determines that investment in a country is realizable (Hill, 2000; Gunhan, 2003) and protection of business against misconducts is assured (Roland and Verdier, 2003).

The legal aspects include law enforcement, the effectiveness of the legal system, the judiciary independence, the property right and the clarity of laws and regulations (Ling and Low, 2007; Ling and Hoang, 2010; Deng and Pheng, 2013). The government enforces the particular law to arrange business and transaction (Gunhan, 2003). The quality of law or regulation is marked by the frequency of regulation changes (Shen et al., 2001). The changes in regulation may probably magnify the cost of operation and the become threats for to operate foreign construction companies (Zhuang et al., 1998). Besides, the effectiveness of regulation is signed by sufficient legal infrastructure when the problem occurs (Ling and Hoang, 2010).

Corruption and bribery practices have been a controversial issue in pursuing construction project over the years and sometimes appear as an unavoidable cultural dimension (Gunhan and Arditi, 2005a). According to Transparency International's reported in Le et al. (2014), the construction sector constitutes the industry's most corrupt which rapidly grow. The corruption may occur at every stage of project phases (Tabish and Jha, 2011). Gunhan and Arditi (2005) specifically highlighted bribery as a threat in overseas construction projects. The corruption practice creates unhealthy competition in the construction projects and increases the cost of conducting business in a country.

3.6.1.3 Economic Health and Stability

The relationships between economic growth and construction development were discussed by many experts such as Strassmann (1970), Edmonds (1979), and Crosthwaite (2000). The factor of economic health and stability includes the rate of GDP, income per capita, interest rate, inflation and currency exchange rate.

According to Baek et al. (2005) and Kim et al. (2010), GDP volatility may indicate risk of domestic market. It significantly influences demand for construction project such as availability of credit (Tse and Ganesan, 1997). As explained previously that when the credit level drops, the construction operation and employment will plunge shortly. In consequence, the number of construction project gradually decrease.

Income per capita is often used to measure wealth of a nation's population. It is a measurement of a country's economic produce (Gross Domestic Product - GDP) or output (Gross National Product - GNP) per person of the population (Amadeo, 2012) Many studies testified the positive correlation between GDP per capita and construction output. Nevertheless, the peak of construction growth occurs in the middle-income nations (newly industrializing countries) instead of the advanced industrialized countries (Crosthwaite, 2000). In the context of the project, income per capita and GNP are variables which nearly outright influence volatility of tender price (Akintoye et al., 1998).

Inflation is an economic condition of the country where the price of needs soars and purchasing power of people declines (Gunhan, 2003). The high inflation rate is directly followed by fluctuation of other financial indicators such as interest rate, and currency exchange (Lam and Chow, 1999; Ling and Lim, 2007). Numerous scientist such as Wang et al. (2004), Ling and Lim (2007), and Shen et al. (2001) affirm that the inflation seriously overburdens the construction projects. This leads to a serious impact on this situation which is cancellation of construction projects since the material price abruptly increases.

Furthermore, it is a common practice to borrow money from the financial institutions to execute construction projects (Kangari, 1988). In the context of investment, interest rate along with internal rate of return is vital aspects to determine the limit of proposed debt (Lam and Chow, 1999; Ling and Lim, 2007). In addition, interest rate significantly contributes to company competitiveness (Gunhan, 2003) and diminishes the risk of bad profit (Kangari, 1988) when the rate is relatively low. On the contrary, high-interest fluctuation undermines company's performance and causes business failure (Kangari, 1988).

Currency exchange is also one of the critical aspects of transnational projects (Lam and Chow, 1999; Shen et al., 2001; Wang et al., 2004). It directly affects company's revenue when it is received and spent in a different currency (Xenidis and

Angelides, 2005). It may cause a budget overrun (Chua et al., 2003). Gunhan (2003) further explains that the weak of local currency implicates on the cost of imported material, plant, and equipment and it increases the burden of debt repayment and loan interest.

3.6.1.4 Cultural, Custom, and Language Differences

Actually, overseas operation is quite unique since there are heterogeneous parties whose various belief and culture from their origin country (Javernick-Will and Levitt, 2010). Because of this environment, there occur a negative effect such as creating cultural conflicts among parties and making trouble project management (Fellow and Handcock, 1994; Chan and Tse, 2003). Communication problems and management frictions may also arise anytime (Nielsen, 2012).

On the other hand, the positive effect of this heterogeneousness is that it promotes some benefits such as a lesson-learn to deal with foreign partners (Barkema and Vermeulen, 1997). Conversely, if the religion and cultural difference are not substantive difference, this may create the competitive advantage of companies. Cross-cultural understanding should, therefore, become a consideration before carrying out an overseas project (Kangari and Lucas, 1997; Gunhan and Arditi, 2005).

3.6.1.5 Easiness and Attitude Toward Foreign Business

This factor includes bureaucratic practice, people's attitude of the host country toward foreign companies, restriction of profit transfer, import-export restriction, and taxation. A prior activity when entering the foreign market is always related to bureaucracy processes such as entry permit for doing business and work permit for workers. Subsequently, other activities involving bureaucracy system when executing project include approval for using public utilities, mobilizing equipment or custom arrangement for picking up imported material or equipment (Suliman, 2007). A strict construction schedule needs a clear and quick bureaucratic process related permit to avoid work delays.

Researchers spotlight the acceptance of the host country people to foreign companies as a potential issue in international construction (Hastak and Shaled, 2000; Dikmen and Birgonul, 2004; Ling and Lim, 2006). In this case, denial of foreign business activities done by people in the host country is a serious problem.

This renunciation can impede or temporarily stop the work progress and even entirely (Suliman, 2007).

Several countries sometimes enforce a regulation restricting foreign subsidiaries to transfer their profit or funds of repatriation by requiring them to spend their earnings in the host markets (Chua et al. 2003; Ling and Huang, 2010). In such countries, like India (Ling and Hoi, 2006), they enact a complicated procedure to repatriate the funds. For the host countries, this regulation prevents an exodus of money/capital, but it reduces off-shore business profit for the company.

Basically, the host countries' policy to protect their trade balance is a common practice in transnational trading. The restriction of imported product by increasing tariffs is one of the economic instruments (Xenedis and Angelides, 2005). If an imported good is subjected to a tariff, the owner will increase the price to cover the cost. Regarding overseas projects, the pricing of imported material should take the tariffs into consideration in project bidding or negotiation.

Furthermore, tax is an important instrument used by the government to generate money as a source of development expenditure. Some common taxes implemented by government are value added tax, personal income tax and corporate income tax (Gibson and Walewski, 2004). The government also uses this instrument to attract new foreign investment by offering taxation incentives (Brink, 2004). The tax can significantly impact company's profit. If the tax is high, the company's expenditure will increase, and the company's income will drop (Al-Khattab, 2007).

3.6.1.6 Climate, Weather, and Other Natural Condition

Construction site, especially for civil works, usually takes a place in an open area which is exposed to extreme weather and other natural circumstances. A consensus among several researchers in international construction acknowledges this factor as a considered variable in venturing OCPs (Hastak and Shaked, 2000; Han et al., 2007; Kim et al., 2008; Cheng et al., 2011). For contractor's staff and workers who are running an overseas project in the same region, they will not face many problems due to weather and climate condition. However, they still need times to adapt with the environment of host country. In this situation, the contractors have to send their staffs and workers early before the project executed. Another way to deal with this above illustration is consideration to employ local staffs and workers.

3.6.1.7 Availability of Basic Infrastructure

This international factor covers basic transportation and communication services such as road access, clean water, fuel supply and telecommunication network. For specific projects which requires special equipment or material, the contractors may need an airport or seaport facilities in host country. Ten studies related making a decision in international construction (e.g. Han and Diekmann, 2001a; Han et al. 2008; Kim et al. 2008; Tang et al., 2012; Olcher and Akyol, 2014) record this factor for assessing risk in OCPs. The availability, such as infrastructure, facilitates the mobilization of construction material and machinery to reach the project location.

3.6.1.8 Availability of Local Resources

It is impracticable to execute a project abroad by sweeping along all company's resources from the home country to the host country. Practically, the companies carry the core resources, such as management team and head and several skilled workers from home and employ local staff and workers for addition. Likewise, they only bring special equipments from their home country. Therefore, the company should identify the availability local resources or markets in supplying the project needs, including local contractors, common equipments and materials. This issue is agreed by many researchers investigating international projects such as Hastak and Shaked (2000), Al-Tabtabai and Alex (2000), Han et al. (2008), Gunhan and Arditi (2005a, 2005b), Kim et al. (2008), Cheng et al. (2011), and Olcher and Akyol (2014). In the absence of the local resources in host country market as narrated above, the company should prepare alternative plan to tackle the problem.

3.6.1.9 Importance of Market

This factor refers to the influence of a particular market toward the company's growth. The indications of the influence are current and future market volume in the core competency (Hastak and Shaked, 2000; Cheng et al., 2011), the potential profitability (Dikmen and Birgonul, 2004; Ozorhon et al., 2006) and the market share (Ozorhon et al., 2006; Han et al., 2008). The needs of a market depend on current and potential size of the construction industry in a certain country and the size of market shares belonging to the companies over a period.

3.6.1.10 Hostilities with Neighboring Countries or in Region

Researchers such as Hastak and Shaked (2000), Al-Tabtabai and Alex (2000), Olcher and Akyol (2014) and Deng and Low (2013) identify that the hostilities with neighboring country or other countries in the same region give a risk which should be considered in the international construction. In fact, if it does not have any diplomatic relationship with neighboring countries, it can trigger a political destabilization in that region. Neo (1976) mentioned in his study that the region like the Middle East and Africa have disharmony relationship between their neighboring countries. Thus, the contractors refrained from entering one country market like Israel, if they have established in other Arabic countries, and vice versa.

3.6.1.11 Cost of Conducting Business

Several international factors described above such as related economic factors, easiness and attitude toward foreign business, and availability of local resources directly contribute to the costs of conducting business in a host country. Costs for preparing tender (Neo, 1976; Deng and Low, 2013) is an initial cost that has to be spent by the company before execution of an overseas project. According to Neo (1976), it is sometimes difficult to collect relevant cost information for tender preparation of overseas projects. He further explains that before a company compete in an overseas tender, it should collect all important relevant data like materials and equipment costs. This activity surely needs an extra expenditure for traveling and collect data in host country.

Furthermore, during the construction, other than direct costs, the company also expend for indirect costs such as the incentive for field staff (Han et al., 2007; Cheng et al., 2011), and business costs of crime or violence (Olcher and Akyol, 2014). Gunhan and Arditi (2005a, 2005b) and Kim et al. (2003) highlight the cost of finance which are all costs and charges as the effect of borrowing money to support company operation, is one of the important international factors in considering OCPs.

3.6.2 Client Related Factors

Client is "the natural or legal person for whom a structure is constructed or the person or organization that took the initiative of the construction" (Organization for Economic Cooperation and Development-OECD, 1997). Basically, there are

three major international factors related to the client, namely the client's reputation, the type of client and the existence of strict quality requirement.

3.6.2.1 Client's Reputation

The reputation of a client can reflect his financial capability and track records in project development. This factor is concurred by many researchers as a crucial factor in considering the international projects (e.g. Dikmen and Birgonul, 2004; Ozorhon et al., 2006; Han et al., 2007). The financial capability of a client refers to his availability and adequacy of the fund to finance the project and pay the contractors (Neo, 1976). The way to identify the financial stability of construction clients, particularly from a private corporation is relatively similar to the clients from other industries. The stability mainly depends on the current assets, credit worthiness, and current liabilities which can be verified from their financial statements (Foster, 1986). The reputation of clients can also be recognized from their track in organizing past projects. A project's sponsor who intends to involve the foreign participants in his projects sometimes has experienced in organizing construction projects. The experienced clients in several projects significantly contribute in managing the involved parties both their consultants and contractors. This client's experiences specifically can present their requirement on the project, whether it is sophisticated or specialized (Suliman, 2007).

3.6.2.2 Type of Client

Different clients or owners, different specific interest in the project they have (Skitmore, 1986). Generally, a construction client can be distinguished into two parties, public client represented by the government or semi-government institutions, and private group. Type of client fully determines on project funding (Deng and Low, 2013). The government projects are usually funded by national budget, foreign aids, and loans, whereas private works are financed by a private corporation (Neo, 1976). Type of client is considered by Dikmen and Birgonul (2004) to support the market entry decision of overseas projects and reckoned by Ozorhon et al. (2006) for modeling international market selection. Explicitly, Neo (1976) states that government projects are more demanded by contractors, particularly for developing countries. He argues that the payment of contractor's works from the government projects is more guaranteed than private projects. In addition, the type of clients can

be categorized according to knowledgeability, organizational type and size, and purpose of ownership (Saliman, 2007).

3.6.2.3 The Existence of Strict Quality Requirement

The issue of quality in the construction projects has been over for long decades, as happened to the issue of cost and time. This factor is highlighted by quite many authors such as Dikmen and Birgonul (2004), Ozorhon et al. (2006), and Bu-Qammaz et al. (2009). As mentioned above, the experienced clients may express a sophisticated requirement which sometimes overstates their quality requirement. This condition can create several problems to the contractors like a difficulty to find alternative standardized material in host country market (Saliman, 2007). Turkish contractors, for instance, faced a problem in regard to the existence of strict quality requirement which lessens their competitiveness in overseas markets (Dikmen and Birgonul, 2004). According to Saliman (2007), it indicates that the main prowess of Turkish contractors was not the matters related quality.

3.6.3 Project Related Factors

As previously mentioned, the construction projects are different from other, such as manufacture projects as a result of the feature of project itself. Furthermore, the most important international factors related to project aspects successfully identified in various studies are explained in the following section.

3.6.3.1 Project Location or Distance from Home Country

Dunning (1988) opines that location is a factor contributing in gaining competitive advantage for multinational companies. Many advantages obtained if the distance of project location and head office is near. Location of work directly affects to many project dimensions like project cost (Akintoye, 2000), project risks (Baccarrini and Archer, 2001), and project performance (Cho et al., 2009). It also influences the resources consideration (Odusote and Fellows, 1992), markup size (Shash and Abdul-Hadi, 1993), time and cost overrun (Kaming et al., 1997) and tendering decision (Shash, 1993). Project location indicates the distance between head office and site office. Short distance results in the low cost of operation and easy support services (Cuervo and Pheng, 2003). This factor is considered by Dikmen and Birgonul (2004) in developing model of market entry decision, but Neo (1976) ignores.

3.6.3.2 Project Desirability to The Host Country

Construction projects have shown an ample evidence in the interest of national development. Studies of Raftery et al. (1998) on Asia construction industry reaffirm the evidence and emphasize the government role dominantly in boosting economic growth through strategic construction projects such as a dam, highway, and power plan. Therefore, the government seems to have a strong interest in such projects. In other words, the desirability of a strategic project execution is absolutely important to government (Ashley and Bonner, 1987; Deng and Low, 2013). Important project for government is indicated when there is government's involvement and intervention in all project stages. Project under PPP scheme, for example, is fully intervened and supported by government. so as one key success factors of the project is government support (Chan and Cheung, 2014). Project importance for host country like PPP projects, therefore, offers some fascinating options for overseas contractors.

3.6.3.3 Project Scale/Size

Wanous et al. (2000) analyze that the size of the project is a negative bidding factor which advocates contractor to ignore the project. Regarding project size, it depends on each company's strategic plan and capacity. For instance, British contractors might take a project in the range of a quarter to 5 million in Pound (Neo, 1976). In fact, the figure of project cost which should be considered by contractors when targeting an overseas project are still controversy. Nevertheless, the size of the project was justified by many researchers as a determinant factor to select OCPs (e.g. Neo, 1976; Dikmen and Birgonul, 2004; Ozorhon et al., 2006). Theoretically, the overhead cost of a project is inversely proportional to a project size, meaning that the ratio of the overhead cost will be smaller when the size of project increases (Neo, 1976). Neo claim that overhead cost of the projects is enormous, compared to domestic works. Hence, the size of the overseas construction project is very important for contractors.

3.6.3.4 Complexity of Project

"Project complexity consists of many varied interrelated parts and can be operationalized in terms of differentiation and interdependence" (Baccarini, 1996). Baccarini further opines that this definition is acceptable for any types of project

management dimension, especially project organization (e.g. number of parties involved) and technology (e.g. task performance difficulties). Among many industry operations, construction operation seems to be the most complex one. However, the influence of complexity dimension of project selection criteria is still debatable. Dikmen and Birgonul (2004), Ozorhon et al. (2006) and Bageis and Fortune (2009) are among of researchers who believe that this factor is significantly important. In the opposite, such opinion is overridden by other researchers such as Jarkaz et al. (2014), Odusote and Fellows (1992), Wanous et al. (2000) and Deng and Pheng (2013). Therefore, the construction project complexity can be identified from two aspects, the number of expertise involved, and the advanced technology employed massively.

3.6.3.5 Type of Project

Skitmore (1986) elicits numerous aspects that should be examined in the construction project selection, including the types of works. He opined that the types of works or projects correlate to the activities, the complexity of the project, physical and monetary size. The types of projects also significantly impacts to management plans. Different type of projects needs different techniques to coordinate and it requires a management adaptation to apply the techniques satisfactorily (Muller and Turner, 2007). There is also a correlation among the types of projects, the project success's criteria, and the project success's factors (Muller and Turner, 2007). The type of work may also reflect the project's competitiveness (Drew and Skitmore, 1997; Drew et al., 2001). A number of studies justified the type of project as a factor influencing the decision to consider bidding invitation (e.g. Drew et al., 2001; Tan et al., 2010). Contractors tend to consider the similar types of works with their previous projects (Jarkas et al., 2014). The reason is that the contractors can apply their knowledge and experiences from the same types of projects to overcome some problems in the new project.

3.6.3.6 Type of Contract

There are many types of contracts in the construction industry such as lump-sum contracts, cost plus contracts; unit price contracts, construction management contracts; design-built contracts and turnkey contracts. International projects commonly use standardized condition of contracts such as FIDIC and JCT which are

modified according to the project needs. Both types and conditions of the contracts characterize the uncertainty of process and product, the complexity of work and ability of the client to contribute (Turner and Simister, 2001). It also influences the project success (Ibbs and Ashley, 1987). Regarding this matter, the contractors are advised to pay more attention, especially on the conditions of contracts which do not refer to any well-known standardized contracts (Bubshait and Almohawis, 1994).

3.6.3.7 Quality of Contract Conditions

Operating in a hostile construction environment which are mostly faced by International construction contractors basically is a risky job. Several contractual requirements presented in the 'general conditions' of international contracts is a potential source of the risks. The conditions of a contract represent the legal reference which organized the agreement between the contracting parties (Suliman, 2007). Therefore, the quality of contract document is extremely fundamental. The quality means that the content of the contract conditions has covered all potential issues with a respect from the contracting parties to keep their responsibilities. Besides the responsibilities, a contract condition should explain rights and penalties in case one of parties fails to carry out his responsibilities. The contract condition should also be free from vagueness of interpretation meaning that all parties can understand each clause in the contract (Bubshait and Almohawis, 1994). Considering the importance of the contract conditions, Bubshait and Almohawis (1994) advise to adopt a common established standard contract like FIDIC or other standardized contracts developed by international professional bodies. They argue that such standardized contracts have been tested over the times, so the area of the vagueness has been identified. In fact, most international contracting parties have known and have been familiar with the standardized contract conditions.

3.6.3.8 Project/Contract Durations

The project duration may indicate size and complexity of construction works. It consequently influences the funding of the projects and other related managements of the projects. In contractor's view, for instance, the contract or project duration is essential for composing a project cash flow. The cash flow aims to facilitate the measurement of the resource allocation, financial planning, profitability and efficiency of capital flow (Chan and Kumaraswamy, 2002). According to Dawood

(1998), there is a correlation between the duration of project and the risk factors in the project. For instance, multi-year funded projects are vulnerable to external factors such as politic (e.g. change in political power which affect country's policy) and economic condition (e.g. inflation which increases material prices). Neo (1976) observed that the contractors gravitate to venture overseas projects with relatively short duration.

3.6.3.9 Number of Potential Competitors/Level of Competition

Intensity of competition in the construction industry is divided into two parts, (1) project competition intensity (PCI) and (2) market competition intensity (MCI) (Ye et al. (2008). PCI is indicated by tendering procedure, competitors' behaviors, and the results of project competition (Ye et al., 2008). Otherwise, MCI is affected by some variables such as the number of competitors and uniformity of enterprises. The lack of market competition could occur when the market is only dominated by a handful of players (Oster, 1999). Besides, industry capacity indicates numbers of active players (competitors), which are capable to carry out the projects (Akintoye and Skitmore, 1992). This aspect explicitly influences contractor's behavior (De Neufville et al., 1977). Too many competitors, however, may diminish the probability to win a project (De Neufville et al., 1991). A number of competing companies, therefore, affects contractors' behavior in making decision to take part in a project competition (Ye et al., 2008).

3.6.3.10 Adverse Site Conditions

Contractors are advised to observe site conditions to identify physical obstacles which will fail construction works. Several adverse site conditions include accessibility (Sonmez et al., 2007; Suliman, 2007), the topography of site (Suliman, 2007), unforeseen ground condition (Hastak and Shaked, 2000; Han et al. 2007; Sonmez et al., 2007), intense security (Sonmez et al., 2007; Saliman, 2007), etc. Given these conditions, it is too risky to take a part in an overseas project tender without a prior identification of the site location. The major impact of these unidentified site condition is work's changes which lead to a higher workload and a need to reschedule the work (Sun and Meng, 2009). In consequence, a dispute between the contracting parties will happen if no one takes responsibility for the cause of the work's change.

3.6.3.11 Strict Safety Requirements

The contractors who venturing project overseas should inspect the attitude toward safety and health practices in the host country (Saliman, 2007). The construction health and safety standards have different practices for each country. The different standard is usually adopted by contractors and the standard required in the host country would lead to considerable problems (Mahalingam and Levitt, 2005). The consideration of a strict safety requirement in the host country for contractors in selecting foreign markets or overseas projects was identified by several studies such as Hastak and Shaked (2000), Han et al. (2007), Sonmez et al. (2007), and Bu-Qammaz et al. (2009).

3.6.3.12 Strict Environmental Regulations

Construction projects in this era have faced an increasing pressure on not only to reduce costs but also to improve the environmental quality (Kartam et al., 2004). Several countries, mostly from developed industries, have strict regulations dealing with environmental protection. The contractors who are operating in such countries must obey and respect the regulation to avoid a claim on environmental damage during the construction works. This international factor can be found in studies by Han and Diekmann (2001a), Han and Diekmann (2001b), Bu-Qammaz et al. (2009), and Eybpoosh et al. (2011). A strict enforcement of the environmental regulation in the host country can slow down the construction progress. It is because the contractors must take good care for all actions which impact on the environmental damage, for instance, handling of a harmful construction waste.

3.6.4   Enterprise Related Factors

A company related factors can be defined as an internal condition of a company which supports the company vision to penetrate into a foreign market. Dunning (1988) in his "eclectic paradigm theory" defined these factors as ownership advantage. Further discussion on company related factor is given below.

3.6.4.1 Relationship with Stakeholders in Host Country

Establishing a mutual relationship with other countries may lead to other several activities such politics, economics, cultural and education and trading (Suliman, 2007). Through these good relationships, construction enterprises may get a benefit by means of developing channels and connections with governmental

agencies, political leaders and other power groups such as business associations and a labor union (Al-Tabtabai and Alex, 2000). Al-Tabtabai and Alex observe that this way is a common strategy implemented by any businesses to get the projects not only in the developing countries but also in the developed economies. They further explain that a good relationship benefits to protect the business interests of the enterprises in the host country and to get a privileged support.

3.6.4.2 Current Workload and Needs for Work

Current workload and needs for work are interrelated and interdependent in considering a project. Ling (2005) corroborated the correlation, if a company has a high workload in a period, the needs for projects will decrease, and vice versa. In studies by Odusote and Fellows (1992) and Flanagan and Norman (1982), contractors preferred the current workload as one of the most important resource considerations in making project selection. Tan et al. (2010) and Han et al. (2008) consider current workload as one of a key factor in making decision to involve in the overseas projects. In fact, contractors need for work for surviving of their organization (Jarkas et al., 2014). According to Oo et al. (2012), this fact can be seen two conditions, slow economic growth and an absent of performing work for a long time. This opinion was also mentioned by Shash (1993) who assert that this factor strongly compels contractors to focus on a target project. The same fact was also discovered in a study of Ahmad and Minkarah (1988) about the US contractors' opinion on bidding decision. On the contrary, in their selection model for international construction market entry, Dikmen and Birgonul (2004) do not take this factor into consideration.

3.6.4.3 Track Record and Experience

The track record constitutes the upmost strength of a company relative to international projects (Gunhan and Arditi, 2005). It proves the company's experiences in previous projects and provides knowledge about how the company organizes, encounters and treats the technical and non-technical problems arising during the operation abroad (Quak, 1991). This is important for a company to convinces clients, particularly for specialist works, project management, and large contracts. The contractor's experience in abroad is also a considered aspect recommended by the consultant to the client in hiring a contractor (Neo, 1976).

Specifically, Dikmen and Birgonul (2004) and Ozorhon et al. (2006) highlight the company's experience in undertaking similar projects as one of the criteria to evaluate a potential overseas project. Besides, company's profile with a good track record and experience gives an access to create more cooperative market entry modes through a partnership with local contractors or a direct approach to clients (Quak, 1989).

3.6.4.4 Familiarity with Host Country

Previous studies have suggested that a choice to join overseas projects is related to firm's familiarity to the host country (Han and Diemenn, 2001a; Dikmen et al., 2007; Sonmez et al. (2007). A study by Hill et al. (1990) underlines "locational familiarity" as one of the most environmental variables impacts upon a choice of entry mode of the multi-national companies. They further explain that the locational familiarity is the perceived distance based on the host country's culture, economic systems, and business practices of the host country. On the other side, Han et al. (2007) highlight the lack of familiarity influences the profit in overseas construction projects, while Gunhan and Arditi (2005) argue that it is a positive value for international companies if their employees are familiar with the target region.

3.6.4.5 Financial Capability and Support

The larger a company is, the bigger advantages the company gets. Some advantages include accessibility to get financial support (benefit to bidding many projects), facility to order material without cash in advance (benefit to maintaining cash flow), accessibility of highly qualified personnel (guarantee of the work's quality), and the opportunity to perform large projects (Saymour, 1987). The overseas projects commonly require a strong company's financial support. According to Gunhan and Arditi (2005), financial strength is a company's capital to conduct strategic plans, to take higher risks for higher returns. Warsawski (1996) proclaimed it is a strategic asset of the company, while Pheng (1996) opined it could be a tempting deal if the contractor proposes attractive financing packages.

3.7   Neuro Fuzzy Based Multi Criteria Decision Making

Decision-making is defined as "acts of choice between alternative courses of action designed to produce a specified result, and one made on a review of relevant information guided by explicit criteria" (Rose in Teale et al., 2003). This term

comprises many criteria and sub-criteria used to set the ranking a decision among alternatives (Saaty, 2005) and it is a part of the wider domain of problem solving (Sutrisna, 2004). An optimal option on several objectives from available alternatives is also involved (Klir and Yuan, 1995; Triantapyllou, 2000; Xia et al., 2011). This section aims to presents a literature relevant to Neuro-fuzzy based multi-criteria decision making (MCDM) which theoretically corresponds to the last objective of this research.

3.7.1 MCDM Applications in International Construction Studies[1]

Analytical Hierarchy Process (AHP) has been used widely due to its simplicity in application and its flexibility to collaborate with other methods. Hastak and Shaked (2000) employed AHP method to develop the International Construction Risk Assessment Model (ICRAM-1). The model assists the decision makers in assessing the latent risk affecting the market expansion abroad. Gunhan and Arditi (2005a) developed a model framework to facilitate the expansion decision into foreign markets through a combination of AHP and Delphi technique. Another amalgamation of AHP and Delphi was employed to assign relative weight to entry modes (Gunhan and Arditi, 2005b). The model is a practical notion for executives enabling them to rate their company's position against market expansion internationally. However, AHP technique fully relies on the subjective judgment and preference of decision makers which significantly influence the decision results.

Han et al. (2008) developed a web-based tool to deal with the specific needs of different types of risks in international construction project stages. AHP was used to draw the relative importance among the five highest-order criteria and Simple Multi-Attribute Rating Technique (SMART) was employed to determine relative weights among the lower-order 36 attributes. A model was then developed using factor analysis and multiple regression analysis to identify the causal relationships between the level of profit and the risk variables. A hybrid AHP-Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE) was utilized to select an entry mode for construction firms involved in international markets (Li et al., 2013). The AHP technique was used to break-down the entry mode problem into several attributes and to determine the weight of each criterion. The PROMETHEE was employed to rank entry modes and to carry out a sensitivity analysis.

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[1] Major part of this section has been published in paper no. 2 of Page v.

Chan et al. (2006) combined AHP and Multi Attribute Utility Theory (MAUT) to advocate a selection model of a dispute resolution for construction professionals involved in international projects. The objectives are to plot a dispute with the most appropriate resolution technique. Inspired by company's strategic analysis in assigning permanent staff and hiring local temporary workers in overseas projects, Lin (2011) studied on human resource allocation and introduced a decision-making model. Lin particularly employed AHP and Delphi technique to analyze personnel proficiency as Project Administrators and Site Engineers.

Bu-Qammaz et al. (2009) proposed Analytical Network Process (ANP) to arrange the interrelations between risks related factors as a trustworthy method for rating the level of risk associated with international construction projects. The principle of this model is to assist the decision makers to estimate the risk ranking so that alternative projects may be ranked. Ölçer and Akyol (2014) developed an Excel spreadsheet-based decision support tool to rate the target countries by considering the risks and opportunities offered. In their study, a combination of Decision-making trial and evaluation laboratory (DEMATEL) and ANP was used to rate the countries under consideration. DEMATEL was utilized to determine the causal relationship among criteria and ANP was used to determine the weights of the elements which include various criteria.

Han and Diekmann (2001) promoted a concept for making stable and systematic procedure risk-based go/no go decision using Cross Impact Analysis (CIA) method. In this model, they applied knowledge deriving from previous research and the input of international experts. The project's profit concept is the main criterion set as a parameter decision. This application could develop different scenarios used to assess the variable sensitivity and come up with probabilistic multiple criterion outputs. In another study, Han et al. (2005) employed CIA to clarify the risk attitude of contractors in bidding decisions regarding overseas projects. In this case, CIA processed two objectives; project profitability and other benefits of the project. The decision makers then determine the weight of both objectives to decide "go bidding" or vice versa.

Ozorhon et al. (2006) developed a model using Case Based Reasoning (CBR) to support the decision of international market selection. This model aims to forecast project's potential profitability and competitiveness level of a company under given condition. CBR exhibits how companies learn from its competitors' experiences in

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international projects and improve their decisions. Similarly, due to the unstructured decision problem in bid markup estimation, Dikmen et al. (2007) proposed a decision support system which systematically estimates markup value for project bidding. This technique utilized CBR to rate risk, opportunity and competition in a project alternative. The ratings are then transformed into risk and markup values using linear utility functions.

Han et al. (2004) studied on a financial portfolio risk management for international projects. They introduced a procedural framework of project-selection for multinational contractors by integrating the risk hierarchy of individual projects and the corporate level. The initial concept of this study is to help companies to select a project contributing to company's portfolio enhancement. Kim et al. (2013) adopted *Real-options* theory, originally from the financial industry, for a model of the market-entry decision in the international construction business. The model is directed to price the revenue volatility in a foreign market.

Dikmen et al. (2007) utilized fuzzy techniques to develop a computerized system along with the influence diagram to rate cost overrun risk in ICPs. Fuzzy set theory was applied to set membership function of risk variables. To aggregate output variables (risk rating) used to determine project risk level, Fuzzy *IF-THEN* rule was employed. In a different form of fuzzy, Cheng et al. (2011) integrated Fuzzy Preference Relation (FPR) and Cumulative Prospect Theory (CPT) for decision support to enter country markets. This idea theoretically can be divided into two outputs; those are country market selection and project selection.

The cost of political risk is one aspect affecting construction firms' decision to enter overseas project bidding. Al-Tabtabai and Alex (2000) disseminated the intelligent of Artificial Neural Network (ANN) to predict the cost of political risk for international construction projects. This application employed expert's knowledge and experience involved in risk assessment. The power of the ANN technique was also exploited by Dikmen and Birgonul (2004) to develop a strategic decision model for overseas market entry decision. Project attractiveness and company competitiveness were set as outputs of the model, while 16 criteria affecting the attractiveness and competitiveness were considered as input variables. Back-propagation technique was used as a learning method in training of the neural network model.

Although new advance techniques were established, statistical methods are still relevant to support the decision in multi-criteria environment. Chen and Messner (2011) utilized a *binary logistic regression* analysis to develop a model for choosing entry mode. They adopted a similar concept of the international business discipline to define hypotheses related to the effect of the company and home-country related factors upon entry mode selection. Analysis on entry mode selection decision was undertaken by using a hypothesis testing. Han et al. (2007) used factor analysis and multiple regression analysis to develop a model for choosing a potential overseas project through predicting its profit performance. The approach was functioned as a systematic risk-screening tool which is operated to define, analyze and evaluate different influencing risk variables. Using the two methods, a range scale-based profit prediction model to opt candidate overseas projects was developed.

Correlation and regression analysis were utilized to discover the most important risk factors impacting project cost contingency during the bidding stages of overseas construction projects (Sonmez et al., 20007). Correlation analysis was harnessed to assign linearity rate between risk factors and contingency, while regression analysis was used to develop a model quantifying the impact of factors on contingency. Kim et al. (2008) introduced a predictive tool which can evaluate categorical ranges of possible cost variances by using linear discriminant analysis. This analysis can predict groups of dependent variables from categorical criteria or variables (Malhotra and Malhotra, 2010). The model allows the decision makers to determine a reasonable cost contingency rate which is useful for entering international project bidding.

Over the years, risk management methodology has been applied in various field of construction project decision making. In ICP studies, Han et al. (2008) developed an integrated risk management system to tailor specific requirements of different type of risks. This model is a web-based system facilitating decision makers to check and monitor different risks arisen at every level of ICP lifecycle in real-time. Risk management technique was also utilized by Gad et al. (2011) to choose alternative dispute resolution methods during the formation of the contract in ICP. This process involves three steps of risk management methodology; those are dispute risk identification, dispute risk assessment and dispute risk control.

There are several general conclusions that are worth calling attention after a perusal of each study above. Two of them are: (1) the nature and context of the

problem and (2) type and complexity of problem. In the first topic, MCDM applications in international construction studies were functioned mostly in factual data for illustrating examples rather than simulated ones. The real data used to analyze and test the models includes completed project records and case studies. The simulated data comprises a group decision maker experiment with case-made and illusive simulation. In term of the methodology, the use of AHP, both single and hybrid application, was dominantly adopted.

Different topic areas of international construction studies in which MCDM methods have been employed could be grouped into five categories; (1) internationalization decision, (2) country/market selection, (3) entry mode selection, (4) project selection or bidding decision, and (5) miscellaneous international expansion. Internationalization decision refers to the management decision to expand company's market overseas or whether the company qualifies for go international. Country/market selection refers to the examination of the potential countries to be penetrated. For this purpose, the companies consider the prospective markets or countries such as those offering high return and opportunity for growth. The use of MCDM tools for this area is quite favorable regarding the number of application.

Entry mode selection refers to evaluation of the alternative strategies to enter particular foreign markets. Similar to MCDM application employed for expansion or internationalization decision, the use of this methodology is also rare for choosing an appropriate entry mode. Project selection or bidding decision refers to the analysis of single or several overseas projects and makes decision to bid or no-bid. MCDM applications for overseas project selection or tender decision were considered as they systematically assist decision maker in examining international factors of ICP. Finally, miscellaneous related international expansion refers to the use of MCDM methods besides those four types above, for example: prediction of mark-up and selection of dispute resolution in international project. MCDM applications regarding the context of problem and type of data used are summarized in Table 3.4.

Table 3.4. MCDM applications systemized based on the context of problem and type of data used

Authors	Decision Support Tool	Context of the problem					Illustration example	Annotation for (5)
		(1)	(2)	(3)	(4)	(5)		
[1] Hastak, M. and Shaked, A (2000)	Risk management + AHP				√		Simulation	
[2] Al-Tabtabai, H. and Alex, A.P. (2000)	ANN					√	Real	Project cost estimation
[3] Han, S.H. and Diekmann, J.E. (2001a)	CIA		√				Simulation	
[4] Han, S.H. and Diekmann, J.E. (2001b)	CIA		√				Simulation	
[5] Dikmen, I. and Birgonul, T.M. (2004)	ANN		√				Real	
[6] Han, S.H., Diekmann, J.E., Lee, Y. and Ock, (2004)	Financial Portfolio Risk Manage.				√	√	Simulation	
[7] Han, S.H., Diekmann, J.E. and Ock, J.H. (2005)	CIA Based Risk attitude				√		Simulation	
[8] Gunhan, S. and Arditi, D. (2005a)	AHP + Delphi	√					NA	
[9] Gunhan, S. and Arditi, D. (2005b)	AHP + Delphi	√	√	√			Real	
[10] Ozorhon, B., Dikmen, I. and Birgonul, M.T. (2006)	CBR		√				Real	
[11] Chan, E.H.W., Suen, H.C.H.and Chan, C.K.L. (2006)	MAUT + AHP					√	NA	Dispute resolution choice
[12] Han, S.H., Kim, D.Y. and Kim, H. (2007)	Multi regression analysis				√		Real	
[13] Dikmen, I., Birgonul, T.M. and Gur, K.A (2007)	CBR + Utility Theory					√	Real	Bid mark-up estimation
[14] Dikmen, I., Birgonul, T.M. and Han, S. (2007)	Fuzzy logic					√	Real	Cost overrun risk rating
[15] Sonmez, R., Ergin, A. and Birgonul, T.M. (2007)	Regression analysis					√	Real	Bidding contingency decision
[16] Han, S.H., Kim, D.Y., Kim, H. and Jang, W.S. (2008)	AHP + Risk Management				√		Real	
[17] Kim, D.Y., Han, S.H. and Kim, H.K. (2008)	Discriminant analysis					√	Real	Bid mark-up estimation
[18] Bu-Qammaz, A.S., Dikmen, I. and Birgonul, M.T. (2009)	ANP				√		Real	
[19] Chen, C. and Messner, J.I (2011)	Binary logistic regression			√			NA	
[20] Cheng, M.Y., Tsai, H.C. and Chuang, K.H. (2011)	FPR and CPT		√		√		Simulation	
[21] Gad, G.M., Kalidindi, S.N., Shane, J. and Strong, K. (2011)	Risk Management					√	NA	Dispute resolution choice
[22] Lin, K.L. (2011)	AHP					√	Real	Human resource allocation
[23] Tang, L.C.M., Atkinson, B. and Zou, R.R. (2012)	Entropy ranking + SWOT Analysis					√	Real	Critical success factors
[24] Kim, D.Y., Ashuri, B. and Han (2013)	Real-option analysis		√				Simulation	
[25] Li, H., Jin, Z., Li, V., Liu, G. and Skitmore, R.M. (2013)	AHP + PROMETHEE			√			Real	
[26] Ölçer, M.G. and Akyol, D.E. (2014)	DEMATEL + ANP		√				NA	

Note: (1) Internationalization, (2) country/market selection, (3) entry mode selection, (4) project selection or bidding decision, (5) other related ICP. NA – Not available.

In the second one, the type and complexity of problems reflect the setting of environment in which decision has to be made. Overall, risk factors dominantly influenced the application of MCDM methods, followed by international factors. Majority of studies show different number of criteria involved, meaning that there have been no fixed criteria affecting ICP agreed by researchers. The categorization of the criteria is not their concern either. The identification and determination of criteria fully depend on the authors' decision after conducting literature review and or on the experts' judgement following a survey.

AHP was used to measure the weight of risk indicators to set the priority among the criteria, sub-criteria, and indicators. Similarly, ANP was also utilized to find relative weight of interrelation risk factors as an input to a decision model. Studies of ICP also highlighted in particular the criteria in the context of political risks, financial risks and project and country risks in which ANN, financial portfolio and regression analysis were used respectively. Unlike AHP and ANP method, the ANN, financial portfolio and regression were employed without measuring previously the preference ranking between the criteria.

Several studies used the term "*international factors*". In fact, they are principally akin to risk factors mentioned above. Home country and firm specific factors and control variables are international factors categorized by Chen and Messner (2010) for selecting appropriate entry mode by using statistical regression analysis. FPR was employed to obtain relative weight of country factors (e.g. monetary inflation, bureaucratic delay, societal conflict) and project factors (e.g. availability of workers, weather condition, availability of basic technology and equipment). Again, AHP was used to examine the weight of international factors consisting of national factors, international environment, international strategy, enterprise and industry, and intrinsic feature of entry mode.

The project attractiveness and company competitiveness were promoted to delineate attributes affecting ICP. Sixteen criteria such as prosperity of host country, host country risk, size and type of project, type of client, etc., were used to develop an ANN model and CBR model separately. In these methods, the criteria were set as inputs while the outputs of the network were project attractiveness and company competitiveness. The difference of both techniques is that CBR uses a case data bank where the past projects were stored to be reused in analyzing new project, while ANN needs a number of past cases as training data to develop a stable network.

Dealing with uncertainties may increase decision making precision, otherwise, they may induce incompetently defined alternative or options (Kangas et al., 2000). Uncertainty occurs because of ill-defined information, discrepancies information among sources, imprecise language, simplification, or supposition (Kim et al., 2008). Many situations in overseas projects contribute to uncertainty because the data cannot be described properly or predicted deterministically such as future political and economic condition in host country and subjective judgement by decision makers.

To minimize uncertain judgements regarding the weight of criteria, deterministic approaches commonly used are sensitivity analysis and outranking methods such as PROMETHEE (Mendoza and Martin, 2006). The example of the application can be found in Li et al. (2013) in choosing entry mode. The evaluation differences among ranking preferences made by decision makers are tackled by PROMETHEE. Tang et al. (2012) demonstrated the use of entropy ranking analysis method to reduce uncertainty between surveyed participants and unravel the weighting problems of multiple criteria. Dikmen et al. (2007) employed utility theory to rationalize the decision made by different decision makers in considering mark-up values. Kim et al. (2008) made use of a statistical method, discriminant analysis, to manage uncertainty when forecasting cost variance between plan and actuality in international projects.

In addition, imprecision data due to invalid sources may rise uncertainty. To deal with this environment, probabilistic approaches may not be applicative because of ambiguous output (Mendoza and Martins, 2006). In such a case, ambiguous data may be solved by setting into linguistic form based on fuzzy logic concept. This concept can be found in the study by Dikmen et al. (2007) who utilized Fuzzy set theory to assess final cost overrun risk rating. Table 3.5 summarizes the MCDM applications in terms of type and complexity of problem.

Table 3.5. MCDM applications based on type and complexity of problem.

Ref. No.	Decision Support Tool	Type of problem	Number of Criteria/ Category	Type of category
[1]	Risk management + AHP	Risk in ICP	73/3	(1) macro or country level risk; (2) market level risk; (3) project level risk.
[2]	ANN	Political risk in ICP	6/-	(1) firm relationship to government; (2) firm relationship to power group; (3) involvement of local business interest; (4) impact of external and regional factors; (5) nationalist attitude toward the firms; (6) project desirability to host country.
[3]	CIA	Risk in ICP	33/5	(1) political risk; (2) economic risk; (3) cultural/legal risk; (4) technology/construction risk; (5) other risks.
[4]	CIA	Risk in ICP	33/5	ditto.
[5]	ANN	International factors, project attractiveness and company competitiveness	16/-	project attractiveness and company competitiveness.
[6]	Financial Portfolio Risk Management	Financial risk in ICP	3/-	financial risk.
[7]	CIA Based Risk attitude	Contractor's risk attitude	5/-	(1) expected return; (2) significant loss; (3) significant gain; (4) variations in loss; (5) chance of gain.
[8]	AHP + Delphi	SWOT factors and International factors	38/6	(1) company strength; (2) threat posed by international markets; (3) opportunities presented by international markets; (4) benefits conducting business overseas; (5) cost conducting business overseas; (6) international expansion modes
[9]	AHP + Delphi	SWOT factors	21/3	(1) company strength; (2) threat posed by international markets; (3) opportunities presented by international markets.
[10]	CBR	International factors, project attractiveness and company competitiveness	16/-	project attractiveness and company competitiveness
[11]	MAUT + AHP	Dispute in ICP	9/-	selection factors.
[12]	Multi regression analysis	Risk affecting profitability	64/5	(1) condition of host country and project owner; (2) bidding process; (3) project characteristic and contractual conditions; (4) characteristic of organization and participants; (5) contractor's ability.
[13]	CBR + Utility Theory	International factors, opportunity and competition	44/4	(1) general; (2) risk; (3) opportunity; (4) competition.
[14]	Fuzzy logic	Risk in ICP	13/2	(1) country risk; (2) project risk.

[15]	Regression analysis	Project and country risks	53/2	(1) project risk; (2) country risk.
[16]	AHP + Risk Management	Risk in ICP	36/5	(1) project characteristic and importance; (2) level of bid competition and market condition; (3) degree of potential profit; (4) contractor position and ability to perform; (5) degree of representing risk exposures.
[17]	Discriminant analysis	Risk in ICP	64/6	(1) condition of host country and project owner; (2) bidding process; (3) project characteristic and contractual conditions; (4) characteristic of organization and participants; (5) contractor's ability.
[18]	ANP	Risk in ICP	28/5	(1) country; (2) inter country; (3) project team; (4) construction; (5) contractual.
[19]	Binary logistic regression	International factors	16/2	(1) home country and firm's specific variables; (2) control variables.
[20]	FPR and CPT	International factors	24/2	(1) country factors; (2) project factors.
[21]	Risk Management	Dispute risk in ICP	9/2	(1) project specific risk; (2) external risk.
[22]	AHP	Personnel management	13/4	(1) professional background; (2) personal characteristic; (3) teamwork capability; (4) interpersonal skills.
[23]	Entropy ranking + SWOT Analysis	Critical success factors and SWOT	11 and 25	critical success factors and SWOT factors.
[24]	Real-option analysis	Investment problem	4/2	(1) cost cash outflow components; (2) capital structure of firm
[25]	AHP + PROMETHEE	International factors	20/5	(1) national factors; (2) international environment; (3) international strategy; (4) enterprise and industry factors; (5) intrinsic feature of entry mode.
[26]	DEMATEL + ANP	International factors	108/6	(1) technical; (2) economical and financial; (3) market promotion; (4) political; (5) operational; (6) social cultural.

3.7.2 Knowledge Gap

Previous research witnessed some successful MCDM approaches described above in solving the decision-making problems. In the subject of internationalization decision, the application of MCDM methods can be addressed to assess the capability of enterprises to operate outside their market origin. In such decision, the intuition and past experience of decision makers in judging the capability of the firm may be more dominant. Indeed, the intuition of decision makers plays important role in strategic decision making (Khatri and Ng, 2000). Thus, the choice of appropriate MCDM methods allowing interactive approach should be accommodated. Pairwise comparisons are a kind of interaction styles that can be used to involve decision makers (Korhonen et al., 1992). In the same time, the subjectivity of decision makers in this process exists due to the divergence of experiences and references. Therefore, the use of hybrid methods corresponding both decision makers' interaction and subjectivity reduction have a robust reason.

Similarly, entry mode selection is equally important for international expansion. However, the use of MCDM methods as decision support aid in this topic is inadequate. The selection of an eminently suitable entry mode may determine the future company's fruitfulness in the target market. Each entry mode has different characteristic, advantages, and disadvantages. MCDM methods may be adopted to assess the fitness between the nature of entry mode and host country or project environment.

Dozens of MCDM methods have been developed, but only a few techniques have been used in international construction studies. There is an opportunity to explore other MCDM methods either by single or by hybrid approach for supporting expansion decision. Construction industry may learn from other advanced industry (e.g. manufacturing and finance) in adopting MCDM with necessary adjustment. Some MCDM methods are, however, still lacking in terms of accuracy and subjectivity in judging the weighted score or rating the criteria. They also overlooked the ill-defined information following the process decision making. To bridge the gap, fuzzy logic, and the neural network is ascertained to narrow the shortcoming.

Fuzzy set theory has been widely employed for making decision, measuring productivity, cost and time performance, evaluation and assessment of risk. This concept considers the complexity, uncertainty, and ill-defined information. Fuzzy

concepts, membership functions, and linguistic variables can fit to solve the problem of the international project's environment. Conversely, ANN offers an auspicious management method in several potential areas such as selection of alternative, estimation, classification, and optimization tasks. ANN has been used due to its ability to improve available automation efforts, including expert systems applications. Correspondingly, the realm of construction engineering and management activities requires expert knowledge, judgment, and experience for their problem resolution. For those reasons, this discipline is the best practical workshop for applying many expert system techniques (Moselhi et al. 1991). Therefore, both artificial intelligence methods can be applied extensively to support making the decision for overseas expansion of construction enterprises.

3.7.3 Adaptive Neuro-Fuzzy Inference System (ANFIS)

3.7.3.1 Basic Concept of Neural Network and Fuzzy Logic

As mentioned in section 2.6.1, the development of model adopts ANFIS algorithm approach. ANFIS combines the feature of FL and NN and it has been ascertained by many experts that amalgamation of two algorithms is a powerful combination for creating a decision support tool. In stand-alone system, both NN and FL are part of mathematical algorithm which have advantages and disadvantages in their applications.

An Artificial Neural Network (ANN) is a system derived through imitation of the human brain system (Kuo, 1998). ANN is an intelligent technique, which was developed by resembling the human nervous system in processing information (Sutrisna, 2004; Escrig-Olmedo et al., 2013). This system is a technology performing mathematical models, which artificializes the adaptive capability of the human brain in processing information (Samarasinghe, 2007; Goh and Chua, 2012). Systematically, Gurney in Sutrisna (2004) defined neural network as "an interconnected assembly of simple processing elements, units or nodes (where the processing ability of the network is stored in the inter-unit connection strength or weight) obtained by a process of adaptation to (or learning from) a set of patterns."

A neural network is developed from a large number of intertwining neurons (nodes) known as processing elements. Each processing element obtains inputs via links with other elements. The links have different *weight*, which strengthens or weaken connections. Each input gained through a *training* process is multiplied by a

weight, and the sum of all weighted inputs is modified by a *transfer* or *activation function* to produce an output signal (Astuti, 2009; Golmohammadi, 2011).

Neurons or nodes are grouped into several layers. In fact, nodes locating in the same layer have similar conditions. The crucial aspect in determining the nature of a node is *activation function* and *weight*. The nodes in the same layer have a similar activation function. The activation function decides whether the signal from the input will be forwarded to other nodes. If a node in a layer wants to be connected to a node in another layer, then all nodes in the layer mentioned early also have to be linked to all nodes in the layer mentioned later (Siang, 2009; Astuti, 2009). There are three types of network connection, called network architecture; (1) single layer, (2) multi-layer and (3) recurrent.

Activation function or transfer function assigns the nature of the network. The activation function is responsible for deciding the output of a node. Activation function constitutes a function transforming the result of calculation of output to a value for further process. Various models of activation function have been proposed, including threshold, sigmoid, and identity function (Siang, 2009).

The critical activities in performing neural network are selecting the network architecture, choosing the learning method and conducting sufficient training of the network (Skapura, 1996; Dikmen and Bergonul, 2004). The most important part in developing the network topology is to determine the number of hidden layers and its nodes (Dikmen and Bergonul, 2004). Too many nodes cause *overfitting*, a condition where the network is only able to memorize provided data set. Such condition will not produce a right output if a new input data is given. Otherwise, if the nodes are too little, input pattern may not be mapped properly (Astuti, 2009).

The learning process in neural network aims to generate a stable network. In fact, the structure of a neural network is fixed, but the weight of the connection between nodes may be changed. The weight shows how strong the connection between nodes. During the learning process, the weight dynamically alters until a stable value gained (Astuti, 2009). The variety of the learning methods were developed such as Hebb's rule (proposed by Hebb in 1949), Perceptron (developed by Rosenblatt in 1957), ADALINE (Adaptive Linear Neuron) (pioneered by Widrow and Hoff in 1960), and Backpropagation (developed by Werbos in 1974 and improved by Rumelhart's team in 1986).

In learning process, the network is trained and tested with a number of data. As previously described in section 2.6.2, there are four types of data sources that can be used. The experiment iterations are conducted by modifying the number of hidden layers and nodes in the hidden layer. The deviation between *calculated output* and the *expected output* is calculated. The performance of network can be said stable when the error produced during training and testing shows minimum score close to zero.

NN offers a method for computation, which differs from other analytical conventional techniques (Boussabine, 1996). Wanous et al. (2003) proclaimed that ANN model offers a better solution for very complex problems. Foold and Kartam (1994a and 1994b) affirmed that ANN is very adaptive to solve problem associated with a complex nonlinear relationship. Additionally, a distinguishing feature of NN over the environment which is different in time series, is adaptivity (Boussabaine, 1996). However, Boussabaine (1996) also reminds that it should be realized that neural network will never 100% equate the ability of the human brain.

NN constitutes a powerful technique for tailoring and predicting ratings more than linear regression, multivariate discriminant, and logistic regression analysis (Escrig-Olmedo et al., 2013). This argument is also supported by Vellido et al. (1999) and Malhorta and Maholtra (2003) who advocate the NN as a more satisfactory method than traditional statistical tools.

Numerous important advantages convincing neural network as an intelligent method compared with conventional statistical techniques were mentioned in many studies (Lin and Lee 1996; Boussabaine, 1996; Moshiri and Caameron, 2000; Wanaous et al., 2003; Maholtra and Maholtra, 2003). Among the advantages are mentioned as follows:

1. NN possesses an ability to modulate its weights automatically to perfect its system. NN gains a superior skill to structure itself through self-optimization in making decision, predicting, pattern recognizing, etc.

2. NN allows non-linear assumptions in its process. NN is able to learn uninformed non-linear input-output mapping directly from the training set.

3. NN enables to process imperfect information but still, result a meaningful answer. NN can generalize input patterns that are new to the network based on its own knowledge about the problem given.

4.   ANN may combine with Fuzzy logic to develop superpower model for decision support system.

Despite the advantages, the major weakness of NN is the absence of understanding of how it actually tackles a given problem, known as *black box*. According to Canuto (2001), NN does not break a problem down into its logical elements (AND, OR and NOT), but it uses a holistic method (comprehension of the processing units) which is hard to understand logically. She adds that, the learning process result of NN is reflected only in a set of weights in which it is an almost impossible task to fully understand on the functioning of NN. In this case, the only one techniques to test the NN operation is by checking the network performance for individual test cases.

A number of studies in CM discipline have taken into account in promoting NN technique. Among the first applications of NN in CM area are markup estimation for project bidding (Moselhi et al., 1991, 1993; Hegazy and Moselhi, 1994), productivity (Moselhi et al., 1992; Chao and Skibniewsski, 1994; Boussabaine, 1996; Portas and AbouRizk, 1997; Sonmez and Rowing, 1998; Shi, 1999), predicting cost indexes (Williams, 1994), the estimation of concrete pavement cost (Adeli and Wu 1998), the estimation of quantities (Yeh, 1998), construction scheduling (Adeli and Park, 1996; Adeli and Karim, 1997; Karim and Adeli, 1999), resource allocation, scheduling and requirements (Savin et al., 1996, 1998; Senouci and Adeli, 2001) and construction litigation (Arditi et al., 1998; Arditi and Tokdemir, 1999).

On the other hand, Fuzzy is a part of mathematics which patterns lacking in clarity facts in the process of human cognition and solves indistinct and complicated problems because of imperfect information that characterizes the real-world system (Singh and Tiong, 2005; Yeung, 2007). The basic concept of FL is to manipulate verbal expression instead of numbers (Baloi and Price, 2003). The verbal expression, called as linguistic variable, constitutes the value of variables in "word" forms (Yeung, 2007). Singh and Tiong (2005) further added a linguistic variable differs from a numerical variable where the value contained is not numbers, but words or sentences in natural or artificial.

In a classical set (*crisp*), the element of a set has two members, 1 if the variable is an element of a set, otherwise 0 if the variable is not an element of a set. On the contrary, a fuzzy set constitutes a set where its element is represented by several degrees of membership (Niskanen, 2004; Yeung, 2007). The element in the

fuzzy set is mapped to a membership value by using the function theory formula. The degree of membership function locates between 0 and 1 (Zimmermann, 2001; Yeung, 2007). If x is an element of the universe of set X, then the fuzzy set A in X is translated as $A = \{(x, \mu_A(x) / x \in X)\}$ where $\mu_A(x)$ is a fuzzy membership function of set A. Set A is part of universe of discourse X at membership in the interval [0 ; 1], then $\mu_A(x) \in [0,1]$ Kusumadewi and Purnomo (2004) further explained that membership function is a curve showing the mapping of the points of the input data into membership values (degree of membership) in the interval 0 and 1. One of the methods that can be employed to obtain degree of the membership is the *function equation*. Some functions are commonly represented, including linear, triangular, trapezoidal, *sigmoid* and Bell-curve (Lam and Pang, 1994).

FL is specially designed to handle natural language in order to mimic the logical process of human being (Fayek and Aduba, 2005). Linguistic variable plays a crucial role in the FL application (Bojadziev and Bojadziev, 2007). If such application is employed in construction management decision-making practice, the result will be more precise. For instance, the terms such as, project and market competition, labor productivity, construction risks, complexity of work, the complexity of technology, safety, availability of material, the quality of work, the project manager experience, and skill of workers can be easily measured by using linguistic variables such as "very high", "high", "moderate", "low" and "very low".

Another important part in FL is inferential rule, a kind of reasoning having a function which takes premises, analyzes their word arrangement, and responds a conclusion. This logic is the foundation of *fuzzy implication technique* (Kusumadewi and Purnomo, 2004). Generally, the logic is signed by using IF and THEN rule as: IF x is A THEN y is B, where x and y are scalars, and A and B are linguistic variables. The proposition following IF is called the *antecedent*, while proposition after THEN is the *consequence*. The *antecedent* reveals to what degree the rule applies, while the *consequence* stipulates a fuzzy function to one or more output variables. The proposition may be extended by using basic operator such OR or AND (Kusumadewi, 2002). This reasoning is applied in the Fuzzy Inference System (FIS), a system for mapping an input space to an output space using FL. The mapping then provides a basis from which decisions can be made or patterns discerned.

According to Canuto (2001), the major benefit obtained from this technique is the ability to phrase the amount of ambiguity in human logic and subjectivity in a relatively undistorted manner. In this respect, Lin and Lee (1996) as reflected by Canuto (2001) argue that FL is appropriate to deal with the problem such as: (1) involving human interactions and there is a need to understand intuitive thinking of human, and (2) where there is no mathematical model of the process, or it is hard to encrypt the model.

Unlike NN, FL does not have learning ability to adjust its membership function and fuzzy rules. Due to the ambiguity, uncertainty or complexity of identifying problem, it is too difficult to define all desired fuzzy rules and membership functions in optimized way when developing fuzzy model (Canuto, 2001).

In the area of construction technology and management, researchers have explored fuzzy techniques to solve problem related-construction industry. Yeung (2007) and Chan et al. (2009) identify four major areas where research promotes fuzzy technique application intensively. Decision-making area is such one on which many researchers pay great attention. Such research covers including contractor selection (Holt, 1998; Singh and Tiong, 2005), competitive bidding (Fayek, 1998), resource allocation (Zhang and Tam, 2003), procurement selection criteria (Ng et al., 2002), contract type selector (Wang et al., 1996), project management decisions (Wang and Liang, 2004), bid/no-bid decision making (Lin and Chen, 2004), project selection (Wong et al., 2000), and many more.

As approved in the previous studies, either fuzzy technique or neural network was believed as a robust method for development of decision models. Fuzzy logic and artificial neural network, however, have some drawbacks (Canuto, 2001). Neural network needs sufficient samples of data because it can only learn from data. It does not present the interpretation of the solution, which resulted from the learning process. It seems like a black box, which does not allow the user to check the rationality of the result.

Additionally, the learning process also takes longer time and it does not promise a success. Otherwise, fuzzy logic needs rules and long setting process in order to work (Nauck et al., 1997). The neuro-fuzzy approach enables to reduce training time not only due to its smaller structure but also because the network can be set with parameters relating to the problem domain (Maguire et al.,

1998). Amalgamation of fuzzy logic and neural network, therefore, constitutes a complementary technique to cross such lacking.

3.7.3.2 Concept and Applications of ANFIS

Initially, Jang (1993) analyzed the lack of traditional mathematical applications for system modeling which is not fit for encountering unclear and uncertain systems. In contrast to the conventional method, he explained that the qualitative aspect of the human knowledge and reasoning process can be patterned by fuzzy *if-then* rules of Fuzzy Inference System (FIS). On its way, this fuzzy modeling has evoked numerous applications such as controlling, prediction and inference. However, he identified some drawbacks; how to standardize in converting human knowledge to the rule base and fuzzy inference database, and how to simplify the ways for tailoring the membership functions (MF's). At the end, dealing with these two shortcomings can minimize the output error magnitude or maximize performance index.

The basic concept of ANFIS is to create the stipulated input-output pairs through constructing a set of fuzzy *if-then* rules with suitable membership functions through embedding the Fuzzy Inference Rule (FIS) into the structure of adaptive networks (Jang, 1993). An adaptive network constitutes a network structure of several nodes linked through directional connections. The node outputs are the results of alterable parameters relating to these nodes. To minimize the errors, the parameters should be updated through determination of learning rules. FIS, on the other hand, operates based on fuzzy set theory and fuzzy if-then rules (Guneri et al., 2011).

The ANFIS method has been widely adopted in many disciplines. Given examples are its applications in medical, business and marketing, hydrography, environmental, educational, and textile science. In medical science, for example, this algorithm helps diagnosis of diabetes (Polat and Gunes, 2007), heart disease (Sengur, 2008), and blood disorder (Khameneh et al., 2012). ANFIS has been employed in the area of business and marketing studies, for instance, predicting the trends of daily stock (Atsalakis and Valavanis, 2009), and financial crisis forecasting (Fang, 2012). In hydrography discipline, it was utilized to forecast the short-term flood (Nayak et al., 2005), predict sea level (Lin et al., 2008), and water resource (Galavi and Shui, 2012). Yan et al. (2010) and Corona-Nakamura et al. (2008), researchers in

environmental science, classify water quality status and water domestic consumption respectively. In educational domain, researchers make use of this algorithm for assessment of student's academic performance (Taylan et al., 2009), and for separation and classification of students based on their learning factor and performance (Iraji et al., 2012). In textile science, Aksoy et al. (2012) studied the demand forecasting method, Venkatesan and Raguphati (2012) researched the defect in textile web material, and Du et al. (2012) modeled the evaluation of clothing comfort.

The ANFIS merges the advantages of both NN and FIS. The ANFIS model can be trained without relying solely on expert knowledge sufficient for a fuzzy logic model. The ANFIS has the advantage of having both numerical and linguistic system. ANFIS also uses the NN's ability to categorize data and recognize patterns. Compared to the NN, the ANFIS model is more transparent to the user and causes less memorization errors. In consequence, several advantages of the ANFIS exist, such as adaptation capability, nonlinear structure of a process ability, and fast learning capacity (Srisaeng et al., 2015). The ANFIS has been adopted for different purposes of studies such as prediction, modeling, and assessment. Table 3.6 presents several ANFIS based approaches in construction engineering and management related studies.

Table 3.6 Samples of ANFIS applications in construction discipline

Purpose	Studies	Topics
Prediction or forecasting	Ekici, B. B. and Aksoy, U. T. (2011)	The needs of energy for building in preliminary design
	Morova, N., Serin, S., Terzi, S., and Saltan, M. (2013)	The pavement serviceability ratio of rigid highway pavements
	Marzouk, and Amin (2013)	Construction materials prices
	Yu, W. D., and Skibniewski, M. J. (2009)	Cost-related knowledge from residential construction projects
	Yuan, Z., Wang, L. N., and Ji, X. (2014)	Concrete compressive strength
Assessment or evaluation	Ebrat, M., and Ghodsi, R. (2014)	Construction project risk assessment
	Thipparat, T. (2011).	Construction Supply Chain Management Evaluation
	Debnath, J., Biswas, A., Sivan, P., Sen, K. N., and Sahu, S. (2016)	Occupational risks in construction sites
	Sun, G., Wang, Y., Mei, X., and Huang, Y. (2012).	Analysis on Durability of Coastal Concrete Dam
	Wang, Y. M., & Elhag, T. M. (2008).	Bridge risk assessment
Modeling	Polat, G., Bingol, B. N., and Uysalol, E. (2014)	Bid/No bid decision
	Latief, Y., Wibowo, A., and Iswara, W. (2013).	Preliminary cost estimation

3.7.3.3 ANFIS Algorithm

The ANFIS model structure is constructed by both ANN and fuzzy logic which allow the model to work with uncertain and imprecise information (Liu and Ling, 2003). It utilizes the NN training process to tune the membership function and the related parameter approaching the desired data sets (Wu et al., 2009).

Structurally, ANFIS consists of three devices namely, a rule base, a database, and a reasoning mechanism. The rule base constitutes fuzzy *if-then* rules, for example, one rule might be "if the project is good, contract is standard and host country is stable, then the project is go". "Good, standard and stable" are forms of fuzzy linguistic variables. FIS contains two rule bases following a linear function as described by Takagi and Sugeno (1985).

Rule 1: IF X_1 is A_1 and X_2 is A_1 THEN $Y_1 = p_1x_1 + q_1x_2 + r_1$

Rule 2: IF X_1 is A_2 and X_2 is A_2 THEN $Y_2 = p_2x_1 + q_2x_2 + r_2$

Where X_1, X_2 and Y_1 and Y_2 are respectively numerical inputs and outputs, A and B are numerical variables, and *p, q* and *r* are parameters determining the relation between input and output. ANFIS algorithm is composed of five layers as illustrated in Figure 3.4.
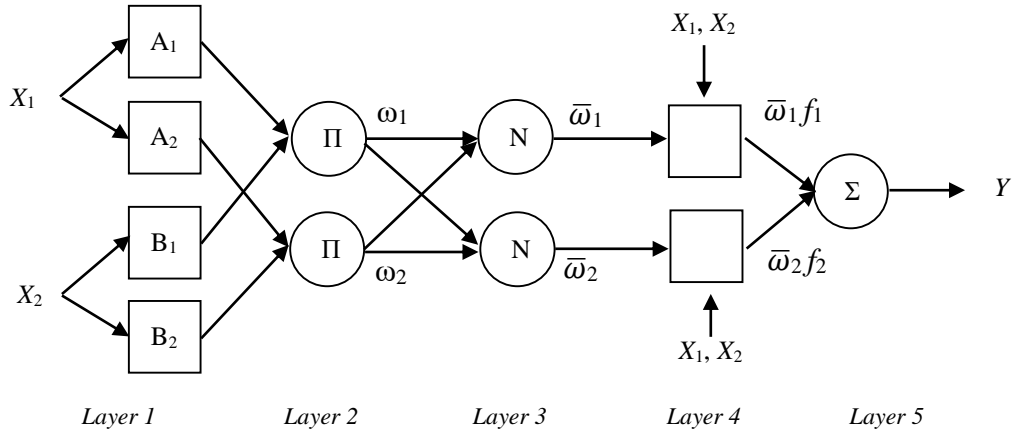
Figure 3.4. ANFIS Architecture (Jang, 1997)

Layer 1: This layer shows the number of numerical inputs belonging to the different fuzzy set. Every node *i* in this layer is represented by square node with the output function is Equation 3.1

$$\begin{cases} O_i = \mu_{A_i}(x_1) \\ O_i = \mu_{B_i}(x_2) \end{cases} \tag{3.1}$$

where $\mu_{A_i}(x_1)$ and $\mu_{B_i}(x_2)$ are membership functions for fuzzy sets of A and B.

Layer 2: In this layer, all incoming signals are multiplied to obtain an output, ω by which operator AND or OR are used, known as firing strength. The output is calculated by Equation 3.2.

$$\omega_i = \mu_{A_i}(x_1) \times \mu_{B_i}(x_2) \tag{3.2}$$

Layer 3: Every node N in this layer calculates the average ratio of previous outputs to produce a new output $\overline{\omega}$. This is obtained by Equation 3.3.

$$\overline{\omega}_i = \frac{\omega_i}{\sum_i \omega_i} \tag{3.3}$$

Layer 4: Square node in this layer produces an output $\overline{\omega}_i f_i$ based on Equation 3.4.

$$Y_i = \overline{\omega}_i f_i = \overline{\omega}_i (p_i x_1 + q_i x_2 + r_i) \tag{3.4}$$

Layer 5: This is an output layer in which the node calculates all outputs from Layer 4 by Equation 3.5.

$$Y = \sum_i \overline{\omega}_i f_i = \frac{\sum_i \omega_i f_i}{\sum_i \omega_i} \tag{3.5}$$

As described in section 3.7.3.1, learning process in a neural network aims to create a stable structure. In ANFIS, the learning process of network combines the least squares estimate (LSE) and the gradient descent method. This hybrid learning procedure is composed a forward step in which the input signal passes forward until Layer 4, where the output parameters are then adjusted using the LSE of the error between the estimated output and the actual output. Then, on the backward step, the error rates propagate back through the system, and MFs in Layer 1 are updated by the gradient descent method (Opeyemi and Justice, 2012). The process of these forward and backward propagations is called as epoch. The hybrid learning algorithm trains the MF parameters to mimic the training data samples.

The parameters to be optimized in ANFIS are the premise parameters. According to Patel and Parekh (2014), these parameters define the shape of the MFs. In order to reduce the error measure, any of numerous optimization procedures can be employed after setting MFs. An adaptive network parameter set allows fuzzy systems to learn from the data being modeled (Walia et al., 2015).

3.8 Chapter Summary

International construction is commonly defined in where one firm performs project outside its home country jurisdiction. Several characteristics of ICP made it drastically different from the domestic ones. Since the given definition of ICP is still

arguable, the present research proposes to use overseas construction project (OCP) to avoid confusion.

The research which is dealing with the international construction industry covers a wide range of issues. Four subject matters as a part of literature review were presented including the expansion motivations, the entry mode strategy, the international factors in OCPs and neuro fuzzy based MCDM. They are underlying theories to conduct this research, particularly for the development of the questionnaire and decision model. The motivations of the international expansions cover nineteen reasons boosting enterprises to penetrate into foreign markets. They are grouped into four related motives; profit, market, resource and promotion related motives. In the topic of entry mode, ten types of the institutional arrangements were introduced. The entry modes are a common strategy which is adopted in exporting construction expertise abroad. In connection with the OCP decision making, there are 31 main important aspects were determined based on a rigorous selection among 26 publications about decision-making in the international construction studies. The aspects, also called as international factors, are divided into four groups based on the source of the factors, namely the host country, client, project, and enterprise related factors.

In modern decision-making concept, decision makers should consider multi-variables before opting an option among many alternatives. In the international construction studies, MCDM methods such as AHP, ANP, CIA, CBR, FL and NN have been adopted to support management decision in making internationalization decision, selecting the market or country, choosing entry strategies, selecting project or deciding for bid and others. After the discussion on MCDM in international construction, several gaps have been identified for encouraging research in the future.

In addition, the application of neuro fuzzy techniques has attracted many researchers' attention in the latter discipline. The basic theories about both FL and NN were discussed as a stand-alone system. ANFIS combines the advantages and overcomes the disadvantages of both algorithms. Several advantages like adaptation capability, nonlinear ability and rapid learning capacity encouraged the use of ANFIS in this study. In the following chapter, the results of data analysis and the discussions on research findings particularly regarding the first two objectives are presented.

Chapter 4

MOTIVATIONS AND ENTRY MODES CHOICE OF OVERSEAS EXPANSION OF INDONESIAN CONTRACTORS

4.1 Introduction

This chapter is divided into five main sections embracing findings and discussion of analysis results obtained from questionnaire, particularly to address the first two objectives. This chapter begins by describing demographic data of respondents and participating enterprises followed by the results of data examination embracing descriptive analysis, test of reliability, relative importance index, test of concordance and inter group correlation. A case study about the involvement of Indonesian contractors in overseas market is presented afterwards.

The elaboration of research findings obtained from survey and reinforced by several interview findings is provided in discussion part. This part is subdivided into two sections reflecting first two objectives indicated above. The first discussion is dedicated to the internationalization motivations of Indonesian large contractors to expand their market operation abroad. Second, the discussion presents the preferred foreign market entry strategy or entry mode to Indonesian enterprises in entering overseas markets.

4.2 Profiles of Respondents and Participating Firms

Basic factual data relating to the companies as the discussion subject were collected. These data were not focused on getting information of respondents as personal, but as a part of their company. The questionnaires were drawn from the contractor companies which are qualified as large-scale company (Grade 6 and 7 or Class B1 and B2) in the capital city of Indonesian, Jakarta. This city was chosen not only as a capital metropolis and an ideal representation of the country but also as a business barometer of Indonesia. Another consideration is that many international enterprises have headquarter offices in Jakarta. Furthermore, the profile of respondents and participating firms are summarized in Table 4.1. The size of the

response across available response categories is indicated in both raw number and percentage. Further explanation of the demographic data of respondents is presented as follows.

Table 4.1. Profiles of respondent and participating company

Profile	Frequency	Percentage (%)
Designation of respondent in company		
▪ Board of commissioners	7	6.80
▪ Board of directors	33	32.04
▪ Heads of department/division	27	26.21
▪ Managers	36	34.95
Respondent's experience		
▪ < 10 years	0	0.00
▪ 10 - 20 years	50	48.54
▪ 21 - 30 years	25	24.27
▪ > 30	28	27.19
Company's memberships		
▪ AKI	41	39.81
▪ Gapensi	45	43.69
▪ AKI and Gapensi	17	16.50
Category of company		
▪ State-owned	6	5.83
▪ National Private	97	94.17
Year of company establishment		
▪ < 10years	0	0.00
▪ 10 - 20 years	11	10.68
▪ 21 - 30 years	45	43.69
▪ 31 - 40 years	38	36.89
▪ > 40 years	9	8.74
Number of permanent staff		
▪ < 250 staff	27	26.21
▪ 251 – 500 staff	44	42.72
▪ 501 – 1000 staff	28	27.18
▪ > 1000 staff	4	3.88
Type of company		
▪ General contractor	81	78.64
▪ Specialist contractor	22	21.36
Having experienced in OCP		
▪ Yes	6	5.83
▪ No	97	94.17

4.2.1 Position and Experience of Respondents

There are returned surveys from 103 questionnaires which was 65% response rate completed by key people who hold strategic positions in their companies. From the rate above which represents companies' top management level, 32.04% were obtained from directors and 6.08% were received from commissioners. The

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responses were also received from others senior management level, reaching 26.21%, constituting heads of department or division. The rest was dominated by company's managers including project managers, marketing managers and operations managers, who made up 34.95% of respondents.

Related to respondents' experiences, the result indicated that half of the respondents (48.54%) approximately have been working for more than 10 years but less than 20 years in their current firms. The result also recorded that nearly 28% of respondents have been serving in their current companies for more than 30 years, while about 24% have joined their current companies between 21 and 30 years.

Furthermore, most of the respondents have a respectable position in their companies and great experiences in their industry. Those two strengths indicate that the respondents are reliable in providing credible data. Thus, their opinions and observations gained through the survey are trusted, important and reliable (Akadiri 2011). Therefore, the questionnaire may be treat as reliable by considering both position level and the long experience of respondents as argued by Abdul-Aziz and Nor-Azmi (2011).

4.2.2 Companies Memberships

As explained in Section 2.4.2, the samples of research are Indonesian large contractors from AKI and Gapensi located in Jakarta. It is common that many companies have more than one association membership. Therefore, those companies affiliated with both AKI and Gapensi were separated into one group. From the 103 firms surveyed, Gapensi members dominated the samples with 43.69%, while the participation of companies from AKI made up into 39.81%. The rest (16.50%) was indicated to some companies which have two organizational memberships.

4.2.3 Category of Companies

The analysis of the returned questionnaires shows that 94.17% of participating firms are private companies while other 5.83% of participants identified as state-owned enterprises (*Badan Usaha Milik Negara* - BUMN). The small figure of participants from BUMN is understandable as the numbers of BUMNs with construction field as their core business are scanty. Most of them are former companies of the Dutch East Indies colonial government, which were nationalized

several years after the independence of Indonesia. Therefore, the opinions obtained through this survey are more likely to be the representative of private enterprises.

4.2.4 Years of Company's Establishment

Reflecting to the company's experience, respondents were asked to indicate their companies' age of establishment. Participating firms which have been operated between 21 and 30 years dominated the survey nearly 44%, and it was followed at 36.89% by enterprises which have been set for 31 – 40 years. Interestingly, only 8.74% firms surveyed have established for more than 40 years, while 10.68% were operated for less than 20 years. This information clearly indicates that the instrument for data collection have properly represented, nearly 90% by extensively experienced firms in Indonesian construction industry.

4.2.5 Number of Permanent Staff

The workforce is one of the measures to indicate the company size. Question on the number of permanent employees shows that majority of companies surveyed around 74% of them hire permanent staffs for more than 251 personnel. This number was dominated by companies employing 251 – 500 permanent workers, hitting until 42.72%. While, there were 26.21% participating contractors which employ less than 250 permanent staff, only 3.88% of enterprises surveyed employ permanent staff more than 1000 people. Due to the advancement of technology in all of the industries, there are problems when using this measure to determine the companies size (Hart and Oulton,1996).

4.2.6 Type of Companies

It was predicted that general contractors are dominant in this survey, reaching 78.64% of participating companies. This corresponds with a statement expressed by Husaini (2015), Head of Construction Development Unit, Ministry of Public Work and People Housing, that around 80% of total local builders in Indonesia are general contractor companies. The specialist contractors involved in this survey (21.36%) concentrated in the field of steel structure, foundation, marine structure, industrial building and mechanical.

4.2.7 Companies Experience in OCPs

There were only 5.83% of participants who have experiences in OCPs. Those were three BUMN companies and three private contractors. This fact implies that Indonesian contractors are still fully relying on demand at home country market, while foreign markets, are not their main concern nowadays. The small number of enterprises have performed OCPs may indicate that there exist some barriers hampering the intention to expand market outside home country's jurisdiction. It may also reflect the competitiveness of local firms to compete in the foreign market is relatively low.

The following sections present the result of analysis and discussion of the main parts of questionnaire including motivating factors, preferred choice of entry mode and international factors considered for overseas projects selection. An exclusive part is provided to analyze a case study in detail, relating to the experienced contractors

4.3 Data Examination

4.3.1 Descriptive Analysis

All information obtained from the descriptive analysis are named means or average score (MS), standard deviation (SD) and standard errors of means (SE). The MS is used to present central tendency of the data in question forms. The SD estimates the variability within a single sample, indicating the closeness of a single data to mean value. The SE measures the variability between samples, indicating the preciseness of the mean of the sample to the population mean (Field, 2009). The results of descriptive analysis from the obtained data are summarized in Table 4.2.

Table 4.2 Descriptive analysis of the observed variables

Observed items	Mean	SD	SE	Skewness	Kurtosis
Motivations					
To increase profitability	6.04	0.779	0.077	-0.034	-1.344
To balance growth	5.02	0.673	0.066	-0.104	-0.761
To increase turnover	5.13	0.661	0.065	-0.073	-0.671
To maintain shareholders' interest	4.17	0.748	0.074	0.160	-1.182
To expand/enlarge business	5.32	0.710	0.070	0.729	-0.435
To avoid saturation in domestic market	5.83	0.573	0.056	0.010	-0.181
To capitalize on booming market	4.48	0.544	0.054	-1.057	0.109
To capitalize on globalization	4.08	0.779	0.077	-0.189	-1.319
To diversify company's risks	4.15	0.589	0.058	-0.486	-0.657
To optimize use of resources	4.95	0.711	0.070	-0.386	0.261
To benefit competitive advantage	5.97	0.690	0.068	0.089	-0.864
To harness company expertise	4.62	0.712	0.070	-0.764	-0.183

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To actualize company's vision	5.04	0.616	0.061	-0.152	-0.488
To respond project sponsor invitation	5.57	0.550	0.054	-0.039	-0.479
To respond home government encouragement	3.92	0.685	0.067	0.048	-0.392
To gain international experience	5.16	0.635	0.063	-0.428	-0.656
To be anchor player in host country	3.69	0.667	0.066	0.148	-0.732
Entry modes					
Strategic Alliance (SA)	4.09	.064	.651	-.375	-.704
Local Agent (LA)	4.26	.085	.863	.209	-.592
Licensing	2.75	.085	.860	-.044	-.437
Joint Venture Project (JVP)	6.61	.049	.497	.299	-1.949
Joint Venture Company (JVC)	5.00	.072	.728	.000	-1.087
Branch Office (BO)	6.15	.051	.521	-.167	-1.057
Representative Office (RO)	5.60	.104	1.053	.061	.597
Sole Venture Project (SVP)	4.34	.085	.858	.038	-.667
Sole Venture Company (SVC)	2.89	.075	.766	.318	-.823
Build Operate Transfer (BOT)	3.76	.070	.707	.384	-.930

Table 4.2 summarizes the responses of the questions in part B and C. The table shows that the mean scores for the internationalization motivations range from 3.69 (to be anchor player in host country) to 6.04 (to increase profitability). Regarding the preferred entry modes, the average scores were distributed between 6.61 (JVP) and 2.75 (Licensing). Large SD signifies that the score cluster is more widely around the mean. In consequence, the mean is not the right representation of the data and vice versa. The table shows that the SD values are relatively small, ranging from 0.544 to 0.779 and 0.049 to 0.104 for motivations and entry modes. Thus, using the average score as a representative value for the data is acceptable. On the other side, a large SE shows a significant difference between the means of the different samples, suggesting that the samples are a poor representative of the respondents and vice versa. The table presents SE values which are trivial compared with the actual means. Therefore, the data sample used in this research was sufficiently representing the population.

Other information obtained are skewness (a measure of symmetry) and kurtosis (a measure of the peakedness) values. A general rule of thumb for skewness is that if the number is greater than +1 or lower than –1, it indicates a substantially skewed distribution. For kurtosis, if the number is greater than +1, the distribution is too peaked, otherwise a distribution is too flat if kurtosis less than –1. Distributions are considered normal if both the skewness and kurtosis values deal with a range of -1.00 to 1.00 (Hair et al., 2017). Table 4.2 shows that several the skewness and kurtosis values of the observed variables exceeded these guidelines, meaning that the data of this research are considered nonnormal distribution.

4.3.2 Cronbach's Alpha Coefficient (α)

As indicated earlier, this statistical test measures the reliability of a questionnaire to ensure that the seven rating of Likert scale (1–7) used for measuring the attributes earns the same result over time. The results of this test are given in Table 4.3. Referring to the table, the coefficients generated exceed the required threshold of 0.7 as advised by researchers in Section 2.5.2. The results indicated marginal and acceptable level of internal consistency reliability among the raters as stated by Stone (1978) and Netemeyer et al. (2003).

Table 4.3. Reliability test of data

Measured objects	Number of items	α	Level
Motivating factors	17	0.742	Marginal
Entry mode choice	10	0.811	Acceptable

4.3.3 Relative Importance Index (RII)

Relative Importance Index (RII) has been frequently used for analyzing survey data in CM research. According to Holt (1998), the researchers applying this technique have the major aim of generating an index which can ordinally compose surveyed variable. Correspondingly, there are several ways to measure RII, but the most frequently cited formula is as given in Equation (2.4).

An attempt was made to investigate respondent's views on 17 motivations and 10 entry market strategies regarding market expansion of Indonesian contractors. RII was used to measure the importance level of each element based on seven points Likert scale from strongly unimportant (=1) to strongly important (=7). The RII scores were then extrapolated to define their criticality, which those are as follows: strongly unimportant (≤ 0.14), very unimportant (0.15 – 0.29), unimportant (0.30 – 0.44), moderately important (0.45 – 0.59), important (0.60 – 0.74), very important (0.75 – 0.89) and strongly important (≥ 0.90).

4.3.2.1 RII of Motivating Factors

Table 4.4 below shows the descending rating of motivating factors and their criticality. RII figures signify the overall priorities or the importance of the rationales. The RII scores range from 0.53 (to be an anchor player in the host country) to 0.86 (to increase company's profitability). The table records that from 17 motivating factors, five motives were indicated as "very important" in driving Indonesian contractors to pursue OCPs, while eight and four motivations were

considered as "important" and "moderately important" respectively. The figures recorded in the table clarify that the reason to pursue overseas projects was motivated by a multiple-motivations rather than a single one.

Table 4.4 Ranking of motivations

Motivations	RII	Ranking	Criticality
To increase profitability	0.86	1	Very important
To benefit competitive advantage	0.85	2	Very important
To avoid saturation in domestic market	0.83	3	Very important
To respond project sponsor invitation	0.80	4	Very important
To expand/enlarge business	0.76	5	Very important
To gain international experience	0.74	6	Important
To increase turnover	0.73	7	Important
To actualize company's vision	0.72	8	Important
To balance growth	0.72	8	Important
To optimize use of resources	0.71	9	Important
To harness company expertise	0.66	10	Important
To capitalize on booming market	0.64	11	Important
To maintain shareholders' interest	0.60	12	Important
To diversify company's risks	0.59	13	Moderately important
To capitalize on globalization	0.59	13	Moderately important
To respond home government encouragement	0.56	14	Moderately important
To be anchor player in host country	0.53	15	Moderately important

Table 4.5 presents the ranking of motivations based on respondents' designation in their companies. Four groups of respondents jointly ranked the expansion motives, namely "to increase company's profitability", "to benefit company's competitive advantage" and "to avoid saturation in domestic market" as the top three. The table records that there were four expansion motives listed in the lowest rank. For those in the lowest list, the motivation "to diversify company's risk" appeared in the group of commissioners, while the rational "to be anchor player in host country" listed in other three groups. Concurrently with the motive "to be anchor player in host country", the motive "to capitalize on globalization" and "to be anchor player in host country" emerged in the group of directors and managers respectively.

Regarding criticality, the groups of respondents showed a conformably perspective of the expansion motivations. The category of motivations placed in "moderately important" to "very important". In category "very important", the group of commissioners put seven motivations with RII ranging from 0.75 to 0.89, while six motives were listed by the group of managers with RII between 0.75 to 0.85. Other two groups, both directors, and heads of department groups had five motivations ranging from 0.77 to 0.86 and 0.78 to 0.85 respectively.

Table 4.5 Motivation based on respondents' position

Motivations	Commissioners (N=7)		Directors (N=33)		Head of Dept. (N=27)		Managers (N=36)	
	RII	Ranking	RII	Ranking	RII	Ranking	RII	Ranking
To increase profitability	0.89	1	0.86	1	0.85	1	0.85	1
To benefit competitive advantage	0.88	2	0.85	2	0.84	2	0.84	2
To avoid saturation in domestic market	0.84	3	0.84	3	0.83	3	0.82	3
To respond project sponsor invitation	0.80	4	0.77	4	0.84	2	0.77	5
To expand/enlarge business	0.79	5	0.74	5	0.73	5	0.78	4
To gain international experience	0.75	6	0.77	4	0.71	6	0.72	8
To increase turnover	0.75	6	0.72	6	0.73	5	0.73	7
To actualize company's vision	0.67	10	0.74	7	0.78	4	0.69	9
To balance growth	0.73	7	0.68	9	0.71	6	0.75	6
To optimize use of resources	0.73	7	0.71	8	0.67	7	0.72	8
To harness company expertise	0.71	8	0.66	11	0.63	9	0.64	11
To capitalize on booming market	0.61	11	0.66	11	0.63	9	0.66	10
To maintain shareholders' interest	0.69	9	0.58	13	0.55	11	0.56	14
To diversify company's risks	0.51	14	0.67	10	0.64	8	0.55	13
To capitalize on globalization	0.55	12	0.56	14	0.61	10	0.61	12
To respond home government encouragement	0.53	13	0.61	12	0.55	11	0.55	13
To be anchor player in host country	0.55	12	0.56	14	0.51	12	0.49	14

Table 4.6 indicates the perspective of respondents on the expansion motivations grouped into their experience in the industry. In order to simplify the name of the groups, the respondents having experience 10-20 years, 21 to 30 years and above 30 years were called as group 1, group 2 and group 3 respectively. In terms of motivations ranking, the consensus was only reached on the top ranking "to increase profitability" and "to response project sponsor invitation" at fourth ranking. Interestingly, in group 1, the top ranking was jointly placed by "to increase profitability" and "to avoid saturation in domestic market". While group 1 and group 3 concurrently listed the motive "to anchor player in host country", group 2 placed the motive "to response home government encouragement" in the bottom.

Table 4.6 Motivation based on respondents' experience

Motivations	10 - 20 years (N=50)		21 - 30 years (N=25)		> 30 years (N = 28)	
	RII	Ranking	RII	Ranking	RII	Ranking
To increase profitability	0.85	1	0.86	1	0.89	1
To benefit competitive advantage	0.83	2	0.83	3	0.86	2
To avoid saturation in domestic market	0.85	1	0.84	2	0.82	3
To respond project sponsor invitation	0.79	4	0.82	4	0.80	4
To expand/enlarge business	0.80	3	0.75	6	0.74	7
To gain international experience	0.73	6	0.70	9	0.78	5
To increase turnover	0.74	5	0.73	7	0.73	8
To actualize company's vision	0.65	8	0.76	5	0.75	6
To balance growth	0.70	7	0.72	8	0.75	6
To optimize use of resources	0.74	5	0.73	7	0.67	10
To harness company expertise	0.62	10	0.66	10	0.70	9
To capitalize on booming market	0.64	9	0.63	11	0.66	11
To maintain shareholders' interest	0.57	11	0.6	12	0.64	13
To diversify company's risks	0.56	12	0.56	13	0.65	12
To capitalize on globalization	0.56	12	0.55	14	0.64	13
To respond home gov. encouragement	0.55	13	0.53	15	0.59	14
To be anchor player in host country	0.48	14	0.55	14	0.56	15

Similarly, the three groups have a slightly different view on the criticality of the motivations. In the category of very important, for example, group 1 listed five motivations having RII ranging from 0.79 to 0.85. In addition, six motivations were found in group 2 with RII between 0.75 and 0.86, and there were seven motivations in group 3 with 0.75 – 0.89 of RII.

4.3.2.2 RII of Entry Modes

Table 4.7 shows responses to question part C asking about the preferred choice of the market entry strategies. In general, the RII score of the entry modes ranged from 0.39 to 0.94 which were distributed in five criticality categories. The

respondents indicated that establishing JVP was "strongly important" followed by setting BO and RO with "very important" for each other. The table clearly indicated two strategies as unimportant modes to enter foreign markets, which were SVC and Licensing.

Table 4.7 Ranking of preferred choice of entry modes

Entry modes	RII	Ranking	Criticality
Joint Venture Project (JVP)	0.94	1	Strongly important
Branch Office (BO)	0.88	2	Very important
Representative Office (RO)	0.80	3	Very important
Joint Venture Company (JVC)	0.71	4	Important
Sole Venture Project (SVP)	0.62	5	Important
Local Agent (LA)	0.61	6	Important
Strategic Alliance (SA)	0.58	7	Moderately Important
Build Operate Transfer (BOT)	0.54	8	Moderately important
Sole Venture Company (SVC)	0.41	9	Unimportant
Licensing	0.39	10	Unimportant

Table 4.8 shows entry modes rating given by respondents based on their managerial position. Overall, there were not many differences among groups in choosing preferable strategies to enter foreign markets. They relatively considered JVP, BO, and RO as the upmost strategic choice to penetrate the markets. At glance, the table shows an agreement of the entry mode choice between the group of commissioners and directors. Three groups of respondents consisting of commissioners, directors and HoD situated Licensing as the bottommost entry strategy. Unlike the three groups, managers listed SVC in the bottom line.

Table 4.8 Ranking of entry mode based on respondents' post

Entry mode	Commissioners (N=7)		Directors (N=33)		Head of Dept. (N=27)		Managers (N=36)	
	RII	Ranking	RII	Ranking	RII	Ranking	RII	Ranking
Joint Venture Project (JVP)	0.91	1	0.90	1	0.85	1	0.84	1
Branch Office (BO)	0.83	2	0.83	2	0.80	2	0.81	2
Representative Office (RO)	0.82	3	0.80	3	0.73	3	0.71	3
Joint Venture Company (JVC)	0.77	4	0.74	4	0.68	5	0.65	6
Sole Venture Project (SVP)	0.61	6	0.62	6	0.70	4	0.74	4
Local Agent (LA)	0.59	7	0.55	7	0.64	6	0.66	5
Strategic Alliance (SA)	0.63	5	0.67	5	0.59	7	0.55	7
Build Operate Transfer (BOT)	0.55	8	0.53	8	0.54	8	0.54	8
Sole Venture Company (SVC)	0.48	9	0.42	9	0.37	9	0.32	10
Licensing	0.43	10	0.40	10	0.35	10	0.38	9

The RII score and ranking given by groups of respondents based on their years in the industry are recorded in Table 4.9. Three new group's names; group 1 representing 10-20 years' experience, group 2 (21-30 years' experience) and group 3 (more than 30 years' experience) were also used to simplify the description of the table. In terms of the ranking agreement, the groups reached consensus on two expansion motivations, i.e., JVP and BO. In the lowest rank, Licensing was considered by group 1 and 2, while group 3 placed SVC.

RII scores given by each group indicate that group 1 subsumed two most important strategies to enter the markets (JVP and BO). At the same category, group 2 put JVP, BO and JVC, while group 3 listed BO, RO, and JVC on it. Surprisingly, the latter group categorized JVP as a strongly important mode to enter foreign markets. The table also indicates the entry modes categorized as unimportant strategies. They were SVC and Licensing in group 1, while group 2 includes both of them and BOT too. This criticality category was not found in group 3.

Table 4.9 Ranking of entry mode based on respondents' experience

Entry mode	10 - 20 years (N = 50)		21 - 30 years (N = 25)		> 30 years (N = 28)	
	RII	Ranking	RII	Ranking	RII	Ranking
Joint Venture Project (JVP)	0.82	1	0.88	1	0.92	1
Branch Office (BO)	0.75	2	0.80	2	0.89	2
Representative Office (RO)	0.70	3	0.72	4	0.83	3
Joint Venture Company (JVC)	0.66	5	0.75	3	0.76	4
Sole Venture Project (SVP)	0.68	4	0.65	5	0.67	5
Local Agent (LA)	0.66	5	0.59	7	0.62	7
Strategic Alliance (SA)	0.53	7	0.62	6	0.66	6
Build Operate Transfer (BOT)	0.58	6	0.44	8	0.60	7
Sole Venture Company (SVC)	0.43	8	0.37	9	0.48	9
Licensing	0.33	9	0.33	10	0.54	8

4.3.4 Kruskal-Wallis and Mann-Whitney U Test

Kruskal-Wallis and Mann Whitney U test were conducted to comprise the differences in ranking for each motivation and entry mode by different groups of samples. Table 4.10 shows that overall, the sig. values of Kruskal-Wallis test for most of the motivations and entry modes were higher than 0.05. This indicates that with a very few exceptions, no differences exist amongst the groups of respondents either in post or in experience categories.

Pairwise comparisons using the Mann-Whitney U test were carried out on each of two groups. To simplify the analysis results, the respondent's posts were

symbolized with A, B, C and D for Commissioners, Directors, HoD and Managers respectively, while 2, 3 and 4 for respondents having experience 11-20 years, 21-30 years and 31-40 years respectively. In total, three tests were carried out as shown in Table 4.10. Similar to results of Kruskal-Wallis test, the sig. values of each categorical pairwise for most of variables exceeded 0.05. This implies that the ranking of motivation and entry mode of most of the respondents' profiles are same among their respective categories (post and experience).

Table 4.10 Results of Kruskal-Wallis and Mann-Whitney U test

| Variables | Kruskal-Wallis | | Mann-Whitney U | | | | | | | | |
| | Post | Experience | Post | | | | | | Experience | | |
			A - B	A - C	A - D	B - C	B - D	C - D	2 - 3	2 - 4	3 - 4
To increase profitability	.766	.154	.487	.361	.349	.623	.598	.840	.892	.862	.474
To benefit competitive advantage	.845	.906	.918	.899	.699	.691	.376	.648	.921	.672	.753
To avoid saturation in domestic market	.322	.594	.455	.903	.628	.854	.660	.783	.815	.322	.483
To respond project sponsor invitation	.600	.305	.784	.613	.785	.238	.994	.229	.932	.174	.203
To expand/enlarge business	.799	.835	.634	.625	.628	.981	.415	.419	.804	.550	.765
To gain international experience	.220	.292	.772	.982	.221	.694	.378	.883	.449	.128	.489
To increase turnover	.094	.480	.984	.266	.780	.065	.602	.315	.323	.322	.927
To actualize company's vision	.189	.576	.450	.344	.709	.828	.193	.156	.921	.275	.507
To balance growth	.146	.430	.464	.078	.313	.161	.605	.151	.570	.369	.210
To optimize use of resources	.759	.474	.772	.351	.737	.405	.973	.421	.245	.826	.330
To harness company expertise	.175	.165	.421	.635	.480	.743	.024	.129	.531	.449	.348
To capitalize on booming market	.791	.388	.367	.537	.369	.647	.989	.637	.770	.153	.418
To maintain shareholders' interest	.227	.820	,159	.014	.021	.823	.904	.901	.929	.577	.584
To diversify company's risks	.980	.377	.768	.831	.040	.708	.674	.709	.944	.247	.365
To capitalize on globalization	.114	.081	.117	.326	.969	.469	.048	.134	.197	.368	.665
To respond home government encouragement	.751	.912	.923	.019	.453	.225	.152	.296	.532	.761	.681
To be anchor player in host country	.519	.382	.166	.043	.349	.376	.463	.904	.952	.722	.685
Strategic Alliance (SA)	.513	.403	.212	.180	.468	.662	.536	.359	.582	.380	.151
Local Agent (LA)	.994	.519	.817	.782	.803	.923	.979	.940	.259	.853	.398
Licensing	.720	.325	.422	.136	.756	.230	.155	.323	.971	.171	.212
Joint Venture Project (JVP)	.591	.195	.698	.454	.304	.528	.257	.665	.071	.547	.265
Joint Venture Company (JVC)	.414	.443	.611	.339	.888	.290	.495	.121	.251	.839	.269
Branch Office (BO)	.156	.694	.698	.697	.304	.229	.257	.031	.844	.389	.596
Representative Office (RO)	.247	.731	.172	.281	.579	.732	.186	.237	.710	.584	.448
Sole Venture Project (SVP)	.254	.979	.176	.225	.288	.376	.163	.696	.835	.965	.895
Sole Venture Company (SVC)	.417	.787	.806	.540	.453	.210	.133	.912	.981	.512	.591
Build Operate Transfer (BOT)	.890	.327	.702	.570	.815	.691	.769	.493	.141	.779	.285

4.3.5 Kendall's Coefficient of Concordance (*W*)

Kendall's coefficient of concordance (*W*) was calculated to confirm whether there were any significant intra-group differences among the respondents and each group of respondents. As presented in Table 4.11, the concordance index for the ranking of motivations and entry mode were 0.557 and 0.697 at significant level of 99%. These facts can be interpreted that there was a relatively strong consensus among respondents in each group's ranking.

Table 4.11 Overall Kendall's coefficient of concordance

	Motivating factors	Entry modes
Kendall's W[a]	.557	.697
Asymp. Sig.	.000	.000

a. Kendall's Coefficient of concordance

A more detail explanation can be seen in Table 4.12, it depicts the intra-group agreement among respondents (as per designation) for motivating factors, indicated 0.784, 0.565, 0.575 and 0.551 at a 0.001 significance level for a group of commissioners, directors, HoD and managers respectively. These managerial groups also recorded the *W* value at 0.729, 0.721, 0.706 and 0.694 respectively for entry mode choice. These figures concluded that among respondents in each group of the managerial post had agreement on those rankings.

Table 4.12 Intra group Kendall's coefficient of concordance – respondents position

		Commissioners	Directors	HoD	Managers
Motivating factors	Kendall's W[a]	.784	.565	.575	.551
	Asymp. Sig.	.000	.000	.000	.000
Entry modes	Kendall's W[a]	.729	.721	.706	.694
	Asymp. Sig.	.000	.000	.000	.000

a. Kendall's Coefficient of concordance

Table 4.13 presents Kendall's coefficient of respondents' experience from each group. As narrated previously, the respondents' experience was called in three groups. The intra-group respondents' agreement on the motivations indicated 0.596, 0.565 and 0.505 at a 0.001 significance level for group 1, group 2 and group 3 respectively. In terms of the entry mode choice, the *W* values were showed as follows; group 1 (0.684), group 2 (0.714) and group 3 (0.719). These figures imply that there was an agreement among respondents in each group on the ranking of the motivations and entry mode choice at a 0.001 significance level.

Table 4.13 Intra group Kendall's coefficient – respondents experience

		10 - 20 years	21 - 30 years	> 30 years
Motivating factors	Kendall's W^a	.596	.565	.505
	Asymp. Sig.	.000	.000	.000
Entry modes	Kendall's W^a	.684	.714	.719
	Asymp. Sig.	.000	.000	.000

a. Kendall's Coefficient of concordance

4.3.6 Spearman Rank-Order Correlation Coefficient (r_s)

Table 4.14 indicates the value of Spearman rank correlation of inter-groups of respondents based on the managerial post. In general, the pair groups' correlation on the motivations and entry mode choice shows an obvious significant agreement at a 0.001 significance level. Regarding the motivations, the values of r_s between paired groups of commissioners - directors, commissioners – HoD, and commissioners - managers were 0.963, 0.966 and 0.961 respectively. Furthermore, the pairs of directors – HoD and directors – managers presented a significant agreement at 0.980 and 0.962 respectively. Another pair, HoD – managers resulted in r_s value of 0.9.72. Those results indicate that there were significant inter-group agreements on the ranking of the motivations.

Similar indication was also found in the results of Spearman rank correlation of inter-groups toward the entry mode choice. The values of r_s between paired groups of commissioners - directors, commissioners – HoD, and commissioners - managers were 0.957, 0.979 and 0.967 respectively. Other pairs of group: directors – HoD, director – managers and HoD – managers presented the r_s value of 0.979, 0.997 and 0.988 respectively.

Table 4.14 Spearman rank correlation between groups (respondents' post)

	Group	Commissioners	Directors	Heads of Department	Managers
Motivations	Commissioners	1.000	.963[**]	.966[**]	.961[**]
	Directors		1.000	.980[**]	.962[**]
	Head of Dept.			1.000	.972[**]
	Managers				1.000
Entry modes	Commissioners	1.000	.957[**]	.979[**]	.967[**]
	Directors		1.000	.979[**]	.997[**]
	Head of Dept.			1.000	.988[**]
	Managers				1.000

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

Related to the values of r_s on pair group of respondents based on their years' experience, the results also presented significant agreement on the ranking of motivations and entry mode choice as recorded in Table 4.15 below. The table shows that the highest r_s score of the motivations was 0.947 belonging to the pair of respondents between group 1 and group 2. In terms of the entry mode choice, the pair of respondents of group 2 and group 3 was the highest with the r_s value of 0.976.

Table 4.15 Spearman rank correlation between groups (respondents' experience)

	Group	10 - 20 years	21 - 30 years	> 30 years
Motivating factors	10 - 20 years	1.000	.947**	.897**
	21 - 30 years		1.000	.923**
	> 30 years			1.000
Entry modes	10 - 20 years	1.000	.906**	.924**
	21 - 30 years		1.000	.976**
	> 30 years			1.000

All of the results described above presents the opinions of respondents which were merely obtained from analysis on the questionnaires distributed to Indonesian large contractors. The weakness of this result is that it cannot be interpreted in details because there is limitation in using Likert scale in order to get further elaboration of the finding. To deal with the problem and to clarify the finding, a case study and an interview were carried out as given below.

4.4 Case Study[2]

4.4.1 The Involvement in OCPs

The involvement of Indonesian contractors in overseas projects has just seriously begun in the last decade. However, the result of information retrieval conducted on diverse resources highlighted the fact that the penetration of Indonesian companies has started in the 1990s. Almost seven years later, another BUMN tried to break the ice to enter foreign projects and this venture keeps burgeoning. As the effect of numerous consideration that should be taken in pursuing OCPs, only a few of Indonesian contractors have been able to compete internationally (Konstruksi, 2012). Table 4.16 below shows the involvement of Indonesian construction enterprises in conducting cross-nation projects.

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[2] Major part of this section has been published in conference paper no. 13 of Page vi.

Table 4.16 Overseas Projects of Indonesian Contractors

No	Contractors	Project name	Type of work	Country	Client/Employer	Year	App. Project cost (USD)
1	PT HUTAMA KARYA*	Yong Peng-Ayer Hitam Toll Road	Road	Malaysia	PLUS Malaysia Berhad	1990 -1993	MYR 52 million
		Metro Manila Skyway	Road	Philippine	Metropolitan Manila Development Authority	1995 -1997	376 million
		Indonesian Embassy Office	Building	Brunei D.	Indonesian Government	2012-2013	6.58 million
		Upgrading and Sealing of Sepik Highway	Road	Papua N.G.	Host Government	2002-2003	8.16 million
		Four Road Links	Road	Timor Leste	Host Government	2014-2015	35.25 million
2	PT ADHI KARYA*	Tilal Complex (Mall, Office and Apartment towers)	Building	Oman	Almadina Real Estate Comp.	2007-2012	105 million
		Shaden al Hail Project (Apartment)	Building	Oman	Shaden Development Comp.	2009-2012	23.1 million
		Doha City Center Hotel	Building	Qatar		2006	NA
		East Coast Railway	Railway	India	Rail Vikas Nigam Ltd.	2007-2012	NA
		TONO Bridge	Bridge	Timor Leste	Host Government	2014-2015	17.1 million
3	PT PEMBANGUNAN PERUMAHAN (PP)*	Palm Jumeirah Gateway Towers Project	Building	UAE	NA	2005-2007	NA
		New Doha International Airport	Airport	Qatar	NA	2005-2013	NA
		Ministry of Finance Building	Building	Timor Leste	Host Government	2012-2014	21.79 million
		Liquica – Mota Ain Road	Road	Timor Leste	Host Government	2012-2013	15 million
		Tibar – Gleno Road	Road	Timor Leste	Host Government	2012-2014	29.29 million
		Karimbala Sector Road	Road	Timor Leste	Host Government	2015	34 million
4	PT WASKITA KARYA*	Burj Views Dubai	Building	UAE	Binladin Group	2006-2008	4.93 million
		Legend Plaza	Building	UAE	Binladin Group	2008-2009	8.99 million
		Abu Dhabi Financial Center (Podium) Tower 4 Structure	Building	Oman	Binladin Group	2008	30.1 million
		King Saud University, Riyadh	Building	Saudi Arabia	Binladin Group	2009	19.79 million
		King Abdullah Financial District: Parcel 2.11 & 2.12	Building	Saudi Arabia	Binladin Group	2010-2011	30.18 million

No	Company	Project	Type	Country	Client	Year	Value
		Fitness College (Structural Works)	Building	Saudi Arabia	Binladin Group	2010	3.02 million
		King Abdullah Mataf Increasing Capacity	Building	Saudi Arabia	Binladin Group	2013	6.44 million
		Upgrading Suai Airport	Building	Timor Leste	Host Government	2013	67.69 million
		Oecusse Irrigation	Irrigation	Timor leste	Host Government	2014	8.07 million
		Oecusse Road and Bridge	Road & Bridge	Timor Leste	Host Government	2014	38.6 million
5	PT WIJAYA KARYA*	East-West Motorway	Road	Algeria	Host Government	2007	34.58 million
		Metro Dubai Light Train Project	Station	UAE	Japanese Contractors	2007	
		Al-Qarji Mall	Building	Libya	Al-Qarji Investment	2010	16 million
		Flyover Baburaja, Brunei	Road	Brunei D.	Host Government	2012	3.9 million
		Batugade-Maliana Road	Road	Timor Leste	Host Government	2012	7 million
		Comoro Bridge 1	Bridge	Timor Leste	Host Government	2013	2.34 million
		Comoro Bridge 2	Bridge	Timor Leste	Host Government	2014	8.5 million
		Diesel Engine Power Plant	Power plan	Timor Leste	Host Government	2015	16.9 million
		Oekusi Airport	Airport	Timor Leste	Host Government	2015	75 million
		Pyay Tower & Residences	Building	Myanmar	Nobel Twin Dragons	2014-2017	125 million
6	PT BRANTAS ABIPRAYA*	Raibera Irrigation	Irrigation	Timor Leste	Host Government	2013-2015	4.2 million
7	PT ISTAKA KARYA *	Loes Bridge	Bridge	Timor Leste	Host Government	2011	1.47 million
8	PT NUSA KONSTRUKSI ENJINIRING (Formerly PT Duta Graha Indah)	Ponte Bear, Suai District	Bridge	Timor Leste	Host Government	2010	0.6 million
		BAER Bridge, Covalima District	Bridge	Timor Leste	Host Government	2010-2012	6.3 million
		Murzuq Gatroon Housing	Housing	Libya	NA	NA	350 million
9	PT MULTI STRUCTURE	Khurais Gas Plant	Power station	Saudi Arabia	ARAMCO	2007-2010	NA
		Ainzara Housing Complex	Housing	Libya	ODAC	2008-2011	NA
10	PT DAYA MULYA TURANGGA	Dilor Bridge	Bridge	Timor Leste	Host Government	2011	6.5 million
11	PT PANDAMAN PUTRA UTAMA	Prime Minister Office Building	Building	Timor Leste	Host Government	2011	6 million
12	PT BIMAVI	Religion Building (Temple)	Building	Timor Leste	Host Government	2014	3 million
13	PT PULAU MAS UTAMA	Military Police Dormitory	Building	Timor Leste	Host Government	2010-2011	2.4 million
14	PT BANGUN PRIMA SEMESTA	Comoro Power Plant	Power plant	Timor Leste	Host Government	2012	2.3 million

15	PT WARISILA INDONESIA	Hera Power Plant	Power plant	Timor Leste	Leste G&S Construction	2011	6 million
16	PT. SASMITO QQ CAMANASA UNIP.	Ministry of Social Solidarity Building	Building	Timor Leste	Host Government	2011	4.3 million
		Social Office Building	Building	Timor Leste	Host Government	2014	0.22 million
17	PT TENDA ARTIKA	Warehouse construction in several cities	Warehouse	Timor Leste	Host Government	2010	1.93 million
18	PT DSI MAKMUR SEJAHTERA	Spatial Design and planning for Southern Coast	Surveying	Timor Leste	Host Government	2010	2.08 million
19	PT CITRA MEGAH KARYA GEMILANG	Ground Reservoirs	Reservoir	Libya	Great Manmade River-Water Utilization Authority		81 million
		External floating roof gas oil storage tank	Storage tank	Libya	Brega Petroleum Marketing Comp.		4 million
		Ain Zara Housing Complex	Housing	Libya	ODAC Libya	2007-2010	710 million
		SEBHA Housing (4000 units)	Housing	Libya	ODAC Libya	2007	274 million
		Al Awata Housing	Housing	Libya	ODAC Libya		
		Khaleed bin Elwaleed Hotel and Office Complex	Building	Libya	National Investment Comp		
20	PT INTI KARYA PERSADA TEKNIK	Associated Unit of Steam Cracker	Industrial	Malaysia	Petronas	2014-2018	NA
		Collie Urea Project	Industrial	Australia		2005-2006	1 million
21	PT BAKTI TIMOR KARYA	Maritime Bridge Rehabilitation	Bridge	Timor-Leste	Host government		3 million

Note: * BUMN (State owned enterprises)   NA=Not available

Sources: Pusbin Sumber Daya Investasi (Development Center of The Investment Resource, Ministry of Public Work and People Housing) (2014) and other sources

Historically, the overseas market penetration of Indonesian companies was commenced by PT Hutama Karya (PT HK) by completing a 10-kilometer toll road project initiated by the Malaysian government in 1990. Following the achievement, in 1995, PT HK signed a contract for development of a 10 Km flyover in Philippine by introducing a construction technology patent called "Sosrobahu" (a rotated shoulder beam). After ten years since the first expansion, there had been no news about the OCPs undertaking by Indonesian contractors, neither BUMNs nor private firms. This vacuity was gradually covered when several Indonesian contractors were seriously targeted overseas projects in 2002. The expansion has even penetrated the Middle East and North Africa markets. Road, bridge and building projects are types of works dominantly executed by the enterprises (Utama et al., 2014).

Indonesian contractors entered the Middle East market for the first time through a subcontracting project of the local partners in 2006. PT Adhi Karya (PT Adhi) was involved in hotel, apartment and some commercial building projects in Qatar and Oman. At the same time, PT Waskita Karya (PT Waskita) participated in several commercial, educational and religious building projects in the UAE and Saudi Arabia. A year later, Algeria and Libya marked Indonesian contractors' penetration in the North African region. PT Wika was the only one BUMN that achieved success after completing a road infrastructure project in Algeria in 2007. Due to their satisfactory performance on the project, the company was offered to construct two additional bridge projects (PT Wijaya Karya, 2009). Before political instability in Libya, PT Wika had been developing a shopping complex with a contract value of USD 11.6 million, a joint venture with a local investment company. Unfortunately, they had to shut down the project and evacuated the workers for safety issue and security reasons in the beginning of 2011 (PT Wijaya Karya, 2011).

An unpleasant experience was also experienced by PT Adhi in conducting an OCP in 2007. The company suffered a financial loss approximately USD 2 million due to contractual dispute. PT Adhi cooperated with two local enterprises (Harish Chandra India Ltd and ARSS Infrastructure) under a joint venture for railway construction project in India. This is the only one information found in respect of the expansion of Indonesian companies in the South Asia region.

In the region of origin, Timor-Leste market shows large demand on the services of Indonesian firms. Seven BUMNs and several private enterprises have

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established their business in this country. As a new country, Timor-Leste considerably needs massive infrastructures and supporting facilities in transportation, education, health, energy and water supply as well as telecommunication sectors (Government of Timor Leste, 2011). USD 4.7 billion has been allocated for infrastructure projects such as petroleum (29%), electricity and transportation (25% and 19%), whereas rest of the budget will be utilized for other infrastructure in the period of 2011-2017 (Government of Timor Leste, 2013).

The development of Timor Leste offers a greater opportunity for Indonesian companies. Unlike other regions, the penetration into Timor Leste's market is supported by numerous advantages, such as geographical location, familiarity in the context of socio-culture, and good relationship between both Indonesia and Timor Leste government (Badan Pembinaan Konstruksi, 2012). Therefore, Timor Leste is highly recommended market for Indonesian companies in expanding their business abroad (Center of Public Communication, 2012).

Other potential regions where Indonesian contractors may feasibly expand their operation are Middle East and North Africa. Although these regions are far away from the home country and differ in cultural, climatic, and seasonal conditions, the study witnessed that Indonesian contractors enjoyed working there and successfully performed the projects in several countries (Utama et al., 2014). Similarities in religion facilitated the adaptation process for both project staffs and workers who were directly come from the home country. This was one of the essential factors making these regions more feasible. In addition, the government role could not be ignored in introducing and marketing the BUMNs. Good relationship between Indonesian government and all Arabian countries' government is the key point in entering this market (Wibisono, 2008; Siringoringo, 2008). Unfortunately, regime change along with political turmoil in several Arabian countries created an instable and uncertain condition to run the business. However, in some of gulf countries such as Oman, Qatar, Saudi Arabia, United Arab Emirate, and Kuwait, the infrastructure development, such as energy, oil and gas installation, transportation, sport venues and stadiums, religion buildings as well as hotel and commercial complexes are still booming. The Middle East region shared 3.58 percent of the global construction (Oxford Economics, 2012).

As argued by Seymour (1987) and *United Nations Centre on Transnational Corporations* (UNCTC, 1989) as cited from Ofori (2003), the selection of foreign projects location depends on the competitive advantage to which the company can perform. The ability of companies to conduct projects in such regions shows the competitiveness of the companies in the market. In general, Southeast Asia region constitutes the biggest potential market for Indonesian enterprises by considering the advantage factors mentioned above. Therefore, the Indonesian contractors are advocated to pay more attention on this market for their overseas business expansion.

As summarized in Table 4.15, seven BUMN companies have taken a part in overseas operations. Two of them seem to be quite active in pursuing overseas projects, namely PT WIKA and PT WASKITA. Based on the experiences of these contractors, the case and the details related to motivations and entry strategies are discussed as follows.

4.4.2 The State-owned Enterprises Experiences

According to PT WIKA's annual report 2014 (PT Wijaya Karya, 2014), this company was established on 11 March 1960 and it has been listed in Indonesian stock exchange since 2007. PT WIKA formerly was a Dutch company, *Naamloze Vennotschap Technische Handel Maatschappij enBouwbedijf Vis en Co*, which was nationalized by Indonesian government in 1960. The composition of shareholders consists of Indonesian government as a majority shareholder (65.05%), local public (18.13%), foreigner (15.59%) and employees and management (1.23%). Nowadays, PT WIKA is a leading construction company in Indonesia with five business pillars including, industry, infrastructure and building, energy and industrial plant, realty and property and investment. The company is the home of 1,912 employees including staff from its subsidiaries.

Through its vision "To be one of the best integrated EPC (Engineering, Procurement and Construction) and investment company in Southeast Asia", PT WIKA has expanded its business orientation to global market. Although the contribution of overseas projects is relatively small compared to domestic works, about 10% of total revenue, the company has carried out several overseas projects spread over three regions, North Africa, Middle East and South Asia. To strengthen the overseas penetration, PT WIKA has formed an overseas department in structure company's organization.

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Similar to other business entities which are fundamentally motivated to generate maximum profit, PT WIKA considers overseas projects to increase its profitability through enhancing the total of company's revenue. Implicitly, long-term profitability instead of the short-term one is WIKA's strategy when entering Algerian market at the first time. Algerian market was also set for expansion to other North Africa and the Middle East markets. In order to support the company's expansion, based on the annual report 2014, the management has established its representative offices in Algeria, Timor-Leste and Myanmar, while in Malaysia, PT WIKA sets a branch office named Wijaya Karya Persero Sdn Bhd.

In Algeria, according to Mr. Bintang Prabowo (President Director of PT WIKA), through a subsidiary which operates in the business of precast concrete, PT WIKA was firstly appointed as a concrete girder supplier for a Japanese consortium (Kajima, Taisei, Nisimatsu, Hazena and Teken) who developed a 400 Km toll road, East West Motorway. To facilitate this project, the management built a precast concrete fabric and also brought a number of workers and operators from Indonesia. Finally, PT WIKA was selected to handle several work packages as a subcontractor of the consortium. The company was responsible to accomplish a total of 118 work packages encompassing 52 bridges, 10 underpasses and 56 drainages of the toll road. This is the first overseas project carried out by PT WIKA.

Mr. Prabowo opines that PT WIKA has not been able to undertake a large scale overseas project as a main contractor. Although the profit gained from large scale projects are very substantial, the working capital and project risk are also very high. In this projects, the strategy of PT WIKA is to be a subcontractor. He admits that his company has not had enough experiences in overseas markets, therefore, a prudential principle in accepting overseas invitations is needed. Conversely, he was confidence in performing small and medium scale overseas works whose relatively have affordable working capital.

After successfully executing the projects in Algeria, PT WIKA then expanded its market to Uni Arab Emirate and Libya. Mr. Destiawan (Overseas Department Manager of PT WIKA) claims that his company was targeting several overseas projects in different countries in the Middle East such as Saudi Arabia, Kuwait and Qatar. In Qatar, the company targeted the infrastructure projects for Football World Cup 2022, while in Kuwait, the target was bridge projects. Despite the successful,

Indonesian government began to advocate other Indonesian companies to expand market to the Middle East (Mr. Bambang Goeritno, Head of Construction Development Body, Ministry of Public Work). The government argues that the Middle East construction market, particularly Gulf countries could reach about USD 1.68 trillion.

From the project experience in the Middle East, PT WIKA identified that the main factor hampering the company to expand business in the region is language differences. In both Algeria and Libya, official languages are Arabic and French, while English language usage was limited. In addition, political riots in the region have considerably contributed to country instability in many aspects since end of 2010. PT WIKA has suspended a shopping complex project and recalled all staff from Libya in February 2011 because of the riots. In consequence, the encouragement of Indonesian government to enter the Middle East market was not effective.

According to the annual report 2014, strategic overseas expansion is one of the company's missions. "The development of overseas market was conducted in stages, starting with a strategic market that provides competitive advantage compared to other countries". Through this mission, the company tended to pursue OCPs in the countries gaining company's competitive advantages. This implies that the neighboring countries in South East Asia region was focus of the company for overseas expansion. Actually, Timor-Leste becomes a popular market. In this country, PT WIKA involved in infrastructure projects such as roads, bridges and power station. In the replacement of Comoro I Bridge project, PT WIKA set a JVP with a local partner namely Consorcio Nacional Timorense (CNT).

Similar to PT WIKA, PT Waskita Karya (PT WASKITA) was also established through the nationalization of a Dutch corporation, *Volker Annemings Maatschapiij N.V.* on January 1, 1961 and listed in stock market on December 2012. Based on the annual report 2014, the composition of company's ownership was 67.33% (Indonesian government) and public for the rest. Besides construction projects as its core business, the company also penetrated into energy, precast concrete, realty and toll road sectors. At the end of 2014, this company hired a total of 1,125 employees. Referring to table 6.19, PT WASKITA is among BUMN which actively pursues projects in foreign markets. The table records four nations, UAE,

Oman, Saudi Arabia and Timor-Leste which have been successfully entered by the company. Based on the report, one activity in company's marketing strategy is increasing market share in overseas market. In order to reinforce the mission of company for enlarging foreign market, PT WASKITA has established four branches in UAE, Saudi Arabia, Timor-Leste and Malaysia (PT Waskita Karya, 2014).

Fascinatingly, all PT WASKITA projects in Middle East were offered by Binladin group, a contractor company owned by the family of the Kingdom of Saudi Arabia. In those projects, PT WASKITA had been a subcontractor of Binladin group since 2006. Though the company acted as a subcontractor for those projects, according to Mr. M Choliq, President Director of PT WASKITA, conducting overseas projects was the best learning to be a professional contractor, and at the same time, it also positively contributed to company's profit and cash flow. According to Mr. Gunadi Soekardjo, a branch manager of PT WASKITA in Malaysia, it is a common practice that a foreign corporation uses the services a local commercial agent for bidding on government tenders to enter the Middle East market. Many Saudi Arabian government tenders require foreign companies to submit joint bids with local partners.

Timor-Leste market has been the target of PT WASKITA in expanding business abroad. In 2013, the company won approximately USD 67.67 million for upgrading existing airport in Suai, Cova Lima District. This was the first PT WASKITA's project in Timor-Leste after having several experiences in the Middle East. Cited from its website, the project was obtained after they successfully won an open tender. Surprisingly, a private Indonesian company, PT Mitra Setia Jaya declared that the cooperation agreement between the company and PT WASKITA contributed to the fruitfulness of PT WASKITA in winning the project (PT Mitra Jaya Setia, 2013).

The expansion of PT WASKITA into Timor-Leste market was a respond to the host government invitation. According to Mr. Agus Prihatmono, a branch office manager of Waskita in Timor-Leste, the government of Timor-Leste has invited his company to compete in a number of major infrastructure projects. However, the company had to be very selective and careful in selecting the projects. He argued that the company tends to select the projects with a trusted funding guarantee, for

example projects funded by World Bank and Asian Development Bank. In addition, the clarity of contractual related matter was the company's concern as well.

Unlike conducting projects in Middle East countries, the neighboring countries joined in ASEAN and Timor-Leste are much easier for overseas market expansion regarding geographical distance, social cultural similarities, language difference and personal and governmental relationships. Trough the prospect, Indonesian government actively encourage both private and BUMN companies to penetrate these countries, especially Timor-Leste. According to Mr. Goeritno, all beneficial aspects of ASEAN and Timor-Leste market are an advantage for Indonesian firms.

Nevertheless, Mr. Goeritno reminded that, as a new independent nation, Timor-Leste had several drawbacks correlated with project arrangement which could be at risk for companies. The top was the lack of institutional capacity in organizing a project, both in governmental organization and in personnel. In terms of legal aspect, this country had several shortcomings such as sufficient regulations and legal institutions. As supporting pieces of development program, the limitation of transportation and communication infrastructure should also be considered by companies.

After scrutinizing internationalization of two BUMNs and government officer's comments, six generic motivations of overseas expansion were identified in general. Those are one motivation associates with profit, two reasons link to market, one motive relates to resource and two rationales deal with opportunity related motive. In those cases, three models of entry modes adopted by companies to enter the overseas markets were also recognized.

4.5 Discussions

Based on the facts collected above, a further description is needed for in depth discussion. Analysis on each major aspect is elaborated and triangulated with interview of several experienced personnel. Interviews were conducted with four practitioners, one academia and one government officer and it was concentrated on the motivations and entry modes. The practitioners were also the respondents of the questioners who were willing to be interviewed. The interview was carried out in Jakarta as well and it spent time about one to one and half hour for each meeting. Detail of the interviewee's profiles is presented in Table 4.17.

Table 4.17 Profile of the interviewees

Inter-viewee	Field	Position	Years of Experience	Involved in OCP	Country explored
1	Contractor	Director	27 years	3 projects	Saudi Arabia, UAE, Timor-Leste
2	Contractor	Head of Dept.	19 years	2 projects	Timor-Leste
3	Contractor	Head of Division	22 years	3 projects	Algeria, Libya, Timor-Leste
4	Contractor	Marketing Manager	20 years	3 projects	Oman, UAE
5	Academia	Senior Lecturer	25 years	-	
6	Government officer	Head of Division	24 years	-	

4.5.1 Motivations Boosting Overseas Expansion

Objective 1 of this research is to investigate the strategic motivations which encourage Indonesian contractors to expand business operation in overseas markets. The questions pertaining to the objective were defined in part B of the questionnaire. Analysis of the rankings and comparison with previous studies provide some key insights. According to Table 4.4, it is indicated that the prime concerns to export services abroad considered by Indonesian large contractors are to increase profitability, to benefit company's competitive advantage, to avoid saturation in the domestic market, to respond project sponsor invitation and to expand or to enlarge market size. These results implied that a multi-motivation is more reasonable than a merely single motive, as motivating factors to enter foreign markets.

4.5.1.1 To Increase Company's Profitability

Unsurprisingly, most of respondents considered expanding their business to foreign markets for the sake of increasing company's profitability. Traditionally, this motive has encouraged numerous companies not only from developed industries (Abdul-Aziz, 1994; Crosthwaite, 1998) but also from developing economies (Abdul Aziz and Wong, 2010; Maqsoom et al., 2014). This fact slightly contrasts to the case study which the companies did not explain explicitly their main purpose to "to increase company's profit. However, the two contractors viewed that the overseas projects still contributed to company's profit in a small percentage.

Arguably, if the fact is analyzed in depth, the cases indirectly connect to the respondents' opinion which the companies expect to increase their profit in small or high number when expanding to overseas markets. The interviewees also delivered the similar ideas on expansion decision, which is to increase company's profit An interviewee said that any management decision on company's operation was always

directed to increase the profit as a final point. Thus, the firm's motivation for international expansion was also inspired by this reason. This view was supported by another interviewee who stated that overseas projects are interesting due to their higher profit. However, the company should prioritize a long-term profitability rather than a short-term one. Another interviewee alluded to the notion of overseas expansion that the companies pursued OCPs for a conviction that the projects provide a better profit and offer several advantages.

The profit means the dollars obtained at the end of the project completion. It is believed that the profit margin obtained from one project abroad may be double or triple bigger than a similar project in domestic market. An interviewee explained that before accepting a project invitation from international client, Indonesian contractors always calculated the target profit by estimating all risk and uncertainty aspects. They will not consider the projects offering potential profit which is less than three-fold. In other words, Indonesian contractors have not been ready to undertake overseas projects with unpredictable profit.

As quoted from an interviewee having experience in Timo-Leste and Algerian markets, the potential net profit ratio from the governmental projects funded by foreign aids or loans in Timor-Leste was a highly satisfaction. He said that,

"In previous years, we were not interested in expanding our business to this country. The failure in conducting projects in this country was higher than its success. We predicted that we could not get the expected profit due to several reasons, such as the lack of design/plan quality and the incompetence of host personnel in charge the project".

He further said that,

"Our company firstly entered markets in some countries of North Africa as a subcontractor of a Japanese consortium before Arab spring (political event in several Arabian countries in 2011). As a subcontractor, we accepted the agreement and realized that the profit of the project was reasonable. Besides, we were informed that there was another project with a sufficient profitability awarded to us".

Although overseas expansion is not a primary source of a whole company's profit, it is the most influential reason driving the company to enter foreign markets. In terms of the percentage of profit share, the interviewees agreed to state that the range is around 10%.

4.5.1.2 To Benefit Company's Competitive Advantage

The second highest motivation selected by respondents was "to benefit competitive advantage" of the company. This motivation was also found in the case study above in which the overseas expansion was motivated to benefit competitive advantages in specific markets like the South-East Asia region and Timor-Leste. According to Abdul Aziz and Law (2012), there were several competitive advantages that could be explored for supporting company's expansion in the foreign market. For instance, the markets which are geographically close to home country can be tried to gain initial experience. The cultural similarities between home and host countries were another example of the competitive advantage of which could be made use to enter foreign markets (Weltch et al., 2001). These neighboring markets allow Indonesian companies to compete openly with other foreign enterprises as a main contractor compared to other regions such as the Middle East.

The arguments above were agreed by all interviewees that distance and understanding on common culture of the host country were among the consideration pushing Indonesian contractors to explore neighboring countries. As explained by an interviewee below,

"ASEAN and Timor Leste markets were our targets due to geographical aspects. Regionally, Indonesia and ASEAN countries and Timor Leste have similarities in social and cultural aspects. Therefore, it will be easier to enter their markets".

Another interviewee argued that beside geographical distance and socio-culture similarities, Indonesian business entities, such as state-owned Banks operating in neighboring country, may also give benefits to Indonesian contractor operation. He said that,

"Indonesian contractors who are going to undertake a project in neighboring countries will be easier in running their businesses as several Indonesian Banks have been opened to support their business' operation. Another advantage obtained from operation in those countries is that their construction workers do not need to face language barriers.

A government officer opined that there is a great opportunity which should be grabbed by Indonesian contractors to exploit neighboring market such as Timor-Leste. He explained that,

"There is a Memorandum of Understanding between Indonesian and Timor-Leste through related technical departments for infrastructure cooperation. The cooperation covers training programs, sharing information,

governmental officers and experts exchange as well as the contractors'
cooperation. Several Indonesian experts have been involved by the government
of Timor-Leste as consultants of this program".

In response to this motivation, Indonesian contractors have paid attention to its former province where they can maximize the potency of locational advantage. Interestingly, the markets provide two advantages to Indonesian firms, firstly the competitive advantages and secondly the accessibility to enter freely. This strategy was also implemented by Turkish construction firms when considering the Central Asian, the Middle East and North African markets (Diekman and Birgonul, 2005), while Singaporean enterprises have enjoyed Chinese market (Ling et al., 2005).

4.5.1.3 To Avoid Saturation in the Domestic Market

Following "to benefit competitive advantage", the respondents opted "to avoid saturation in domestic market" as one of very important reasons to overseas expansion. It is slightly mystifying why the respondents inclined to this motive as a primary reason of expansion, while there was no a single statement found in case study neither explicitly nor implicitly regarding this reason. According to two experts, the domestic construction industry in the last decade constantly and significantly grows every year. As one of the largest construction market in Asia, domestic market provides a number of strategic infrastructure projects funded by central government, local authorities, other BUMNs or foreign investment. Supported by the stability of economic growth in domestic and regional, the possibility of market saturated in domestic market is relatively small. In consequence, instead of looking for the projects abroad, the local companies put more concentration to compete at home market. In other words, overseas expansion would be considered if the ratio of the demand on projects and the services supply (number of contractors) at home market is imbalance. Pursuing OCPs to deal with the saturated market condition was advised by Pheng and Hongbin (2004) for countries having small markets. Nevertheless, this reason is also found on American and Japanese large contractors which relatively have large construction market (Abdul-Aziz, 1994).

4.5.1.4 To Expand Business and To Capitalize on The Globalization/Regional Free Trade

Despite of the later opinion, the case study clearly shows two arguments of overseas expansion which are "to expand business" and "to capitalize on the globalization/regional free trade". The first mentioned motivation is in parallel with the opinion of respondents who agreed that this was very important motivation, whereas the second one was moderately important reason. Both reasons indirectly have strength of linkage to the strategy of company in observing market in one hand and the potencies of company on the other hand.

According to an interviewee (academia), the overseas market penetration is a strategic way for business expansion by focusing on neighboring markets where the regional free trade agreement has been signed between the governments. While securing domestic market, market expansion in neighboring countries offers various opportunities for company's development. In the course of expansion, the companies benefit the markets enabling them to enter effortlessly, less impeding regulations of host countries. Such market has been available in the ASEAN having a free economic market agreement since 2015. A government officer emphasizes the importance of ASEAN market for Indonesian contractors that the market was worthy of consideration for business expansion. He gave fact that ASEAN construction market provided approximately USD 14,7 billion in the first quarter of 2012 possessed by five countries only (Singapura, Malaysia, Thailand, Philippine and Vietnam), while Timor-Leste budgeted about USD 2.8 billion for construction expenditures 2012-2015.

From the contractor's perspective, an interviewee explained that

"Our company expansion in ASEAN and Timor-Leste markets is aimed at taking opportunities through ASEAN economic community (AEC). In this agreement, the professionals from those countries may practice or carry out business in other ASEAN countries as they operate the business in their home country. This is a chance for our company to enlarge market shares in the region which is familiar with us".

Another interviewee mentioned that,

"If Indonesian contractors do not make use of AEC by venturing the neighboring markets, the companies will detect that the home market is indirectly gettig worse because of foreign companies' penetration. Hence, Indonesian large companies have to think more about this expansion, at least to expand in Southeast Asia region".

4.5.1.5 To Respond Project Sponsor Invitation and To Gain International Experience

Finally, in the light of opportunity related motive, to respond project sponsor's invitation and to gain international experience are the conceivably reasons of the companies' expansion. In the cases above, the invitation of project sponsors could be from the host government like Timor-Leste, main contractors or consortium of the projects, the home government as well as private investors. The forms of invitations were as material and worker supplier, subcontractor and main contractor which were obtained through selected competitive tenders and negotiations. In addition, the contractors affirm that OCPs have given valuable experiences to companies and their personnel. It is clearly found that experiences from OCPs were deliberately important in the initial years of expansion rather than other motivations. OCP's experiences increase companies' confidence to compete against foreign competitors in foreign markets.

4.5.2 Preferred Choice of Entry Mode

4.5.2.1 Mode of Entry Overseas Market

In the Objective 2, this research intends to investigate the entry mode choice preferred by Indonesian contractors. To address this point, ten types of entry modes were provided in the part B of the questionnaire. Analysis of the RII scores as summarized in Table 4.7 shows that the respondents preferred to three types of entry modes including JVP, BO and RO. JVP indicates the importance of cooperation model, hierarchical level at project, contractual type and mobile mode as classified by Chen and Messner (2009). As argued by an academia below:

> *"Indonesian firms' participation in OCPs through JVP will make them easier to compete rather than being a single fighter. Otherwise, a company must be supported by enough resources if adopting the competitive modes like SVP. Before joing JVP, one thing they should have is an experience in collaborating or in owning a network with foreign entities".*

Almost similar to the opinion of academia, a government officer underlined that low competitiveness and less experience in developing network with foreign institutions, even in domestic market, are the major factors hampering the expansion. He highlights, for those who ever interacted with respective foreign companies such as from Japan and Korea, this experience relatively aids them to enter foreign markets and make collaboration with foreign entities. Another interviewee claims

that, his company entered Timor-Leste market via JVP with a local partner. He opined that,

> *"JVP is a simple and flexible way to enter foreign markets, particularly for companies from a country, like Indonesia, whose government policies have a lack support in international competition.*

A practitioner said that,

> *"We enter Libya market through JVP by collaborating with a Libyan company, Solar Sahara Investment, the sharing is 70% WIKA and 30% partner. This is our first project in Libya where the company performes a management service project. Reflecting on political situation in this country, entering foreign market via JVP is safer or less risky than having an investment type or a sole venture".*

Similar to consulting firms from neighboring country, Malaysia, JVP was voted as the most preferred mode to enter foreign markets (Abdul-Aziz and Low, 2012). The Malaysian consultant firms highlighted personal business networks with clients and lead consultant firms to enter overseas markets. The difference is that Malaysian firms entered the host markets dominantly through "piggybacking" on Malaysian clients and consultants. Conversely, Indonesian companies preferred to collaborate with the host companies. JVP with local firms has been witnessed as a strategic step to enter host markets over the years. The multinational companies from developed industries like the US, Germany and Japan have even been adopted this strategy (Chen and Messner, 2011).

Following the JVC as a very effective and the most preferred entry strategy, establishing BO and RO in host country were also viewed as favored strategic plan of Indonesian contractors. According to an interviewee, the main reasons why the Indonesian contractors preferred to BO or RO after JVP are usually encouraged by the attractiveness of the market and the readiness of companies to compete against competitors. It indicates that the contractors have paid more attention and want to concentrate on the markets. These phenomena can be seen clearly in which the number of BOs and ROs belong to Indonesian institutions in Timor-Leste are more than in other countries.

Dissenting opinion was given by another interviewee below:

> *"Choosing BO or RO as an entry strategy may create a management's burden for parent company. In fact, it is not applicable with most of Indonesian contractors which have limited resources. Thus, pursuing one-off projects through JVP or as a nominated subcontractor/supplier is precisely more*

practicable than establishing BO or RO. It is because only strong companies, such as BUMNs and a few of private contractors can afford this mode. The setting of BO or RO in host markets obliges the company to obey the host country's regulations and policies which sometimes diminish their competitiveness".

In contrast to the later opinion, the academia argues that although by establishing BO or RO lessens the flexibility and mobility of company in foreign market penetration, this mode constitutes an optimistic strategy of expansion to well-identified markets. Instead of hunting projects in numerous countries, putting highly concentration on one to two well-known overseas markets is more effective and efficient.

Entering foreign markets through LA is a special case. It is a practical compulsory in the Gulf countries. According to Chen and Messner (2009), the aim of this policy is to enable the government to control the qualification of foreign firms, whereas Schirmer (1996) impugns the effectiveness of this mode in construction industry. An interviewee having experience in Oman and UAE said that:

"We entered Dubai for a construction project through a sponsor (agent). The agent guaranteed and assisted us in preparing everything related to work permits, licenses and taxes. The sponsor fee is based on percentage of the executed works. The existence of a sponsor, on one hand, helps government to control the foreign firms, on the other hand, it convinces the project's owner on the firms' expertise. Without employing a sponsor, we cannot enter this country market.

Given the arguments above, in terms of the characteristic, JVP and BO or RO are types of strategy which are conflicting. As indicated about JVP, BO or RO urges competitive approach instead of cooperative model, hierarchical level at corporate as alternative of project level, investment pattern as replacement for contractual form and permanent model as substitution of mobile model. It can be concluded that the selection of such modes by respondents tends to disobey the characteristic. Perhaps, there are other considerations affecting the choice of mode by respondents which are beyond of this research scope.

4.5.2.2 Transformation of Strategy to Enter Overseas Market

The results of questionnaires on the entry mode were fully confirmed in the case study. As argued by Chan (2008), the application of single entry mode is unpractical. The companies commonly alloy two or three types of entry strategies depending on situation and condition of the host country market environment. In the

Indonesian contractors' cases, five modes (JVP, SVP, LA, BO or RO) were employed at the first time entering the host country. Interestingly, each initial entry was followed by establishing BO or RO if the company wants to develop and maintain business further in the host country markets. This fact indicates that the selection of entry mode is not a rigid decision. The following figures may illustrate the transformation of the entry modes which can be used by Indonesian contractors in the expansions.

Firstly, Figure 4.1 shows that the company entered a market through SVP. The company competes or negotiates a work package belonging to a main contractor or a consortium either as a material/manpower supplier or a subcontractor. Based on the first experience in the market, company then sets a BO or RO if it considers building the business. On behalf of head office, BO or RO researches the market and develops networking for business establishment. After that, the company commonly sets a JVP with the local firms or directly competes as a single entity depending on the targeted project in the host country.
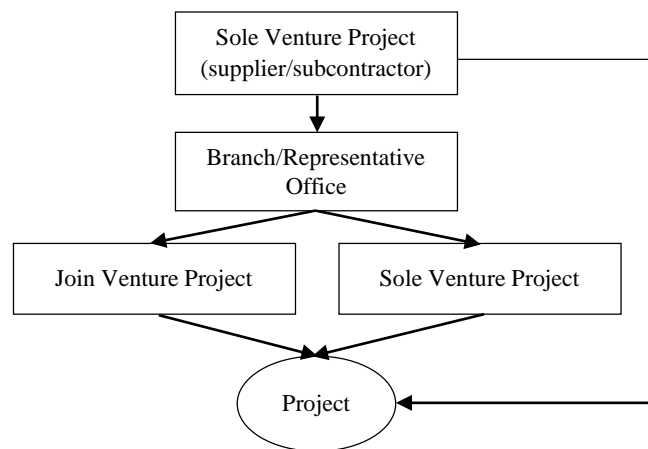
Figure 4.1. First model of entry mode transfer

Secondly, the company directly sets a branch or representative office in a targeted foreign market as presented in Figure 4.2. This approach is usually employed when the company's management has design a strategic expansion planning on a foreign market which is vividly identified. This approach has been adopted by several contractors to enter Timor-Leste. After setting a BO or RO, the company can apply JVP with local enterprises or SVP on a targeted project.
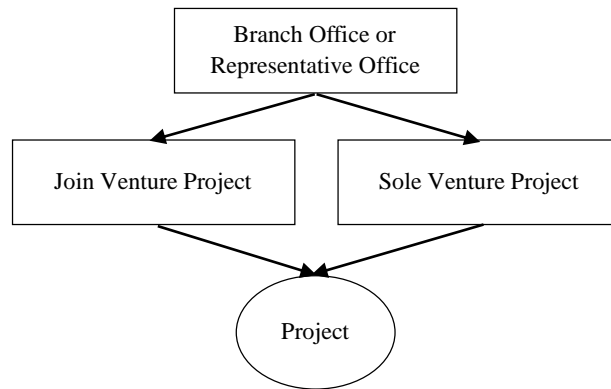
Figure 4.2. Second model of entry mode transfer

Thirdly, the company enters the host market through a JVP, commonly with local firms as described in Figure 4.3. As explained in the case study, a BUMN entered Indian market via JVP with two local firms for a railway project, but then the company exited the country after a contractual dispute with client. Unlike the BUMN case, a private enterprise entered Timor-Leste through JVP with local firm for a power plan and subsequently it established a RO. As representation of the parent office, RO personnel assist the company to build up networking, promote the company and gather the information related to the company's business. Similar to the previous transformation, JVP or SVP can be employed for getting projects directly.
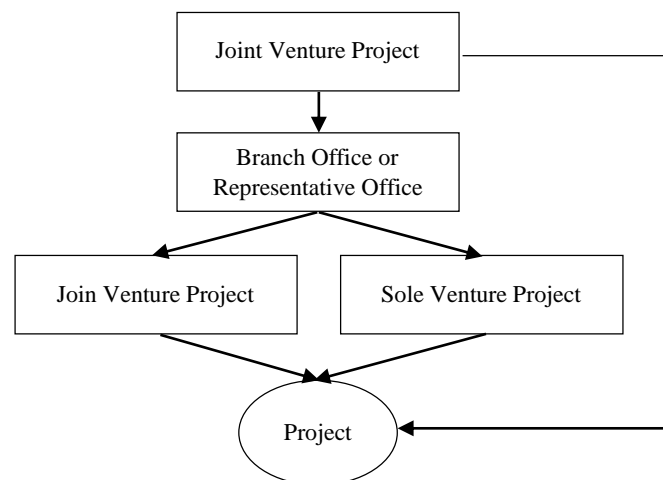
Figure 4.3. Third model of entry mode transfer

Lastly, the company enter a market via a local agent as illustrated in Figure 4.4. A local agent will carry out works related to his duties based on host country regulations such as assisting the contractor to get a recommendation for a project. Referring to the literature, only in the Middle East market such as UAE and Saudi

Arabia where each foreign company intending to participate in the projects must engage a commercial agent service. Despite of the agent, the responsibility to get the projects still belongs to the company. An agent is only a sponsor to enable operation in the host market. So, the project pursuance is obtained from SVP and JVP. After obtaining few experiences in the market, the company then launches BO or RO if it intends to focus on and sustain business in the market.
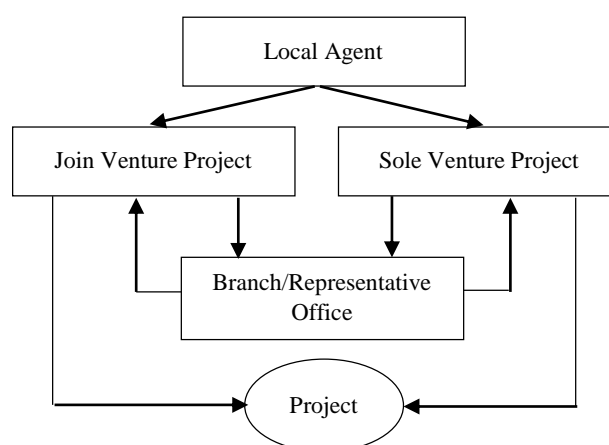
Figure 4.4. Fourth model of entry mode transfer

4.6   Chapter Summary

This chapter has presented the results of data analysis processed with several statistical tools including descriptive statistic, Cronbach Alpha coefficient, Kendall's coefficient of concordance and Spearman rank-order correlation. The relative importance index (RII) has measured the importance of the motivations and preferred entry modes in the view of the Indonesian large contractors. Two cases of the Indonesian enterprises have clarified the expansion in respect to the motivations and the entry strategy.

Results of case study show that the foreign expansion of Indonesian contractors has begun in the 1990s, but it has been seriously performed in the last decade. State owned enterprises (BUMN) still dominate the expansion record while several private firms have started to enter neighboring markets. Regionally, there are three markets which have been penetrated by Indonesian contractors: Southeast Asia, Middle East and North Africa. Amongst the markets, Timor Leste has been viewed as the most potential target to be explored intensively.

The chapter has successfully investigated the motivations and the preferred choice of entry modes supporting the expansion. The results of questionnaire survey triangulated with the case study and interview findings conclude that the major motivations encouraging the contractors to pursue OCPs are (1) to increase profitability, (2) to benefit company's competitive advantage, (3) to avoid saturation in the domestic market, (4) to respond project sponsor invitation, and (5) to expand/enlarge market size. Regarding the strategy to enter the overseas marketplaces, it can be concluded that the types of mode namely (1) joint venture project (JVC), (2) branch office (BO), (3) representative office (RO), (4) sole venture project (SVP), and (4) local agent (LA) were adopted, but the first-three modes were preferable to Indonesian enterprises.

Chapter 5

ADAPTIVE NEURO-FUZZY BASED DECISION SUPPORT SYSTEM FOR OVERSEAS CONSTRUCTION PROJECTS

5.1   Introduction

The main aim of Chapter 5 is to reveal the development process of Adaptive Neuro Fuzzy Inference System (ANFIS) based decision support system for OCPs. As illustrated in Figure 2.2, the process begins from determination of the international factors in OCPs. This chapter initially described the result of Delphi study as a instrument to assign the international factors involved in OCP evaluation, followed by the explanation of OCP assessment and provision of case database. The development procedure of ANFIS is then explained starting from the introduction of ANFIS tool box in Matlab software. Preparation of data set as input-output data of ANFIS model is described followed by the process of setting the initial FIS structure. Training the data with different parameter setting is elucidated in the next section. Afterward, model validation and generalization were presented. At the end of this chapter, cross validation technique by comparing the performance of ANFIS model with General Feedforward Neural Network (GFNN) is presented.

5.2   Determination of International Factors in OCPs

As indicated in section 2.4.5, a Delphi survey was adopted as the instrument of data acquisition related to determination of international factors (Objective 3) which are used as variables in further evaluation on OCP cases. One of the critical points in conducting Delphi study was the arranging of experts' panel. It was a challenging work to find an appropriate panelist in the industry where information to support the study was scanty. From invitation letters sent to companies which are identified having overseas experience summarized in Table 4.15, only three responses were received. Fortunately, four experienced interviewees enthusiastically accepted the invitation of Delphi panelists.

The sizable of panelist number in previous studies were varying. However, an acceptable sufficient number of panelists should be fulfilled (Hsu and Sandford,

2007). As explained in Ameyaw (2014), in construction-related Delphi research, researchers advised a minimum sufficient number of panelists. For instance, eight experts are proposed by Hallowell and Gambatese (2010), while 10 to 15 panelists are encouraged by Adler and Ziglio (1996) as reproduced in Rajendran and Gambatese (2009).

Having the indication of sufficient number of Delphi panelist, seven experts did not meet the minimum limit. Hence, to find other potential Delphi experts, a semi-snowballing technique was undertaken by means of requesting recommendation from the existing experts. A similar approach to identify potential panelists was carried out in research conducted by Moglia et al. (2009) and Ameyaw (2014). As a result, eleven experts agreed to participate in Delphi study as recorded in Table 5.1.

Table 5.1 Profile of experts in Delphi survey

Expert panelist	Position	Industrial experience	Involved in OCP (project/s)	Country explored
1	Director	27 years	3	Timor-Leste
2	Head of department	19 years	2	Timor-Leste
3	Head of division	22 years	3	Oman, Qatar
4	Head of department	20 years	2	Algeria, Malaysia
5	Project manager	18 years	2	Saudi A., Timor-Leste
6	Head of division	20 years	2	Timor-Leste
7	Director	21 years	2	Timor-Leste, Brunei Darussalam
8	Head of overseas branch	25 years	3	Saudi A, Uni Arab Emirate
9	Project manager	18 years	1	Timor-Leste
10	Director	24 years	2	Papua New Guinea, Timor-Leste
11	Head of overseas division	22 years	3	Libya, Malaysia, Timor-Leste

From 11 panelists, three participants held the top level in their respective companies with industrial experience of more than 20 years. The rest of them were Heads of Department (two respondents), Heads of Division (three respondents), Head of Overseas Branch (one respondent) and two Project Managers. In general, all the experts were senior level personnel having maturely industrial experience. Although their experiences in OCPs were relatively few, their position and industrial experience may guarantee the reliability of the feedbacks. Therefore, the 11 panelists involved in the Delphi survey had represented the merging of judgments.

Learning from the experience when conducting questionnaire survey on the Indonesian large contractors, surveys through self-administered and personal interviews were adopted. Face to face interview allows researcher to identify and

clarify unclear items to the panelists (Cooper and Schindler, 2006), although a pilot study was commenced after developing the Delphi questionnaire.

As stated earlier, the use of Delphi method is directed to determine the international factors in OCP decision making, while there were no supporting references which specifically explore the international factors in the view of Indonesian contractors. Therefore, the responses on the questionnaire were merely extracted from the professional and experiential knowledge of the individual panelists.

In analysis of data obtained from the first and the second-round survey, the internal consistency of dataset was assessed. The overall alpha value of the importance of international factors and their frequency level of risk occurrence are 0.772 and 0.735 respectively. These scores are greater than approximately 0.70, showing a good internal consistency and reliability with the data obtained from the Delphi survey and thus the adopted seven-point Likert scale is reliable.

One benefit of the Delphi method is that it can rectify the panelist's opinions to reach a group consensus and reduce the bias at the same time given the unspecified nature of the process (Chan et al., 2001). Kendall's W was used to assess the degree of consensus obtained in each round. The Kendall's W scores for the importance of international factors showed 0.481 and 0.571 for first and second survey respectively. The consensus among experts on the frequency level of risk occurrence was 0.751 and 0.873 in two round surveys. The results indicate that this survey was optimum in two rounds, while the *W* scores were relatively high, meaning that the agreement among the experts was robust. The results of the survey are shown in Table 5.2 and Table 5.3.

Table 5.2. The importance of the international factors

International factors	1st round		2nd round		SD	SE
	Mean	Rank	Mean	Rank		
Political stability and sensitiveness	6.73	1	6.82	1	.405	.122
Legal environment	4.73	20	4.82	20	.603	.182
Economic health and stability	5.64	7	5.73	7	.786	.237
Cultural, custom and language differences	4.64	21	4.64	21	.505	.152
Easiness and attitude toward foreign business	4.00	31	4.18	30	.751	.226
Climate, weather, and other natural condition	4.82	17	4.91	18	.831	.251
Availability of basic infrastructure	4.91	15	5.00	15	.775	.234
Availability of local resources	4.27	25	4.36	25	.505	.152
Importance of market	4.36	23	4.45	23	.820	.247
Hostilities with neighboring country or region	4.36	24	4.45	24	.820	.247

	1st round Mean	1st round Rank	2nd round Mean	2nd round Rank	SD	SE
Cost of conducting business	5.00	13	5.09	13	.831	.251
Client's reputation	6.36	2	6.36	2	.505	.152
Type of client	5.82	4	6.00	4	.775	.234
The existence of strict quality requirements	4.18	27	4.27	27	.786	.237
Project location or distance from home country	4.82	18	5.00	16	.894	.270
Project desirability to the host country	4.18	28	4.27	28	.467	.141
Project scale/size	6.18	3	6.27	3	.786	.237
Complexity of project	5.45	8	5.45	9	.522	.157
Type of project	5.73	6	5.82	6	.405	.122
Types of contract	5.18	12	5.36	11	1.120	.338
Quality and clarity of contract condition	5.82	5	5.91	5	.701	.211
Contractual duration	5.36	10	5.45	10	.522	.157
Level of competition	4.45	22	4.55	22	.522	.157
Adverse site conditions	4.27	26	4.36	26	.674	.203
Strict safety requirements	4.18	29	4.27	29	.647	.195
Strict environmental regulations	4.09	30	4.09	31	.539	.163
Relationship to stakeholders in host country	4.82	19	4.91	19	.701	.211
Current workload and needs for work	4.91	16	5.00	17	.632	.191
Company's track record/experience	5.27	11	5.27	12	.467	.141
Familiarity with host country	5.00	14	5.09	14	.701	.211
Financial capability and support	5.45	9	5.55	8	.522	.157
Cronbach's alpha			.772			
Kendall's coefficient of concordance (*W*)	.481		.571			
Sig.	.000		.000			

Table 5.3. The frequency level of risk occurrence related to the international factors

International factors	1st round Mean	1st round Rank	2nd round Mean	2nd round Rank	SD	SE
Political stability and sensitiveness	3.64	17	3.73	17	.647	.195
Legal environment	3.36	21	3.45	21	.820	.247
Economic health and stability	4.82	8	4.91	8	.701	.211
Cultural, custom and language differences	3.82	14	3.91	14	.831	.251
Easiness and attitude toward foreign business	3.91	12	4.09	12	.701	.211
Climate, weather, and other natural condition	3.18	23	3.18	23	.603	.182
Availability of basic infrastructure	2.82	24	3.00	24	.632	.191
Availability of local resources	3.91	13	4.09	13	.539	.163
Importance of market	3.64	16	3.82	16	.874	.263
Hostilities with neighboring country or region	2.00	31	2.18	31	.603	.182
Cost of conducting business	3.18	22	3.36	22	.924	.279
Client's reputation	3.82	15	3.91	15	.539	.163
Type of client	3.64	18	3.64	18	.505	.152
The existence of strict quality requirements	3.36	19	3.64	19	.505	.152
Project location or distance from home country	4.27	9	4.64	9	.505	.152
Project desirability to the host country	2.09	28	2.27	28	.905	.273
Project scale/size	5.91	4	5.91	4	.539	.163
Complexity of project	6.09	2	6.27	2	.647	.195

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Type of project	5.09	7	5.27	7	.647	.195
Types of contract	5.91	3	6.09	3	.701	.211
Quality and clarity of contract condition	6.73	1	6.73	1	.467	.141
Contractual duration	5.36	6	5.55	6	.820	.247
Level of competition	4.09	10	4.36	10	.505	.152
Adverse site conditions	4.09	11	4.36	11	.505	.152
Strict safety requirements	2.27	29	2.27	29	.467	.141
Strict environmental regulations	2.36	27	2.36	27	.505	.152
Relationship to stakeholders in host country	2.64	25	2.73	25	.467	.141
Current workload and needs for work	2.64	26	2.73	26	.467	.141
Company's track record/experience	2.09	30	2.27	30	.467	.141
Familiarity with host country	3.45	20	3.55	20	.934	.282
Financial capability and support	5.82	5	5.91	5	.701	.211
Cronbach's alpha			.735			
Kendall's coefficient of concordance (*W*)	.751		.873			
Sig.	.000		.000			

In more detail, both Table 5.2 and Table 5.3 show that though a factor is a very important aspect in evaluating OCPs, it does not parallel with its frequency level of risk occurrence. For instance, the factor of "political stability and sensitiveness" places in the top ranking of the important factor, whereas it is in rank 17 based on the frequency level of risk occurrence. In contrast, the important rank of the factor of adverse site condition placed in rank 26, while its frequency level of risk occurrence in rank 11. Given the both samples, it is necessary to determine the significant factors influencing the decision makers in evaluating an OCP.

Determination of the most significant international factors considered in making decision on OCPs is the third objective of this research. This objective was defined for the sake of the development of a decision model. Referring to the analysis of Delphi survey, the expert panelist has agreed on the important rate of the international factors and the frequency level of risk occurrence related to the factors. Both the important rate and the frequency level of risk occurrence have different functions for project evaluation. While, the important rate shows the international factors that should be taken into consideration in assessment of OCPs, the frequency level of risk occurrence related to the factors presents the probability that the risks allied to the factors affect the OCP. To combine the two scores, the significant index was calculated using the Equation (2.5).

Table 5.4 presents the significant index ranged from 3.05 for "project desirability to the host country" to 6.29 for "quality and clarity of contract condition". Of 31 international factors, two factors had indexes larger than 6.00, seven factors in the range of 5.00 and 6.00, while there were 12 factors ranged from 4.00 to 5.00. In total, there were 21 factors having indexes for more than 4.00 as indicated by the dash-line. These factors were determined as the most significant aspects which were used further for evaluation of OCPs. These factors are subsequently called as attributes in the model development process.

Table 5.4. Ranking of the significance of the international factors

Rank	International factors	SI	The importance of the international factors		The probability of risk occurrence related to the factors	
			Mean	Rank	Mean	Rank
1	Quality and clarity of contract condition	6.29	5.91	5	6.73	1
2	Project scale/size	6.08	6.27	3	5.91	4
3	Complexity of project	5.84	5.45	8	6.27	2
4	Financial capability and support	5.71	5.55	7	5.91	5
5	Types of contract	5.68	5.36	10	6.09	3
6	Type of project	5.53	5.82	6	5.27	7
7	Contractual duration	5.48	5.45	9	5.55	6
8	Client's reputation	5.04	6.55	2	3.91	15
9	Political stability and sensitiveness	5.02	6.82	1	3.73	17
10	Economic health and stability	4.84	5.00	15	4.64	9
11	Project location or distance from home country	4.79	6.00	4	3.64	18
12	Type of client	4.66	4.55	21	4.36	10
13	Level of competition	4.44	4.00	31	4.91	8
14	Adverse site conditions	4.34	4.36	25	4.36	11
15	Cultural, custom and language differences	4.22	4.64	20	3.91	14
16	Availability of local resources	4.20	4.36	24	4.09	13
17	Familiarity with host country	4.19	5.09	13	3.55	20
18	Easiness and attitude toward foreign business	4.12	4.18	29	4.09	12
19	Cost of conducting business	4.08	4.45	22	3.82	16
20	Importance of market	4.08	5.09	12	3.36	22
21	Legal environment	4.03	4.82	19	3.45	21
22	Climate, weather and other natural condition	3.91	4.91	17	3.18	23
23	The existence of strict quality requirements	3.91	4.27	26	3.64	19
24	Availability of basic infrastructure	3.84	5	14	3.00	24
25	Current workload and needs for work	3.68	5	16	2.73	26
26	Relationship to stakeholders in host country	3.64	4.91	18	2.73	25
27	Company's track record/experience	3.44	5.27	11	2.27	30
28	Strict safety requirements	3.10	4.27	28	2.27	29
29	Strict environmental regulations	3.09	4.09	30	2.36	27

| 30 | Hostilities with neighboring country or region | 3.07 | 4.45 | 23 | 2.18 | 31 |
| 31 | Project desirability to the host country | 3.05 | 4.27 | 27 | 2.27 | 28 |

After observing those 21 attributes, they were then classified into five relevant groups. The classification of the attributes aims to simplify and accommodate the evaluation process. As indicated in section 3.6, different studies use different categorization of the international factors. Borrowing the idea of those studies, the attributes were classified into five categories namely, project (X1), contract (X2), client (X3), host country (X4) and business (X5) as summarized in Table 5.5. Project has six attributes as the largest category, whereas the smallest factor (client) contains two attributes.

Table 5.5. Categorization of the international factors

Code	Factor	Attribute
X_1	Project	
$X_{1.1}$		Project scale/size
$X_{1.2}$		Complexity of project
$X_{1.3}$		Type of project
$X_{1.4}$		Level of competition
$X_{1.5}$		Project location or distance from home country
$X_{1.6}$		Adverse site condition
X_2	Contract	
$X_{2.1}$		Types of contract
$X_{2.2}$		Quality and clarity of contract condition
$X_{2.3}$		Contractual duration
X_3	Client	
$X_{3.1}$		Type of client
$X_{3.2}$		Client's reputation
X_4	Host country	
$X_{4.1}$		Political stability and sensitiveness
$X_{4.2}$		Legal environment
$X_{4.3}$		Economic health and stability
$X_{4.4}$		Cultural, custom and language differences
$X_{4.5}$		Easiness and attitude toward foreign business
X_5	Business	
$X_{5.1}$		Availability of local resources
$X_{5.2}$		Cost of conducting business
$X_{5.3}$		Importance of market
$X_{5.4}$		Familiarity with host country
$X_{5.5}$		Financial capability and support

5.3   OCP Evaluation Form and Case Database

After determining the factors and attributes for evaluation of OCPs, a database containing historical data of previous OCPs should be prepared. An evaluation form was designed to record the characteristic of completed OCPs (see Appendix D1/D2). Initially, the form contained only the input-out variables by expecting that the data would be available. Prior to the evaluation, the form was discussed with three experts, two from industry (interviewee 1 and 3) and one from university (interviewee 5) to seek suggestions regarding clarity and conformity of parameters.

One important suggestion arose when the experts argued that the information of several attributes, such as level of competition and adverse site condition, tend to be unavailable or unknown, even though a market research was carried out. This unavailable information can be found in a country with lacking governmental organization system and just freed from political conflict (interviewee 1 and 3). To counter the unknown information, a scale "unidentified" was given for criteria, such as level of competition and adverse site condition.

Furthermore, two advices were given concerning the difficulty in obtaining the data due to the project cost and the expecting of project type in the future (interviewee 5). First, the expert convinced that most of contractors are reluctant to inform the exact figure of their project value, while classifying the cost in several intervals could be misleading. To substitute this figure, "small-medium-large-mega" parameter was used. This change of scale will not influence the judgement and the final assesment of the decision makers, as reflected in the new scale of the project size information.

Second, the experts' comment on the list of project types that is frequently undertaken by Indonesian contractors. For instance, the projects such as buildings, roads, and bridges, are types of common overseas project performed by Indonesian firms. Other several types of project should be considered in the evaluation form. As the effect, this addition enhances the number of parameters which should be simplified, otherwise it makes some difficulties in tuning ANFIS algorithms. An appropriate parameter was chosen to serve this problem so that they can accommodate the mentioned shortcoming and provide a measured scale at the same

time. Table 5.6 shows the final attributes along with their parameters used in the OCPs evaluation form.

Table 5.6 Types of input-output variables and parameters

Code	Attributes and Factors	Type of scale	Parameter
$X_{1.1}$	Project scale/size	Ordinal	Small – Medium – Large – Mega
$X_{1.2}$	Complexity of project	Ordinal	Low – Medium – High
$X_{1.3}$	Type of project	Ordinal	Never done before – Have few experiences – Have many experiences
$X_{1.4}$	Level of competition	Ordinal	Low – Medium – High – UI
$X_{1.5}$	Project location or distance from home country	Ordinal	Near – Medium – Far
$X_{1.6}$	Adverse site condition	Ordinal	Low – Medium – High – UI
	Project score (X_1)	Numeric	(lowest 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 highest)
$X_{2.1}$	Types of contract	Categorical	Local standard – Combination – International standard – UI
$X_{2.2}$	Quality and clarity of contract	Ordinal	Low – Medium – High – UI
$X_{2.3}$	Contractual duration	Ordinal	Short – Medium – Long – UI
	Contract score (X_2)	Numeric	(lowest 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 highest)
$X_{3.1}$	Type of client	Categorical	Host government – Host private – Home private – Home government
$X_{3.2}$	Client's reputation	Ordinal	Poor – Medium – Good – Excellence – UI
	Client score (X_3)	Numeric	(lowest 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 highest)
$X_{4.1}$	Political stability and sensitiveness	Ordinal	Poor – Medium – Good – Excellence – UI
$X_{4.2}$	Legal environment	Ordinal	Poor – Medium – Good – Excellence – UI
$X_{4.3}$	Economic health and stability	Ordinal	Poor – Medium – Good – Excellence – UI
$X_{4.4}$	Cultural, custom and language differences	Ordinal	Low – Medium – High
$X_{4.5}$	Easiness and attitude toward foreign business	Ordinal	Poor – Medium – Good – Excellence – UI
	Host country score (X_4)	Numeric	(lowest 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 highest)
$X_{5.1}$	Availability of local resources	Ordinal	Poor – Medium – Good – Excellence – UI
$X_{5.2}$	Cost of conducting business	Ordinal	Low – Medium – High – Very High – UI
$X_{5.3}$	Importance of market	Ordinal	Low – Medium – High
$X_{5.4}$	Familiarity with host country	Ordinal	Low – Medium – High
$X_{5.5}$	Financial capability and support	Ordinal	Poor – Medium – Good – Excellence
	Business score (X_5)	Numeric	(lowest 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 highest)
	Decision (Y)	Categorical	Go – Not Go

Note: UI = Unidentified

The number of the input are 21 attributes which are divided into five factors (X_1, X_2, X_3, X_4 and X_5). Each attribute is given a unique parameter in the type of ordinal and categorical scale. Moreover, all of the parameters should be highlighted in accordance with the condition of each project. Based on the highlighted parameters, the scores of each factor are determined by the experts. The scores range from 1 being the lowest to 9 being the highest. On the output criteria (Y), the parameter consists of two options, GO and NOT GO which indicate the final decision on the OCP being evaluated.

The data of OCPs were collected by asking experienced personnel (four interviewees). They were asked to describe the past OCPs based on their experience by highlighting the parameter of the 21 attributes and then marking the score of the factors. The highlighted attributes are according to the expert's remembrance of his involvement in a OCP. For instance, an expert highlights on the attribute of project related factor as follows: project size [mega]; complexity of project [high]; type of project [have many experiences]; level of competition [high]; project location [far]; and adverse site condition [high]. The expert then asked to mark a score of project related factor, ranging from 1 to 9 which may typify the OCP environment of the factor. If the expert relatively marks a lower score, it indicates that the highlighted parameters relatively reflect an unideal condition of the project related factor.

After assessing the five factors, lastly, the experts made a judgement based on the information given in the form. Since the real data based on experts' experience, the decision should be "Go". Though all projects were carried out, the experts were invoked to reassess and to judge whether the projects are potentially feasible to be grabbed or not.

Unfortunately, only nine projects were successfully collected through this effort. Regardless of insufficient number of data, the researcher faced a lack of access in collecting the data. This is because there were no data compiled neither by governmental agencies nor professional associations. Furthermore, there was no record available stating the figure of OCPs undertaken by Indonesian firms. Besides, most of the real data contained preferred scenarios to present an ideal environment in making decision, whereas other possible scenarios never occured. Thus, these problems gave a robust reason to generate and to use simulation cases as a dataset.

To anticipate small number of the data, a set of simulation cases artificializing the real cases was generated. This approach was adopted in several knowledge domains adopting neuro-fuzzy as mentioned in section 2.6.2. Such data is also known as synthetic data, defined as "data that is generated by simulated users in a simulated system, performing simulated actions", (Lundin et al., 2002, p. 268). Lundin et al. add that it includes simulated actions performed by human on a system. They explain simulated actions as the people (or a program) performing actions in pursuance of a specification created by the experimenter. Several benefits of using simulated dataset were pointed out by Lopez-Rojas and Axelsson (2012) as follows:

1. A freedom to select attributes contributing to the complexity of the structure of data,

2. Simplifying the preparation of data and extraction from the real sources,

3. Possibility of tuning different scenarios tailored to meet various conditions which are not available in real data sets,

4. Possibility of setting the quantity of data for different trial setup,

5. Availability of dataset representing realistic scenarios, and

6. Providing data set for reproducing experiment by other researchers.

Based on the benefits above, a set of simulation case scenarios was provided. The initial form provided to collect OCPs data was then added with objectives of research, instructions, assumptions and explanations of each attribute and parameters. These additional features are crucial as the cases are supplied by investigator, and other experts (out of the five interviewees) were involved to help evaluation of the cases. These assumptions and information are needed to avoid ambiguities and to simplify the decision-making process. They describe a start-point or a benchmark of the procedure. The assumptions and information were described in Appendix D1/D2.

In preparing the simulation data, Lopez-Rojas and Axelsson (2012) alert about congruity and biased information. Congruity is the data which is neither representative nor realistic, while biased information is caused by human judgement or opinion. Another importance challenge is to make the model to be more realistic. To minimize the shortages and responses to the challenge, and to judge the output of a case, the experts were requested to examine whether the given parameters are

reasonable. In addition, the case scenarios were set based on reports or press releases in previous OCPs published in companies' website, magazines and newspapers.

Thoroughly, it should be noted that the aim of simulation cases is not merely to generate dataset in the view of real world. Otherwise, it supplies an alternative scenario to enrich the environment of dataset, so the experts can make decision in various circumstances. The expert's judgements on each case play a vital role in determining the decision model.

To create a simulation case, similar procedure explained in obtaining the nine real data above was repeated. The parameter of each attribute which was randomly highlighted by the investigator sets it apart from the collected real data. The highlighting of parameters has taken the reasonableness and the reality of cases into consideration. The experts were also asked to view the case before evaluations. A hundred and fifty different OCP cases were generated and distributed to fifteen experts, including eleven Delphi panelists. Each expert was responsible to evaluate 10 case scenarios. Of 150 cases sent to the experts, 110 cases were sent back by 11 experts. Other four experts failed to complete evaluation with unrevealed personal reasons. Thus, there were a total of 110 cases used further in this research.

5.4 ANFIS Based Model

In this section, ANFIS based model for Go/Not Go decision is designed. A performed massive mathematical calculation for generating model was instrumented by Matlab software from Mathwork Inc.

5.4.1 ANFIS Tool Box

As described above, 110 simulation cases examined by 11 experts were exerted in this research. This case database was then processed by using Adaptive Neuro-Fuzzy Inference System (ANFIS), one of the combination Artificial Neural Network (ANN) and Fuzzy Logic algorithms. MATLAB software has utilized to help analysis and develop the ANFIS based go/no go decision model. A massive numerical calculation is the main challenge of fuzzy and neural network algorithm. Thus, the use of a computer program is necessary. Figure 5.1 illustrates the procedure of using ANFIS toolbox in MATLAB software.
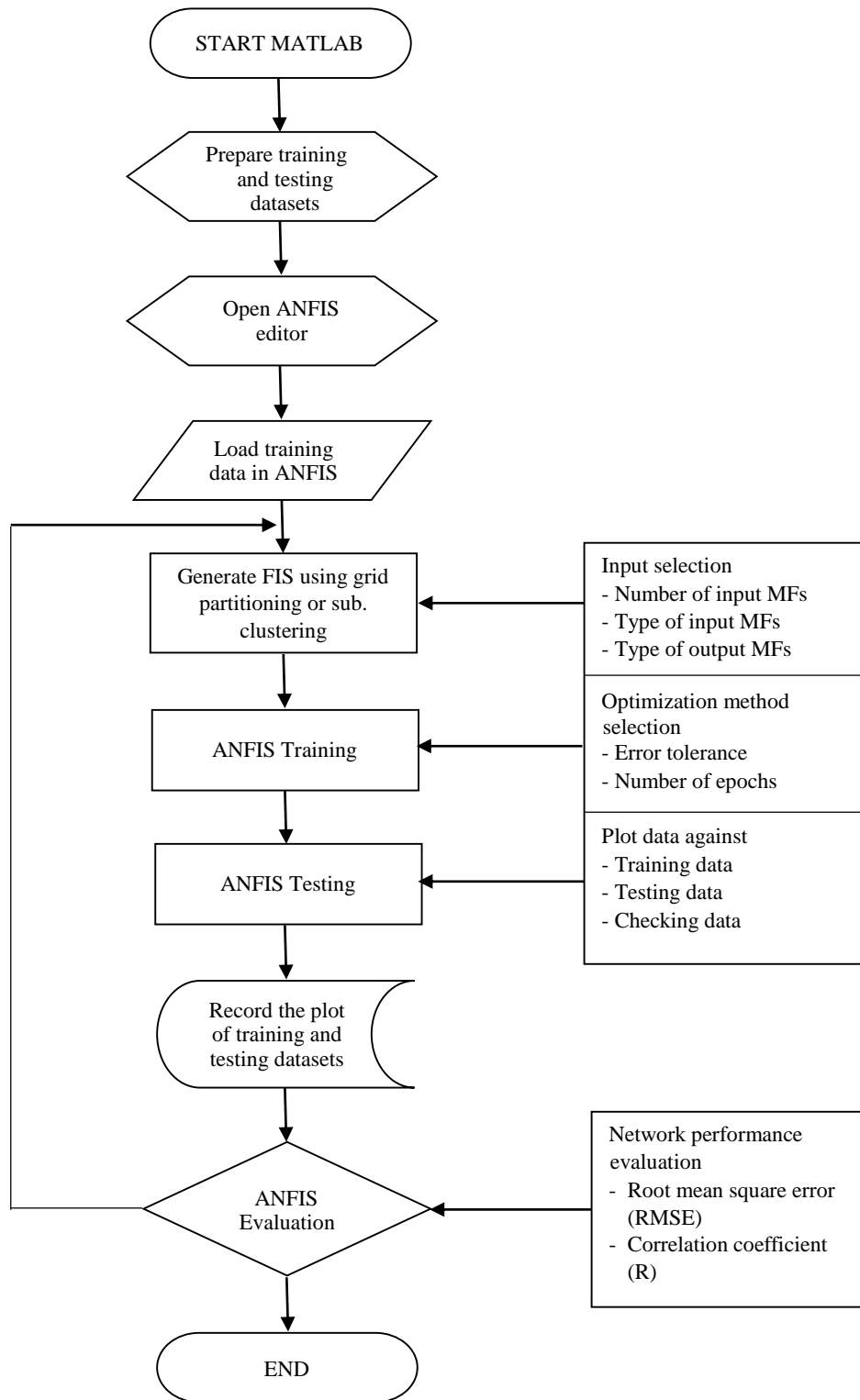
Figure 5.1. Flowchart of ANFIS application (Adapted from Bhutto et al., 2015)

5.4.2 Preparation of Data Set

ANFIS system needs a set of pair input-output data. To prepare this data, the evaluation results of 110 cases of OCPs were tabulated in a table, presenting five

input criteria (project, contract, owner, host country and business) and one output (Go/No Go). The grades given by the experts were then normalized using equation 5.1

$$x' = \frac{x - min}{max - min}$$

(5.1)

where x' is normalized score, x is initial score, *min* and *max* are the smallest and the largest score. This equation casts the initial scores in one unified range [0 to 1]. The different range between input value and output value needs the data to be normalized. According to Khalil and Muhammad-Ali (2013), there are two reasons why the data normalized. First, it abolishes the influence of one factor toward another one, and second, it converges weight faster than converaging with un-normalized data.

On the output side, the categorical scales on decision (Y) should be transformed into crisp number in which the program can recognize the input attribute. Linguistic variables of output were coded in a binary digit representing 1 for Go and 0 for Not Go. However, Lam et al. (2001) advice that the use of 1 and 0 approach in imitative based learning algorithms results in very slow learning speed. They suggest assigning 0.95 and 0.05 instead of 1 and 0 to avoid expected slow convergence. Table 5.7 presents the initial and normalized data set.

Table 5.7. Data set for training, testing and checking

No	Initial Data						Normalized Data					
	X1	X2	X3	X4	X5	Y	X1	X2	X3	X4	X5	Y
1	8	9	3	9	5	0	0.875	1.000	0.250	1.000	0.500	0.05
2	9	8	5	5	5	1	1.000	0.875	0.500	0.500	0.500	0.95
3	3	3	2	9	2	0	0.250	0.250	0.125	1.000	0.125	0.05
4	5	3	9	4	2	0	0.500	0.250	1.000	0.375	0.125	0.05
5	8	3	6	8	4	0	0.875	0.250	0.625	0.875	0.375	0.05
6	5	6	4	9	1	1	0.500	0.625	0.375	1.000	0.000	0.95
7	3	7	9	5	8	0	0.250	0.750	1.000	0.500	0.875	0.05
8	3	1	3	7	3	0	0.250	0.000	0.250	0.750	0.250	0.05
9	9	4	2	8	4	0	1.000	0.375	0.125	0.875	0.375	0.05
10	4	4	3	3	6	0	0.375	0.375	0.250	0.250	0.625	0.05
11	7	1	3	5	9	0	0.750	0.000	0.250	0.500	1.000	0.05
12	2	3	8	6	4	0	0.125	0.250	0.875	0.625	0.375	0.05
13	9	2	8	7	6	0	1.000	0.125	0.875	0.750	0.625	0.05
14	9	2	8	4	2	0	1.000	0.125	0.875	0.375	0.125	0.05
15	2	8	9	8	9	0	0.125	0.875	1.000	0.875	1.000	0.05
16	8	9	7	1	2	0	0.875	1.000	0.750	0.000	0.125	0.05
17	5	1	9	1	8	0	0.500	0.000	1.000	0.000	0.875	0.05
18	8	8	9	3	2	1	0.875	0.875	1.000	0.250	0.125	0.95
19	5	7	5	4	4	1	0.500	0.750	0.500	0.375	0.375	0.95

20	4	3	2	9	7	0	0.375	0.250	0.125	1.000	0.750	0.05
21	4	3	8	2	6	0	0.375	0.250	0.875	0.125	0.625	0.05
22	3	2	1	2	5	0	0.250	0.125	0.000	0.125	0.500	0.05
23	2	8	9	8	6	0	0.125	0.875	1.000	0.875	0.625	0.05
24	8	2	2	6	6	0	0.875	0.125	0.125	0.625	0.625	0.05
25	6	3	8	4	2	0	0.625	0.250	0.875	0.375	0.125	0.05
26	5	9	5	4	8	1	0.500	1.000	0.500	0.375	0.875	0.95
27	2	7	8	9	5	0	0.125	0.750	0.875	1.000	0.500	0.05
28	2	9	4	6	4	0	0.125	1.000	0.375	0.625	0.375	0.05
29	2	1	1	5	4	0	0.125	0.000	0.000	0.500	0.375	0.05
30	9	3	9	9	7	0	1.000	0.250	1.000	1.000	0.750	0.05
31	9	3	9	2	7	0	1.000	0.250	1.000	0.125	0.750	0.05
32	4	7	3	4	4	0	0.375	0.750	0.250	0.375	0.375	0.05
33	9	9	2	3	9	0	1.000	1.000	0.125	0.250	1.000	0.05
34	4	6	5	9	5	1	0.375	0.625	0.500	1.000	0.500	0.95
35	9	7	4	2	4	0	1.000	0.750	0.375	0.125	0.375	0.05
36	6	1	4	4	1	0	0.625	0.000	0.375	0.375	0.000	0.05
37	9	3	3	8	4	0	1.000	0.250	0.250	0.875	0.375	0.05
38	2	2	5	4	5	0	0.125	0.125	0.500	0.375	0.500	0.05
39	6	3	1	8	2	0	0.625	0.250	0.000	0.875	0.125	0.05
40	6	9	8	3	6	1	0.625	1.000	0.875	0.250	0.625	0.95
41	5	9	8	2	9	0	0.500	1.000	0.875	0.125	1.000	0.05
42	5	7	3	8	3	0	0.500	0.750	0.250	0.875	0.250	0.05
43	3	8	8	4	4	0	0.250	0.875	0.875	0.375	0.375	0.05
44	5	9	1	5	7	0	0.500	1.000	0.000	0.500	0.750	0.05
45	5	3	4	9	3	0	0.500	0.250	0.375	1.000	0.250	0.05
46	4	4	4	1	1	0	0.375	0.375	0.375	0.000	0.000	0.05
47	7	4	6	1	7	0	0.750	0.375	0.625	0.000	0.750	0.05
48	9	2	2	3	1	0	1.000	0.125	0.125	0.250	0.000	0.05
49	3	4	1	7	7	0	0.250	0.375	0.000	0.750	0.750	0.05
50	7	1	6	5	7	0	0.750	0.000	0.625	0.500	0.750	0.05
51	6	5	1	6	8	0	0.625	0.500	0.000	0.625	0.875	0.05
52	8	5	3	1	4	0	0.875	0.500	0.250	0.000	0.375	0.05
53	1	5	9	4	3	0	0.000	0.500	1.000	0.375	0.250	0.05
54	7	7	7	8	7	1	0.750	0.750	0.750	0.875	0.750	0.95
55	3	2	8	3	5	0	0.250	0.125	0.875	0.250	0.500	0.05
56	5	2	2	2	3	0	0.500	0.125	0.125	0.125	0.250	0.05
57	6	6	8	7	4	1	0.625	0.625	0.875	0.750	0.375	0.95
58	5	2	5	9	9	0	0.500	0.125	0.500	1.000	1.000	0.05
59	7	4	5	5	2	1	0.750	0.375	0.500	0.500	0.125	0.95
60	7	8	7	5	1	1	0.750	0.875	0.750	0.500	0.000	0.95
61	1	6	7	2	8	0	0.000	0.625	0.750	0.125	0.875	0.05
62	3	2	7	7	1	0	0.250	0.125	0.750	0.750	0.000	0.05
63	9	9	3	5	9	0	1.000	1.000	0.250	0.500	1.000	0.05
64	9	5	1	5	6	0	1.000	0.500	0.000	0.500	0.625	0.05
65	5	7	3	5	1	0	0.500	0.750	0.250	0.500	0.000	0.05
66	2	5	4	3	5	0	0.125	0.500	0.375	0.250	0.500	0.05
67	4	2	4	4	3	0	0.375	0.125	0.375	0.375	0.250	0.05
68	3	3	2	9	7	0	0.250	0.250	0.125	1.000	0.750	0.05
69	2	8	7	7	8	0	0.125	0.875	0.750	0.750	0.875	0.05
70	7	9	6	7	5	1	0.750	1.000	0.625	0.750	0.500	0.95
71	2	8	3	9	3	0	0.125	0.875	0.250	1.000	0.250	0.05
72	9	6	9	6	5	1	1.000	0.625	1.000	0.625	0.500	0.95

73	2	9	9	3	4	0	0.125	1.000	1.000	0.250	0.375	0.05
74	8	9	1	9	9	0	0.875	1.000	0.000	1.000	1.000	0.05
75	7	6	7	9	3	1	0.750	0.625	0.750	1.000	0.250	0.95
76	7	3	1	9	6	0	0.750	0.250	0.000	1.000	0.625	0.05
77	3	9	4	6	2	0	0.250	1.000	0.375	0.625	0.125	0.05
78	6	4	1	8	9	0	0.625	0.375	0.000	0.875	1.000	0.05
79	8	9	7	2	9	0	0.875	1.000	0.750	0.125	1.000	0.05
80	3	8	9	1	6	0	0.250	0.875	1.000	0.000	0.625	0.05
81	6	4	3	2	2	0	0.625	0.375	0.250	0.125	0.125	0.05
82	4	3	2	4	5	0	0.375	0.250	0.125	0.375	0.500	0.05
83	9	8	9	4	4	1	1.000	0.875	1.000	0.375	0.375	0.95
84	8	3	2	4	1	0	0.875	0.250	0.125	0.375	0.000	0.05
85	4	6	5	7	4	1	0.375	0.625	0.500	0.750	0.375	0.95
86	1	7	2	3	6	0	0.000	0.750	0.125	0.250	0.625	0.05
87	8	1	8	5	8	0	0.875	0.000	0.875	0.500	0.875	0.05
88	3	7	6	3	5	0	0.250	0.750	0.625	0.250	0.500	0.05
89	4	4	6	2	2	0	0.375	0.375	0.625	0.125	0.125	0.05
90	1	1	3	4	7	0	0.000	0.000	0.250	0.375	0.750	0.05
91	5	4	3	3	3	0	0.500	0.375	0.250	0.250	0.250	0.05
92	3	4	8	9	8	0	0.250	0.375	0.875	1.000	0.875	0.05
93	6	6	9	8	3	1	0.625	0.625	1.000	0.875	0.250	0.95
94	9	8	1	4	2	0	1.000	0.875	0.000	0.375	0.125	0.05
95	7	7	3	5	3	0	0.750	0.750	0.250	0.500	0.250	0.05
96	7	6	9	8	6	1	0.750	0.625	1.000	0.875	0.625	0.95
97	5	3	1	1	2	0	0.500	0.250	0.000	0.000	0.125	0.05
98	8	4	4	2	9	0	0.875	0.375	0.375	0.125	1.000	0.05
99	5	6	8	7	4	1	0.500	0.625	0.875	0.750	0.375	0.95
100	9	3	5	7	4	0	1.000	0.250	0.500	0.750	0.375	0.05
101	6	1	5	2	9	0	0.625	0.000	0.500	0.125	1.000	0.05
102	1	4	8	1	2	0	0.000	0.375	0.875	0.000	0.125	0.05
103	2	6	9	4	7	0	0.125	0.625	1.000	0.375	0.750	0.05
104	7	3	6	3	6	0	0.750	0.250	0.625	0.250	0.625	0.05
105	5	1	7	2	2	0	0.500	0.000	0.750	0.125	0.125	0.05
106	6	8	7	7	5	1	0.625	0.875	0.750	0.750	0.500	0.95
107	9	7	5	8	2	1	1.000	0.750	0.500	0.875	0.125	0.95
108	3	3	3	4	6	0	0.250	0.250	0.250	0.375	0.625	0.05
109	3	6	8	5	8	0	0.250	0.625	0.875	0.500	0.875	0.05
110	8	2	7	2	9	0	0.875	0.125	0.750	0.125	1.000	0.05

As stated in section 2.6.3, the datasets were randomly divided into three parts: 70% (77 cases) for training, 20% (22 cases) for testing and the rest for validation (11 cases). Other nine real cases were reserved to compare the accuracy of the model. Since the input-output data have been already collected, applying fuzzy inference for modeling do not necessarily have a predetermined model structure based on the characteristics of variables. The training data set can be used for generating an initial ANFIS model, whereas the testing and the checking data sets are used for validation and generalization of the model. These data sets were then stored into Matlab

workspace and given names as "train", "test" and "check" as shown in Figure 5.2. This step ends the preparation of the inputs and outputs of data set.
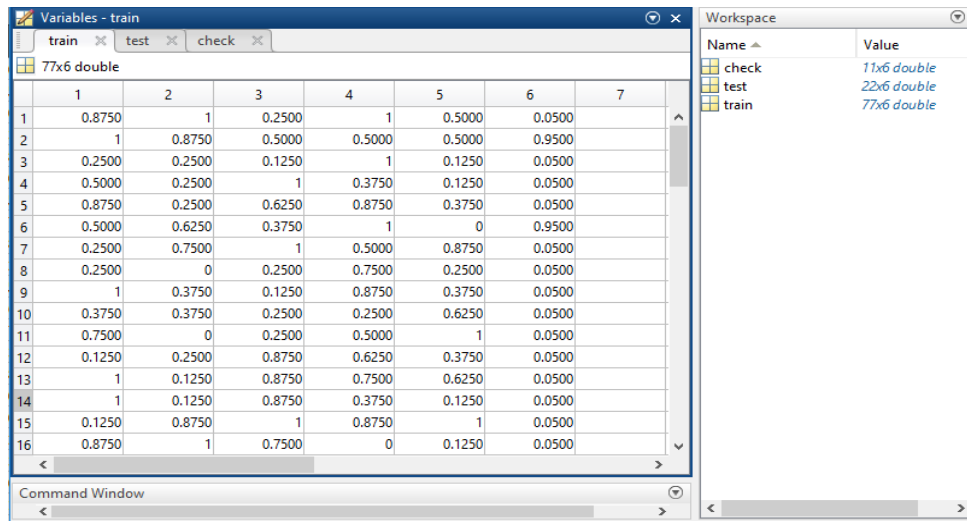
Figure 5.2. Stored data into workspace

5.4.3 Initial FIS Structure

Prior to generate FIS, the involved parameters in generating initial FIS rule are set in ANFIS tool box. To present this tool box, "anfisedit" command was typed in command window. The training data set stored in Matlab workspace are loaded by selecting *training* and *worksp* at *load data*. In the same token, testing and checking data sets were also loaded. Figure 5.3 presents the view of training, testing and checking data plots in ANFIS tool box. The blue circles (o) represent training data set, the blue dots (•) indicate testing data set and the blue crosses (+) show checking data set.
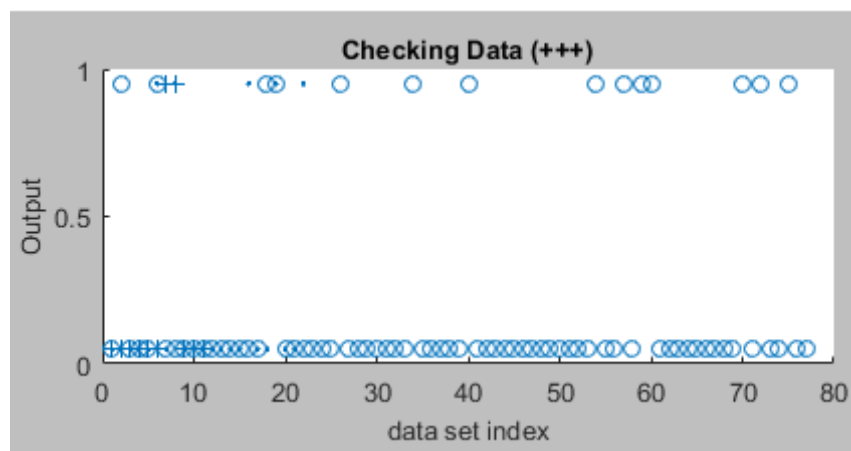
Figure 5.3. Training, testing and checking data plots in ANFIS tool box

Before starting the FIS training, an initial FIS model structure must be specified by choosing *grid partition* which generates a single-output Sugeno-type FIS. At generate FIS, as showed in Figure 5.4, the number of membership functions (MFs) of INPUT were set for [2 2 2 2 2] which indicate that each input has two MFs (Low – High), whereas their type of MF of were set at "trimf" indicating triangular MF, and at OUTPUT, "linear" was chosen as the type of MF.

Figure 5.4. Generate-FIS dialog box

ANFIS editor provides eight types of MFs namely triangular (trimf), trapezium (trapmf), generalized bell-shape (gbellmf), Gaussian curve (gaussmf), Gaussian combination (gauss2mf), phi-shape (pimf), difference between two sigmoidal functions (dsigmf) and product of two sigmoidal (psigmf). After setting these parameter, the ANFIS model structure can be viewed as presented in Figure 5.5. To obtain the optimum ANFIS model the training minimum error, the number and the type of input MFs were tuned arbitrarily. First, FIS train was executed using two MFs and the eight types of MFs alternately. Then, the procedure was continued for three MFs and the eight types of MFs.

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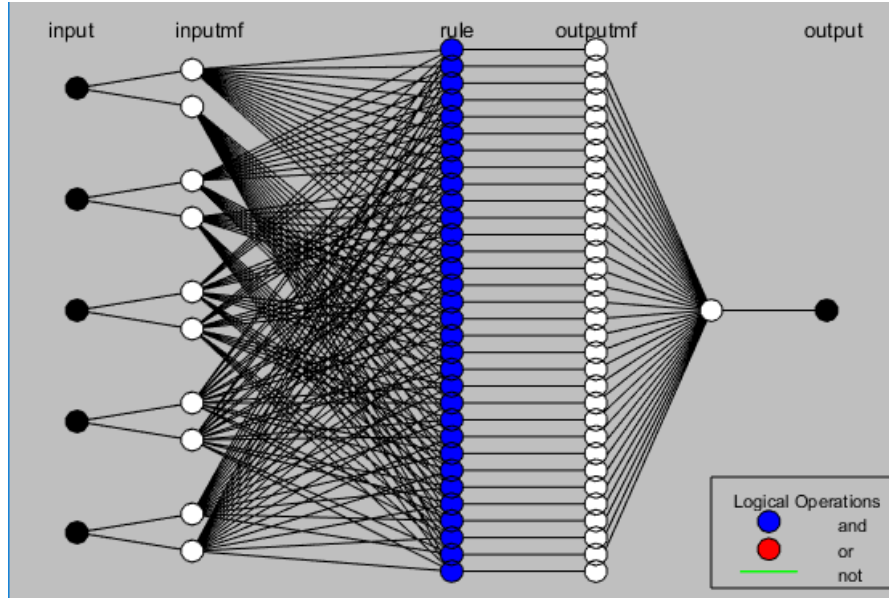
Figure 5.5. Structure of ANFIS

5.4.4 Training the FIS

Given the above parameters, the system was trained with *hybrid* learning algorithm. Another set parameter in ANFIS editor is *Error tolerance* which is functionates to determine a stopping criterion of training related to the size of error. Once the training data error remains within this tolerance, the training process will stop. Since the performance of training error is unsure, the error tolerance was kept in default form (0). The training error is the variance between the output value of training data set and the output of the FIS for the same input value of training data set. The training error records the root mean squared error (RMSE) of the training and checking data set at each epoch. The FIS training process shows only the plots of training and checking data set.

Different numbers of epochs were applied in studies related construction such as Ebrat and Ghodsi (2014) and Polat et al. (2014) who set 500 and 100 epochs respectively. In contrast, Guneri et al. (2011) set only 40 epochs in their study. The number of training epochs in this research were set at 100 meaning the process of training will stop whenever the epoch reaches the maximum number (100 in this case) or the training error achieves the setting error tolerance. A large epoch numbers in training process may result overfitting, otherwise, it impacts on the ability of network to map a pattern. Figure 5.6 shows training error plots of training and checking data set.
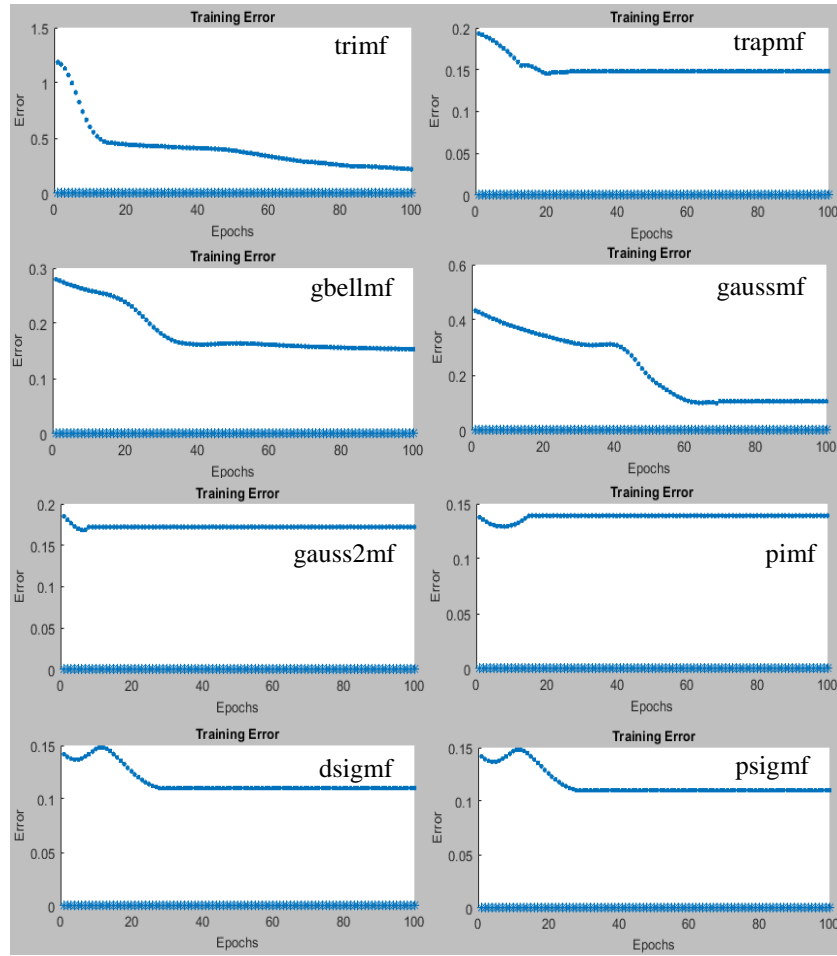
Figure 5.6. Plot of training and checking data set for two number MFs

Figure 5.6 shows FIS process of training and checking data with two number of MFs and each type of MFs. The blue crosses (top line) indicate the error plots of the checking data, and the blue asteriks (bottom line) are the error plots of the training data. Of eight types of MFs, two types of them which are *dsigmf* and *psigmf* produced a similar pattern of training errors against epochs. Training error stop generating a new error value before 20 epochs when tuning MF with *gauss2mf* and *pimf*. Other setting of MF types stoped the training process after 20 epochs. At glance, there are six figure indicate the overfitting, showing the trends increase at several epochs, but they are unnoticeable.

After completing tuning and training all type MFs with two numbers of MFs, three numbers of MFs for all types of MFs were also carried out. When tuning process is performed for four MFs, an alert stating that the system has created a large rule-base, so the program could not run under ANFIS. Thus, the try and error procedure was stopped for other number of MFs.

Similar to Figure 5.6, the FIS proces of training and checking data set for three number of MFs is presented in Figure 5.7. It is clear that all configuration of MF types in FIS process resulted overfitting indicated by increasing train error of checking data. Training the data sets sometimes result in overfitting of checking data which is a condition where the network is only able to memorize data set provided in the learning process. Such condition will not produce a right output if a new input data is given (Astuti, 2009). On the other words, "the network has memorized the training examples, but it has not learned to generalize to new situations" Matwork Inc. (2015). This phenomenon is indicated by checking errors graph increase suddenly when training performed. However, the checking error graphs remain stable after several epochs. With increase of the number of epoch may decline and reach a stable error (Ebrat and Ghodsi, 2014). In such phenomenon, the optimum ANFIS model is given by parameter generating the minimum checking error.

Each Train-FIS process basically creates an ANFIS model which is a trained system. As stated above that the average training error records the RMSE, and to find the RSME of each data set, the trained systems were then tested against training, testing and checking data set. Test-FIS in ANFIS editor is used to test the data set. The average train errors shown for each option constitute the RMSE for the given data as tabulated in Table 5.8.
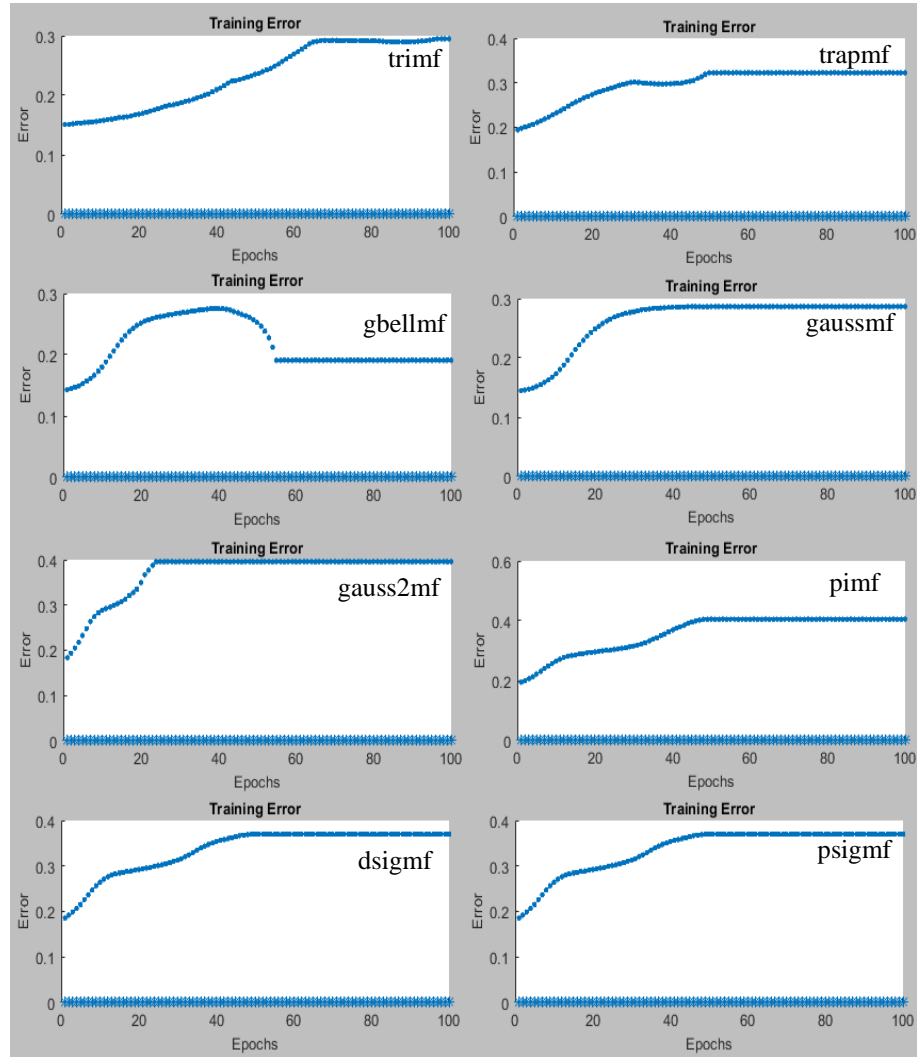
Figure 5.7. Plot of training and checking data set for three number MFs

Table 5.8. Result of Test-FIS of training, testing and checking data

No	Type of MF	Average training error (RMSE)					
		2 MFs of input			3 MFs of input		
		Train	Test	Check	Train	Test	Check
1	Trimf	1.14×10^{-5}	0.304	0.215	2.97×10^{-7}	0.277	0.295
2	Trapmf	6.52×10^{-6}	0.256	0.148	1.44×10^{-7}	0.227	0.323
3	Gbellmf	5.71×10^{-6}	0.347	0.153	3.17×10^{-7}	0.119	0.160
4	Gaussmf	5.31×10^{-6}	0.130	0.075	1.90×10^{-7}	0.220	0.287
5	Gauss2mf	7.89×10^{-6}	0.305	0.172	1.33×10^{-7}	0.203	0.396
6	Pimf	5.82×10^{-6}	0.290	0.139	1.23×10^{-7}	0.208	0.405
7	Psigmf	4.30×10^{-6}	0.277	0.109	1.66×10^{-7}	0.196	0.370
8	Dsignmf	4.30×10^{-6}	0.277	0.109	1.66×10^{-7}	0.196	0.370

Overall, the RMSE of each data for various number and types of MFs show very small value (almost zero). Generally, these values can be said that the network works well under all parameters. The minimum training errors of training data for

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two and three number MFs of input were obtained from *gaussmf* (5.31 x 10⁻⁶) and *trapmf* (1.44 x 10⁻⁷) respectively. The average training error for testing data of both parameters were 0.130 and 0.227, and for checking data are 0.075 and 0.323. Based on the results, the ANFIS model for Go/Not Go decision on OCP is developed using the parameters as follows; two input membership functions, Gaussian (*gaussmf*) membership function and hybrid optimization method.

Through the ANFIS model, the correspondence between FIS output and testing and checking data can be observed as shown in Figure 5.8 and Figure 5.9 respectively. In these figures, the red asterisk (*) symbols indicate FIS model outputs, while the blue dot (•) symbols represent the output of testing data. It is clearly seen from both figures that either testing or checking data outputs correspond to FIS model outputs. These indications demonstrate that the developed ANFIS model is accurate.
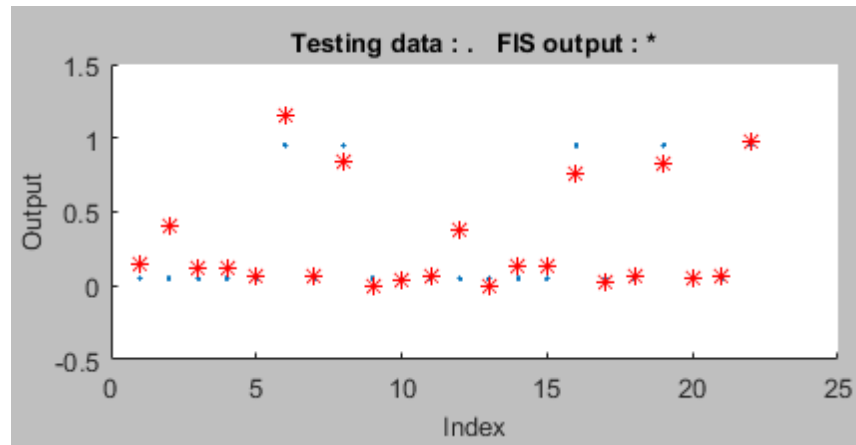
Figure 5.8. FIS output value and testing data
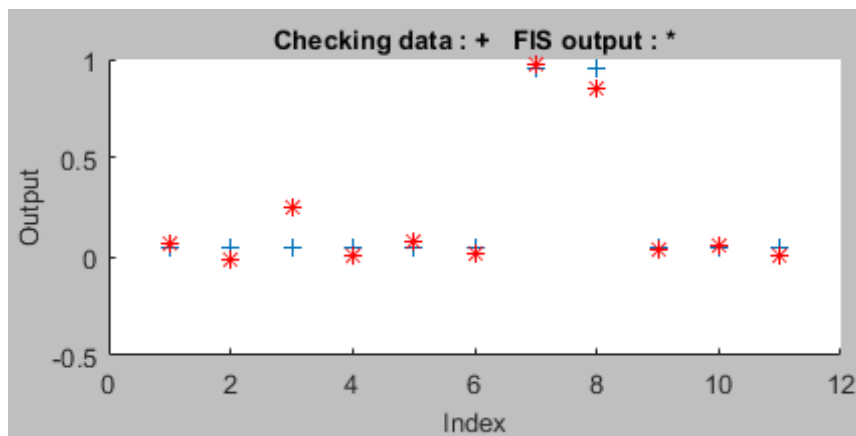
Figure 5.9. FIS output value and checking data

Nevertheless, the divergence between FIS output and testing or checking data is still visible, but it is trivial. Inadequate number of data and the problem in selecting data set for testing are two common factors contributing to this problem. Small data set causes the data disable to represent all the necessary features, so the data which is separated for testing and checking cannot sharply emulate the trained system.

Of the trained system, the ANFIS rule which is the ANFIS model for Go/Not Go decision making in OCP was obtained as depicted in Figure 5.10. This *if-then* rule displays the all records of FIS and enables management to make a quick choice of OCP by subtitute the input scores based on an analysis of a particular project. This rule shows an score output (1.26) for five input pairs (project, contract, owner, host country and market) with given score average of 0.5. Changes made on score of each input (red circle on figure 7.11) will generate a new output value. The decision makers can further determine a threshold output score in deciding Go or Not Go for OCPs under evaluation.
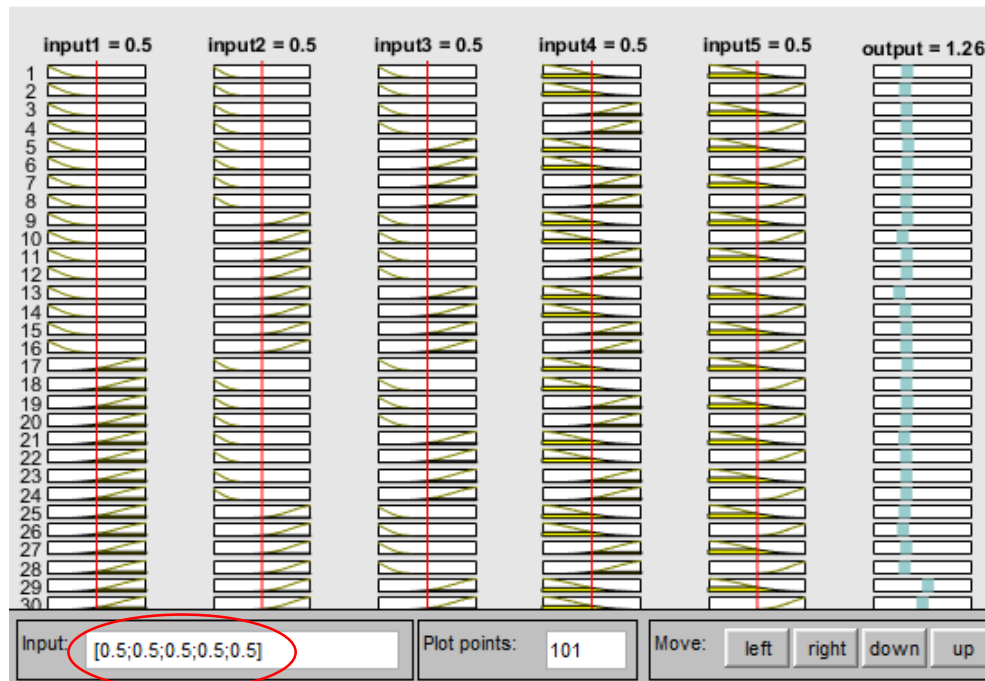
Figure 5.10. ANFIS rule of Go/Not go decision model

Training result can also be seen in form 3-D surface diagrams as shown in Figure 5.11. The diagrams present the relatioship of input pairs against output. On the other words, the diagrams represent how each input influences the decision on OCP. Yellow surface indicates the peak or decision to GO while the blue is the

bottom area of surface diagram, meaning NOT to GO. In a general view, they can be infered that each input has different magnitude influence on decision.
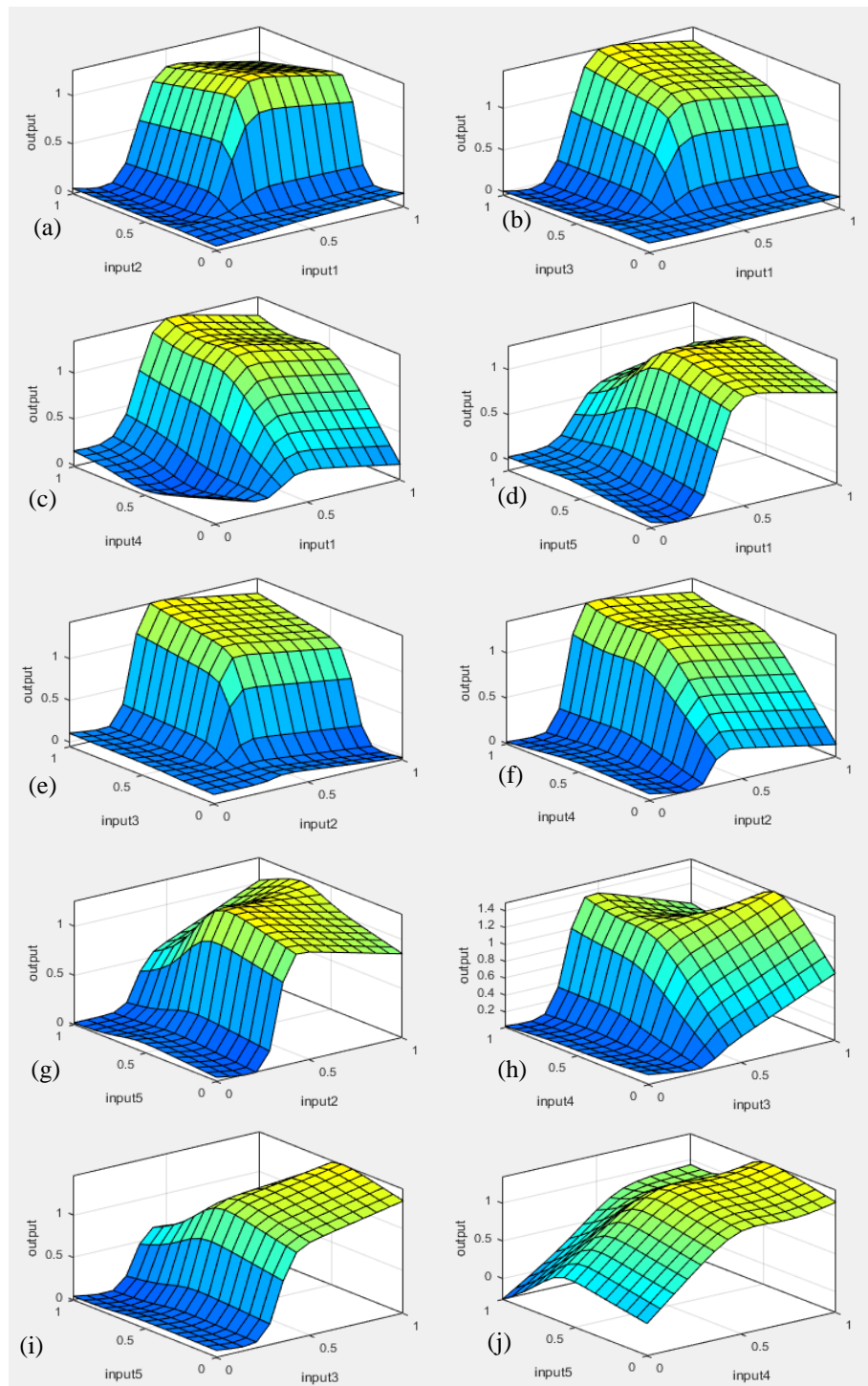
Figure 5.11. Surface view of training data

Figure (a) to (j) consecutively displays the pairs of inputs as follows:

(a) Project (input-1)-Contract (input-2)   (b) Project (input-1)-Owner (input-3)

(c) Project (input-1)-Host country (input 4) (d) Project (input-1)-Market (input 5)

(e) Contract (input-2)-Owner (input-3)   (f) Contract(input-2)-Host country (input 4)

(g) Contract (input-2)-Market (input 5)   (h) Owner (input-3)-Host country (input 4)

(i) Owner (input-3)-Market (input 5)   (j) Host country (input 4)-Market (input 5)

5.4.5 Validation and Generalization

The developed ANFIS model must be validated to view its effectiveness. "Model validation is the process by which the input vectors from input/output data sets on which the FIS was not trained, are presented to the trained FIS model, to see how well the FIS model predicts the corresponding data set output values" (Matworks, 2015). As explained in section 2.6.5, the model effectiveness was measured using two methods, convergence and generalization as suggested by Refenes (1995) as applied by Wanaous et al. (2003).

Two statistical methods, RMSE and R were adopted to observe the convergence and generalization capability of the model. Convergence verifies the learning mechanism implemented for training data. As shown in Table 6.8, Gauss MFs with two input MFs and hybrid learning method generated very small prediction errors (RMSE = 0.130) for 22 cases of testing data and (RMSE = 0.075) for 11 cases of checking data. These results verify the performance of modeling capability for the given cases.

The correlation coefficient (R) between testing/checking data output and output result of trained ANFIS signifies the efficiency of the model. The closer the score of R to 1, the better the model fitness is obtained (Ebrat and Ghodsi, 2014). To calculate R value, first, the desired (A) and predicted outputs (F) were collected. Using ANFIS rule (Figure 5.10), the input scores of 22 testing and 11 checking data were set, while the generated outputs (F) were then recorded and tabulated as illustrated in Table 5.9 and Table 5.10 respectively. The score of R for testing and checking data set was then calculated using the equation 2.7.

Table 5.9. R calculation of testing data set

A	F	$A - \bar{A}$	$F - \bar{F}$	$(A - \bar{A}) \times (F - \bar{F})$	$(A - \bar{A})^2$	$(F - \bar{F})^2$
0.050	0.142	-0.113	-0.148	0.017	0.013	0.022
0.050	0.404	0.149	0.114	0.017	0.022	0.013

0.050	0.122	-0.133	-0.168	0.022	0.018	0.028
0.050	0.113	-0.142	-0.177	0.025	0.020	0.031
0.050	0.060	-0.195	-0.230	0.045	0.038	0.053
0.950	1.150	0.895	0.860	0.770	0.802	0.739
0.050	0.063	-0.192	-0.227	0.044	0.037	0.052
0.950	0.841	0.586	0.551	0.323	0.344	0.303
0.050	0.000	-0.255	-0.290	0.074	0.065	0.084
0.050	0.034	-0.221	-0.256	0.057	0.049	0.066
0.050	0.069	-0.186	-0.221	0.041	0.034	0.049
0.050	0.374	0.119	0.084	0.010	0.014	0.007
0.050	-0.006	-0.261	-0.296	0.077	0.068	0.088
0.050	0.127	-0.128	-0.163	0.021	0.016	0.027
0.050	0.126	-0.129	-0.164	0.021	0.017	0.027
0.950	0.765	0.510	0.475	0.242	0.261	0.225
0.050	0.022	-0.233	-0.268	0.062	0.054	0.072
0.050	0.062	-0.193	-0.228	0.044	0.037	0.052
0.950	0.823	0.568	0.533	0.303	0.323	0.284
0.050	0.045	-0.210	-0.245	0.051	0.044	0.060
0.050	0.070	-0.185	-0.220	0.041	0.034	0.049
0.950	0.980	0.725	0.690	0.500	0.526	0.476
			Σ	2.807	2.835	2.807

$$R = \frac{2.807}{\sqrt{2.835 \times 2.807}} = 0.995$$

Table 5.10. R calculation of checking data set

A	F	A – Ā	F – F̄	(A – Ā) x (F – F̄)	(A – Ā)²	(F – F̄)²
0.05	0.061	-0.164	-0.150	0.025	0.027	0.023
0.05	-0.015	-0.164	-0.226	0.037	0.027	0.051
0.05	0.255	-0.164	0.044	-0.007	0.027	0.002
0.05	0.001	-0.164	-0.210	0.034	0.027	0.044
0.05	0.074	-0.164	-0.137	0.022	0.027	0.019
0.05	0.020	-0.164	-0.191	0.031	0.027	0.036
0.95	0.977	0.736	0.766	0.564	0.542	0.587
0.95	0.857	0.736	0.646	0.476	0.542	0.417
0.05	0.031	-0.164	-0.180	0.029	0.027	0.032

0.05	0.054	-0.164	-0.157		0.026		0.027	0.025
0.05	0.006	-0.164	-0.205		0.034		0.027	0.042
			Σ		1.271		1.325	1.278

$$R = \frac{1.271}{\sqrt{1.325 \times 1.278}} = 0.976$$

The calculations above present the correlation between desired simulated test data set and predicted ANFIS model and between desired simulated checking data set and computed ANFIS model. Both R scores (0.995 and 0.976) show a strong correlation as explained that the closeness of R scores to 1 is an indication of the fitness of the designed ANFIS model. Of both RMSE and R values can be summarized that the performance of designed ANFIS model for Go/Not Go decision making in OCPs was found to be satisfactory.

The generalization ability of the ANFIS model is then examined further. This examination aims to verify the accuracy and correctness of the model when measuring real cases. This course of action measures the ability of the model in recognizing patterns beyond the learning samples (Wanaous et al., 2003). Nine real cases of OCPs described in Section 5.3 were used for this purpose. Table 5.11 presents the feature of the cases

Table 5.11 Data of OCPs for model generalization

OCP	Project	Contract	Owner	Host country	Business	Expert Judgement
A	8	7	4	7	3	Go
B	6	7	8	6	6	Go
C	7	3	5	7	6	Not Go
D	4	4	6	6	7	Not Go
E	8	6	6	5	5	Go
F	6	8	4	5	5	Go
G	6	7	6	8	4	Go
H	8	7	7	7	5	Go
I	7	8	7	5	7	Go

Before assessing the decision of the projects using ANFIS model for Go/Not Go decision making, the input data have to be normalized. Equation 5.1 was utilized to normalize input data as recorded in Table 5.12. Each normalized project data was then entered into trained system in which the ANFIS rule processes the data and

generates a new output score. Through nine real-life cases of OCPs executed by Indonesian large contractors, the ANFIS model was able to predict the desirable decision with 11.11% fault. The result of the real cases suggests a substantial generalization ability of the proposed ANFIS model for Go/Not go decision making in OCPs.

Table 5.12. Evaluation results of the real cases of OCPs

Case	Normalized data					Output value	Predicted Decision	Notes
	X_1	X_2	X_3	X_4	X_5			
A	0.88	0.75	0.38	0.75	0.25	0.80	Go	Correct
B	0.63	0.75	0.88	0.63	0.63	1.07	Go	Correct
C	0.75	0.25	0.50	0.75	0.63	0.09	Not go	Correct
D	0.38	0.38	0.63	0.63	0.75	0.54	Go	Incorrect
E	0.88	0.63	0.63	0.50	0.50	1.15	Go	Correct
F	0.63	0.88	0.38	0.50	0.50	0.85	Go	Correct
G	0.63	0.75	0.63	0.88	0.38	1.06	Go	Correct
H	0.88	0.75	0.75	0.75	0.50	0.90	Go	Correct
I	0.75	0.88	0.75	0.50	0.75	1.08	Go	Correct

5.5   Cross Validation

As explained in section 2.6.5, cross validation was considered to view the performance of the proposed model against other methods in a similar function. In the current study, another advanced artificial intelligent tool, general feedforward neural network (GFNN) was used as a comparison method. A brief description of NN has been given in section 5.5.2. By using a similar software utilized on ANFIS analysis, a model based NN for decision making of OCPs was developed. In this model, the 110-normalized data as recorded in Table 5.7 was used for training (70%), validation (20%) and testing samples (10%). In contrast to ANFIS, data supplied for the three samples are arranged automatically by the system. The procedure for running NN using Matlab software is described below.

In Matlab workspace, the data were separated into two files, input and output data. To run the NN program, a syntax, *nnstart* was typed in to open the NN window. For the purpose of mapping a set of inputs to a set of targets, *Fitting app* menu was chosen. This menu enables to select data, to develop and to train a network, and to evaluate its performance using mean square error (MSE) and correlation coefficient

(R). The characteristic of the network is a two-layer feed-forward with sigmoid hidden neurons and linear output neurons.

The input and the target data are then uploaded and the percentage of the data allocation for training, validation and testing samples is set as illustrated in Figure 5.12 and Figure 5.13. As mentioned above, the certain data belongs to each action are organized by the system. The number of hidden nodes is then set. As explained in section 5.5.2, the number of nodes influence the learning process of the network. Therefore, a trial and an error procedure on the number of nodes was carried out to find the optimum performance network.
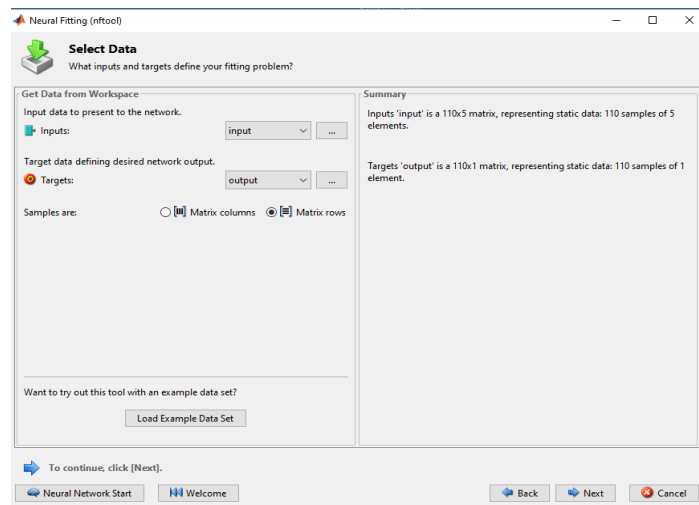
Figure 5.12. Upload input-output data
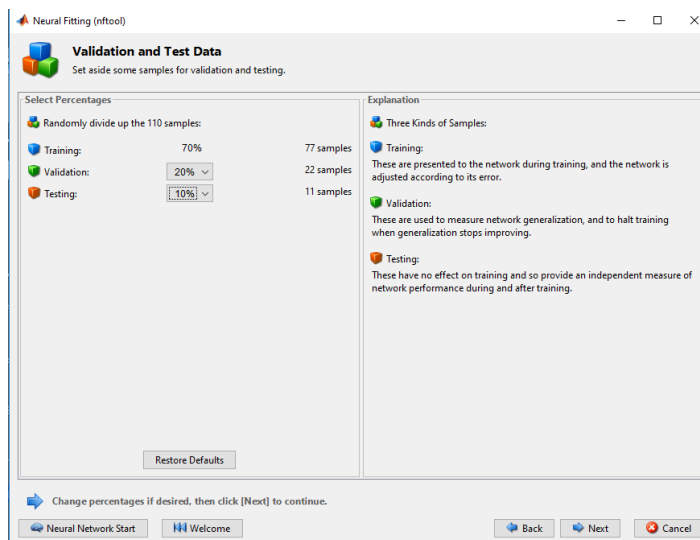
Figure 5.13. Setting percentage of data distribution

In this system, a training process produces two performance indicators, MSE and R for training, validation and testing samples. The training samples are dedicated

to the network during training and the network attunes according to its error. The validation samples are treated to assess generalization of network and to pause training when the progress of generalization is stagnant. The testing samples provide a performance measure of network independently since they have no effect on training (Matwork, 2015).

The first trial was conducted by entering 1 for number of hidden nodes and followed by setting the type of training algorithm, *Levenberg-Marquardt* backpropagation (trainlm) in this case. Trainlm, a default option of the system, is "a network training function that updates weight and bias values according to Levenberg-Marquardt optimization". This algorithm offers a rapid backpropagation process, but it needs more memory than other algorithms (Matwork, 2015).

During the trial, the changes of two performance indicators (MSE and R) were recorded as summarized in Table 5.13. It should be noted that the performance of the network highly depends on the initial conditions and sampling (initialization of weights) generated randomly by system. Training iterations were therefore employed three times for each number of hidden nodes as hired by Dikmen and Birgonul (2004), and the performance scores are the average values after trainings.

Table 5.13. MSE and R with different number of hidden nodes

Type of layer		MSE1	MSE2	MSE3	Ave. MSE	R1	R2	R3	Ave. R
5-1-1	Training	0.0550	0.0715	0.0835	0.0700	0.7568	0.7565	0.7687	0.7607
	Validation	0.0503	0.0450	0.0563	0.0505	0.7681	0.5951	0.3492	0.5708
	Testing	0.1529	0.0908	0.0299	0.0912	0.1253	0.5189	0.0000	0.2147
5-2-1	Training	0.0626	0.0628	0.0650	0.0635	0.7196	0.7912	0.7075	0.7394
	Validation	0.0628	0.0617	0.0987	0.0744	0.7936	0.4093	0.6375	0.6135
	Testing	0.0868	0.1281	0.0420	0.0856	0.0000	0.6113	0.0000	0.2038
5-5-1	Training	0.0468	0.0446	0.0603	0.0506	0.7743	0.8198	0.7407	0.7783
	Validation	0.0749	0.0441	0.0653	0.0614	0.7606	0.7350	0.7191	0.7382
	Testing	0.0417	0.1168	0.1060	0.0882	0.7549	0.5415	0.2262	0.5075
5-10-1	Training	0.0391	0.0581	0.0279	0.0417	0.8350	0.7543	0.8964	0.8286
	Validation	0.0652	0.1219	0.0441	0.0771	0.1420	0.2873	0.8248	0.4180
	Testing	0.0954	0.0555	0.0806	0.0772	0.7627	0.7728	0.4288	0.6548
5-15-1	Training	0.0197	0.0244	0.0351	**0.0264**	0.9262	0.8990	0.8330	**0.8861**
	Validation	0.0592	0.0492	0.0711	**0.0598**	0.7931	0.8337	0.6600	**0.7623**
	Testing	0.0194	0.0981	0.0315	**0.0497**	0.9439	0.6115	0.9122	**0.8225**
5-20-1	Training	0.0541	0.0613	0.0813	0.0656	0.7601	0.7909	0.6458	0.7323
	Validation	0.0462	0.0704	0.0667	0.0611	0.8265	0.6850	0.8329	0.7815
	Testing	0.0720	0.0944	0.0772	0.0812	0.7309	0.5842	0.6493	0.6548

5-25-1	Training	0.0213	0.0692	0.0138	0.0348	0.9204	0.7124	0.9674	0.8667
	Validation	0.0705	0.0933	0.0637	0.0758	0.7303	0.6417	0.6591	0.6770
	Testing	0.1112	0.2289	0.0951	0.1451	0.5521	0.3483	0.7036	0.5347
5-30-1	Training	0.0300	0.0519	0.0578	0.0466	0.8848	0.8055	0.8527	0.8477
	Validation	0.0572	0.1305	0.1014	0.0964	0.8028	0.4399	0.5132	0.5853
	Testing	0.1585	0.1694	0.1495	0.1591	0.0000	0.3471	0.5318	0.2930
5-35-1	Training	0.0158	0.0474	0.0493	0.0375	0.9334	0.8213	0.8371	0.8639
	Validation	0.0813	0.1372	0.0673	0.0953	0.6598	0.3479	0.0000	0.3359
	Testing	0.1079	0.1563	0.1487	0.1376	0.7336	0.1077	0.4871	0.4428
5-40-1	Training	0.0141	0.0042	0.0068	0.0084	0.9466	0.9841	0.9654	0.9654
	Validation	0.0321	0.0456	0.1456	0.0744	0.9054	0.6552	0.5839	0.7148
	Testing	0.1583	0.0572	0.0883	0.1013	0.4492	0.9051	0.7271	0.6938
5-50-1	Training	0.0559	0.0796	0.0098	0.0484	0.8496	0.6770	0.9620	0.8295
	Validation	0.1097	0.1400	0.1487	0.1328	0.5045	0.3202	0.2370	0.3539
	Testing	0.1026	0.1104	0.8707	0.3612	0.0000	0.5640	0.7465	0.4368
5-100-1	Training	3.3e-17	0.0468	1.1e-16	0.0156	1.0000	0.7834	1.0000	0.9278
	Validation	0.1832	0.1622	0.2622	0.2025	0.3306	0.3861	0.4921	0.4029
	Testing	0.1679	0.0932	0.0850	0.1154	0.5210	0.6712	0.5220	0.5714

Like ANFIS algorithm, a minimum training error (close to 0) indicates the good performance of the network and a high correlation coefficient (close to 1) determines the efficiency of the network. After conducting training with different numbers of nodes (1 to 100), the 5-15-1 network indicating five inputs - fifteen nodes in hidden layer - one output was selected as acceptable performance as depicted in Figure 5.14. This network shows a very small prediction error (MSE=0.0264) and a very high correlation (R=0.8861) between actual and predicted targets. Although other networks such as 5-50-1 and 5-100-1 presented a lower MSE and higher R scores than 5-15-1 network, they were not selected because of overfitting as explained in section 5.5.2.3. The validation and testing results also verified the performance of the network.
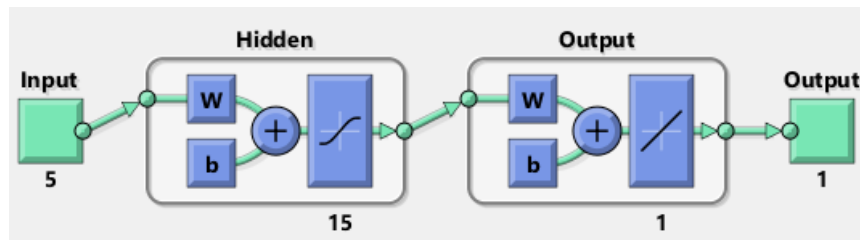
Figure 5.14. Illustration of selected 5-15-1 network

As executed by ANFIS, the selected NN model was then used to predict the nine-real OCP cases. To generate the prediction results, *Simulink diagram* menu was activated. Each input parameter of the real cases was entered to the model and the outputs were monitored and recorded as summarized in Table 5.14. The output scores determine the decision of the real OCP cases. Like ANFIS, a score above of 0.50 was agreed as the threshold point to decide *Go* and vice versa. The table shows that the GFNN model produced an identical predicted decision on the real cases with the ANFIS model, 11.11% unsuccessful prediction.

Table 5.14. Result of GFNN model on real cases

Case	Normalized data					Output value	Predicted Decision	Notes
	X_1	X_2	X_3	X_4	X_5			
A	0.88	0.75	0.38	0.75	0.25	0.692	Go	Correct
B	0.63	0.75	0.88	0.63	0.63	1.017	Go	Correct
C	0.75	0.25	0.50	0.75	0.63	0.233	Not go	Correct
D	0.38	0.38	0.63	0.63	0.75	0.527	Go	Incorrect
E	0.88	0.63	0.63	0.50	0.50	0.811	Go	Correct
F	0.63	0.88	0.38	0.50	0.50	0.789	Go	Correct
G	0.63	0.75	0.63	0.88	0.38	0.960	Go	Correct
H	0.88	0.75	0.75	0.75	0.50	1.059	Go	Correct
I	0.75	0.88	0.75	0.50	0.75	1.006	Go	Correct

Both ANFIS and GFNN model failed to predict actual Go/Not go decisions on one case only meaning the accuracy of prediction is nearly 90%. Table 5.15 verifies and compares the applicability and performance the ANFIS model with GFNN model. On one hand, the performance of ANFIS model ($5.31x10^{-6}$) extremely surpassed the GFNN model (0.026) in the training stage. In validation phase, on the other hand, the GFNN model's performance exceled the ANFIS model, 0.060 compared 0.130. Interestingly, in testing samples, the performance variance of both models was trivial. The better efficiency of the ANFIS model over the GFNN model can be checked from the scores of coefficients correlation (R). In training and validation phases, the efficiency ratio of ANFIS model to GFNN model was approximately 11% and 23% respectively. The ratio was about 16% in the testing stage.

Table 5.15. Performance comparison of ANFIS and GFNN model on real cases

Samples data	Training Error		Coefficient correlation (R)	
	ANFIS	GFNN	ANFIS	GFNN
Training	5.31×10^{-6}	0.0264	0.999	0.8861
Validation	0.130	0.0598	0.995	0.7623
Testing	0.075	0.0497	0.976	0.8225

Since the two tools have a learning ability, the results of the models developed from the techniques are not much different as revealed in Table 5.16. The nature and characteristic of each network affected the final score and the efficiency of the model. Furthermore, the selection and the allocation of samples for each training stage influence the performance of the models. Overall, the predicted scores of ANFIS model seem to be larger than GFNN model's predicted scores, seven for ANFIS and two for another. This implies that the ANFIS results are more concrete and it gives higher conviction than GFNN for making decision in fuzzy environment like OCPs.

Table 5.16. Decision comparison of ANFIS and GFNN model on real cases

Case	Predicted scores		Decision accuracy	
	ANFIS	GFNN	ANFIS	GFNN
A	0.80	0.692	Correct	Correct
B	1.07	1.017	Correct	Correct
C	0.09	0.233	Correct	Correct
D	0.54	0.527	Incorrect	Incorrect
E	1.15	0.811	Correct	Correct
F	0.85	0.789	Correct	Correct
G	1.06	0.960	Correct	Correct
H	0.90	1.059	Correct	Correct
I	1.08	1.006	Correct	Correct

5.6   Chapter Summary

This chapter presented two main related focuses which directly correspond to Objective 3 and Objective 4 of this study. As answer on Objective 3, this chapter has fruitfully determined the international factors in OCPs. The two rounds Delphi survey has reached the experts' consensus on the important rate of the factors and the probability of risk occurrence associated with the factors. By computing the

significant index, of 31 identified international factors, 21 variables were determined and then categorized into five criteria viz. (1) project, (2) contract, (3) client, (4) host country, and (5) business. The five criteria along with 21 variables were then used to form an OCP evaluation sheet.

The evaluation form was initially created to record the characteristic of completed OCPs. However, due to the limitation of real data availability, the evaluation sheet was then utilized as an instrument to generate simulation OCP cases. In evaluation form, each variable is provided a unique fuzzy parameter scale in type of ordinal (e.g. Low – Medium – High – Unidentified, for variable level of competition) and categorical (e.g. Host government – Host private – Home private – Home government, for variable type of client). Meanwhile, each criterion is given numeric scale from 1 to 9. To generate simulation cases, each variable is randomly given a scale by highlighting the scale. Eleven examiners consisting of experienced personnel in OCPs were assessed the appropriate score of each criterion based on the highlighted variables and decide whether the contractors should go for the given case. Through this process, 110 simulation cases were successfully collected and used as data bank for model development.

An adaptive neuro fuzzy inference system (ANFIS) was adopted to model the decision based on a set of given simulation cases of OCPs. This ANFIS based support system for OCP decision making was developed via Matlab, a computer program from Mathwork Inc. For ANFIS procedure, the 110 simulation cases were randomly fragmented into three data groups: training, checking and testing with proportion of 70%, 20% and 10% respectively. Try and error experiment by combining all ANFIS parameters (number of MFs, types of MFs and type of optimization method) was carried out to obtain an optimal network. To find the optimal one, the performance of ANFIS model indicated by the accuracy and the efficiency of the model were measured using root means square errors (RMSE) and coefficient of correlation (R). The results of experiment show that the optimum model for go/not to go OCPs was reached with two input MFs, Gaussian (*gaussmf*) MFs and hybrid optimization method. Finally, General Feedforward Neural Network (GFNN) was utilized for cross validation to notice the performance and the applicability of the developed model. GFNN result validated and reinforced that ANFIS model can be applied for decision support aid in OCPs.

Chapter 6
CONCLUSIONS

6.1   Introduction

This chapter summarizes the entire study's findings and presents conclusions. It is divided into five sections. The first section reminds the aim and objectives of this research as well as a summary of what has been discussed in the previous chapters. The second section provides the summary of the major findings which are the accomplishment of the research objectives and followed by the description of significance and contributions of the research. The fourth section presents the research limitation in relation to the data and methodology. Finally, several recommendations for future related research are suggested.

6.2   Review of Research Objectives

International expansion of construction enterprises as widely discussed in this research is not a new phenomenon in a construction business, otherwise it has been lasting over decades. The opening era in global trade has reinforced this business entity in which the local firms can expand their marketplaces outside their domestic market. Though Indonesian contractors have several experiences in executing overseas construction projects (OCPs), very little attention has been given to investigate this involvement.

As has been discussed in Chapter 1, the companies with international visions have several strategic motivations to be multi-national players. The motivations of one company can be different each other even though in a similar industry, like construction. Despite the motivations, the strategy to enter one international market should be understood as well. Each country's market has uniqueness in several aspects such as business environment and domestic socio-politic issues.

Related to the explanation above, the purpose of the current research was to provide an empirical study and to investigate the internationalization phenomenon from Indonesian contractors' point of view. The central focuses were an investigation of the expansion motivations, the preferred entry modes, and the

determination of the international factors in deciding overseas construction projects. Furthermore, this research was also undertaken to develope a decision support system for considering an overseas construction project (OCP) through a multi criteria decision making approach.

Considering the research objectives and the scopes, a robust research method was designed as comprehensively discussed in Chapter 2. This research advocated a mixed method research approaches which successfully addressed the research objectives and helped to facilitate a deeper understanding.

An adequate understanding engaging with the internationalization of construction enterprises in theoretical contexts is very relevant and important for this research. For this reason, Chapter 3 was provided to describe three principal subjects in the domain of international construction: the motivations, the entry modes and the international factors. In addition, neuro-fuzzy based MCDM method which specifically highlights the Adaptive Neuro Fuzzy Inference System (ANFIS) algorithm was also provided in this chapter as theoretical platform of decision model development. At the end, this study has successfully achieved the defined research objectives which have been fully discussed in Chapter 4 and 5 respectively.

6.3 Summary of Major Findings

The results of literature review of past studies summarize 19 primary motivations of overseas expansion, 10 modes to enter overseas markets and 31 main international factors determining the decision on OCPs. Based on these findings, a set of questionnaires were developed and distributed to Indonesian large contractors to examine their perspectives. The case study and interviews were conducted to legitimate the findings.

The statistical descriptive analysis of the questionnaires and relative important index revealed that the salient motivations boosting the companies to pursue cross country projects are "to increase company's profitability", "to benefit company's competitive advantages", "to avoid saturation in domestic market", "to respond project sponsor invitation" and "to expand/enlarge market size". The case study and interviewees emphasized that first, the overseas projects offer better profit margin, up to twofold although they have not contributed significantly on overall company revenue. Second, they have several decisive competitive advantages (e.g. cultural similarities, good businessmen and government relationships, locational

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factors) driving them to explore overseas markets particularly neighboring countries. Third, they considered to penetrate overseas markets if domestic market run into saturation.

As a response to questions about the strategy to enter the overseas markets, the statistical analysis recorded that Indonesian contractors preferred to adopt joint venture project (JVP), branch office (BO) and representative office (RO). An interesting finding from this issue relates to the reasons in choosing JVP and BO or RO. JVP was adopted because it is simple and flexible in operation, but it needs a strong networking with international partners. Meanwhile, JVP requires a good cooperation with partners, BO or RO relatively stress on the competitiveness of the companies but it is less flexible. The establishment of BO or RO depends on the attractiveness of the market and the company's readiness (competitiveness). This mode indicated an optimistic strategy of expansion to well-identified markets. From several entry processes of Indonesian enterprises to foreign markets, this study has illustrated four models of entry mode transformations that can be adopted by Indonesian contractors.

In addition, practically, Indonesian contractors have employed local agent (LA) to enter specific market like the Middle East countries such as UAE and Oman. Another entry mode, sole venture project (SVP), has also used especially as a subcontractor and a supplier for an international consortium. Based on these facts, the use of multi strategy instead of single one is actually more effective to penetrate overseas markets.

A two-round Delphi survey involving 11 experienced panelists was applied to determine the international factors in OCPs. The results of literature review found a dozen of the international factors which were then extracted into 31 variables. The experts were invoked to rate the important and the probability of risk occurrence related to the variables. The top five important rates were political stability and sensitiveness, client reputation, type of client, project scale and type of contract, meanwhile the frequency level of risk occurrence were dominated by quality and clarity of contract condition, complexity of project, types of contract, project scale/size and financial capability and support. To determine which variables more significant in the interest of OCP decision making, the rates of both aspects were then reassessed. Of 31 international factors, 21 variables were found to have

significance index above 4.0 and they were classified into five relevant groups namely, project, contract, owner, host country and business. These variables and their groups were used to evaluate a set of simulation cases.

Dealing with the complexity of problems in OCPs is a big challenge for decision making that either contractor should go or should not go. A hybrid of neural network and fuzzy inference system called Adaptive Neuro Fuzzy Inference System (ANFIS) was utilized to resolve this problem. This incorporation technique resulted in a go/not to go model with a good accuracy, above 89% of nine real cases of OCPs.

The development of the model began with determining the international factors in examining an OCP and creating a set of simulation cases representing OCPs' scenery. An evaluation form was designed to generate input-output data for ANFIS application. The input data were rated by examiners on five criteria: project (X1), contract (X2), host country (X3), owner (X4) and market (X5) based on randomly fuzzy numbers given to the variables. On the output (Y), the examiners judged for *go* or *not to go* based on their experience and intuition.

The optimum ANFIS model was achieved by trying all possible settings and comparing the error scores of each setting. The best setting of model was attained using a combination of parameter setting e.g., number of membership function (two inputs), type of membership function (Gaussian or *gaussmf*) and optimization method (hybrid). Two measurers, root mean square error (RMSE) and coefficient of correlation (R), also indicated that the model was found to be satisfactory. Finally, the result of ANFIS model was compared and validated with the results derived from General Feedforward Neural Network (GFNN). Regarding the convergence, the models showed a balance performance toward three types of samples (training, validation and testing). However, the ANFIS model performed a little bit better than the GFNN models in respect to the model efficiency. Both models demonstrated an equal performance ability in predicting the real cases. This result suggests that ANFIS can be applied for supporting decision involving multiple criteria in OCPs.

6.4   Significance and Contributions

6.4.1 Overseas Expansion of Indonesian Contractors

The studies pertaining internationalization of construction industry seem to overlook the participation of developing industrial economies. This study appears to

be one of the first attempt to empirically explore the limitation from the perspective of Indonesia. It brings a new horizon for the construction practice in Indonesia and may help construction enterprises intending to expand their operation abroad to understand the expansion reasons and to plan their strategy to enter foreign marketplaces.

Nineteen strategic motives identified from the literature can generically represent intrinsic and extrinsic reasons underpinning the expansion rational of construction firms around the globe. Meanwhile, 10 types of market entry modes commonly adopted in construction business can precisely specified what strategies suitably employed by the companies. These can fulfill the emptiness of information a knowledge regarding internationalization of Indonesian construction enterprises in the interest of Indonesian construction stakeholders. Result of the Delphi study on 31 international factors in OCPs can validate previous related studies and can also indicate that not all factors are significantly taken into account as decision variables in OCPs.

6.4.2 Development of ANFIS Based Decision Support Tool

ANFIS based model for supporting decision in OCPs can approximately predict the decision of real OCP cases at 88.89% accurate. Furthermore, the model was cross-validated using General Feedforward Neural Network (GFNN) as a comparison method. The prediction results of GNFF model on nine real cases were similar with ANFIS model. This evidences that the developed ANFIS model can predict the decision satisfactorily. Therefore, it can help companies' management to make preliminary assessment of an OCP.

6.4.3 Robustness of the Methodology

This study applied the integration of quantitative and qualitative approaches which have been believed as a suitable research methodology for studies related construction management. Data collection through questionnaires and face to face interview involved personnel who have prominent position and long experience in construction industry, representing large size contractor companies in Indonesia. Hence, the results of this study can truly reflect the reality of contractor enterprises in Indonesia.

6.4.4 Applicability of Research Findings and ANFIS Model

Though the setting of the study is Indonesian contractor companies, the findings particularly the transformation of market entry strategy and determination of international factors can be adopted and reapplied to other developing countries having similar enterprises characteristics.

The use of simulation cases as data set in development the model has several advantages as discussed in section 5.3. This technique can be replicated to generate other case scenarios which are not available publicly or limited in terms of quantity.

Likewise, the use of ANFIS algorithm as an instrument of the model development merge the advantages and reduce the disadvantages of both neural network and fuzzy logic techniques. It does not need a complex mathematical configuration and coding. Thus, the user can easily adopt and simply adjust the system for their needs.

6.4.5 Research Contributions

This research provides the current facts of Indonesian contractors related to overseas business expansion. Although their involvement has not been as massive as other developed and emerging economies, and their global effect is comparatively minor, the unique features of this nation are also equally important to be investigated. This research offers several significant insights into the realm of international construction both theoretically and practically.

Theoretically, the research findings redound to the benefit of the already vibrant body in transnational construction industry subject. It provides an exciting opportunity to advance our knowledge in this discipline regarding the expansion motivation, market entry strategy and factors to be considered in OCPs. As indicated, the numbers of these typical studies are lack. In associated with Indonesian enterprises, this research can contribute to provide a basis of knowledge for further related studies.

In addition, as a contribution to the body knowledge, this research has promoted and demonstrated a decision support model for OCP where a potential ability of neuro-fuzzy integration in ANFIS was used. By determining the important key for international factors in OCPs and designing the OCP evaluation form, this

study presents a new method for supporting decision with multiple criteria in the context of international construction study.

Practically, the contribution is defined as a possibility which the finding and the results of this research may help newcomers to put their global visions by learning from the experiences of other companies. This research constitutes a significant endeavor in promoting OCPs for others Indonesian construction enterprises which initiate to expand their market size abroad. The contribution of this research based on its specific objectives are as follows:

1. Studying on the drives boosting enterprises to pursue OCPs helps companies to achieve their definite goals by planning their strategy efficiently.

2. Understanding on the types and the characteristics of each mode of entry may recover companies' resources, especially dealing with time and money from mistakes of a risky strategy implementation.

3. Examining the critical aspects for selection of potential OCPs or consideration of a bidding invitation assists companies to project their participation.

4. Facilitating companies in making decision process in a fuzzy environment can be achieved through the decision-making model proposed in this study.

6.5   Research Limitations

Numerous efforts have been devoted to minimize the errors and the fallacy in this research. However, the generalizability of its results is still subject to certain limitations relating to the scope, methodology, data analysis and decision-making tools. The major limitations that should be considered are revealed below.

First, the scope of research excluded the discussion on the organizational theories, the school of thought theoretically underlying the internationalization studies. Those theories are one of the important topics in the area of international businesses. In one side, explaining the organizational theories and its succeeding philosophy may aggrandize the research. In another side, it distorts the focus of the research. In similar reason, this research also omitted the hindrance factors hampering the Indonesian contractors for overseas expansion.

Second, the data of this research were collected using questionnaires completed by those who have a strategic position in large contractor companies in Jakarta, Indonesia. One of the shortages in this survey is there might be a personal bias of respondents caused by subjective views in their perception. This may or may

not reflect the reality which influences the objectivity of the responses. However, the survey has served initial findings on the internationalization issue from perspectives of Indonesian large contractor firms.

Third, this research is limited by the lack of record of the OCPs which have been undertaken by Indonesian contractors, while there were difficulties to collect such information from primary sources. To solve this problem, the simulation cases reflecting the OCPs' environment were created as a historical databank. Consequently, the generated data might be nor representative or biased-information. Thus, the model may or may not be genuine due to the involvedness of unknown variables.

It would be nice to generalize the findings to address the broader context of international construction. However, the current study focused on the specific context which is applicable to Indonesia. Different economic jurisdictions may be subject to different variants which may need some tailor-made adjustments. Nevertheless, what might be generalized is that of the research methodology. For those who wish to examine OCPs in their own regions, they may adopt and replicate the research methodology developed in this study to conduct their own work. This may also facilitate benchmarking OCPs with different economies and regions.

Finally, this research used a combination of neural network and fuzzy logic, Adaptive Neuro-Fuzzy Inference System (ANFIS) to develop the decision model. This system fully depends on the given historical data to generate an ANFIS based go/not go model. In fact, different data enter to the system will produce different models. This system also needs a sufficient number of data in order to maximize its learning mechanism, so the produced model enables to accurately predict a new case. In consequence, the decision makers are restricted to incorporate a new factor or an attribute. In order to accommodate the new factor or attribute, the decision makers have to prepare a new data base containing the new factor and redevelop a new model.

6.6   Recommendation for Future Research

As indicated in research limitations, this study recommends more researches to extend the boundaries of knowledge and to modify the findings of this research. Several recommendations that can be given for further studies are expressed below.

1. This study has provided an empirical research of the Indonesian contractors' involvement in OCPs. Though this project expansions are still scanty, and they have not been exposed widely, this study successfully identified the motives triggering the internationalization of Indonesian large contractors. Unfortunately, the deterrent factors hampering this intention have not been covered in this discussion. Therefore, further researches investigating the hindrance factors impeding this mission would be very interesting and worthwhile.

2. Similarly, this study has investigated the preferred choice of entry strategy that can be adopted by Indonesian firms to join foreign markets. However, this study merely focused on each entry mode in isolation, ignoring underlying constructs which affect the choice of the entry mode. Therefore, future research should concentrate on treating this gap by considering the concepts of organizational theories such as eclectic paradigm and porter's diamond theory.

3. In the absence of the best method in construction management studies, it is suggested to employ other research approaches such as Focus Group Discussion in finding a consensus on the main motivations, entry modes and international factors by involving top management of the companies. In addition, in terms of analysis method, it is encouraged to use other techniques such as correlation analysis, factor analysis and structural equation modelling to modify the previous or to gain new findings.

4. There is always a risk of using simulation data that does not reflect a reality which can lead to biased results. For improving the accuracy of the model and to produce the definitive evidences, future trials assessing the real-life cases are advocated.

5. Lastly, the proposed ANFIS model presents a rapid and a straightforward to make a decision in OCPs based on five inputs and one output variable. If decision makers want to change or modify the variables or an attribute, specifically for the output, it is advised to utilize extended versions of ANFIS such as Coactive Neuro-Fuzzy Inference System (CANFIS) or multiple ANFIS (MANFIS).

APPENDIX A1: Questionnaire Sheet (English version)

THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學

DEPARTMENT OF
BUILDING & REAL ESTATE
建築及房地產學系
INTERNATIONAL · COLLABORATIVE · CONSTRUCTION

Mei 2015

Mr./Mrs. ....

Director of PT. ....
....
....

Invitation of survey on a research of the Indonesian contractors in the overseas projects

Dear Sir/Madam,

I am writing to request your help regarding a research topic as mentioned in the subject above. I am Wahyudi and I am currently a PhD student at Department of Building and Real Estate, the Hong Kong Polytechnic University, Hong Kong. I am conducting a research under supervision of Professor Albert PC. Chan.

Refer to the above subject, the objectives of this study are;
1. To investigate the most likely motivations encouraging Indonesian contractors to expand operation in overseas markets.
2. To investigate the preferred choice of entry modes adopted to enter overseas construction markets.
3. To determine the most important international factors considered by Indonesian contractors in making decision on overseas construction projects.
4. To develop a multi-criteria decision support system for making decision on overseas construction projects.

Due to the lack of information on Indonesian contractors in overseas, this study attempts to narrow such limitation.

I am therefore requesting that you or a member of your senior staff (preferably your Manager in charge overseas projects, if any) participates in this survey. Your company was selected because of among the large-size company in Indonesia and member of Indonesian Contractors Association. Your answers will be treated as confidential and used for the research purposes only.

The success of this research really depends on your contribution. We fully intend to share the findings of this study with the participants. Therefore, I am looking forward to your participation in this study and I thank you in advance.
Please feel free to contact me through email at <u>wahyudi.utama@   </u> if you have any inquiries.

Sincerely yours,

Wahyudi P. Utama   Prof. Albert P.C. Chan
PhD. Student   Supervisor
Dept. Building and Real Estate   Dept. Building and Real Estate
The Hong Kong Polytechnic University   The Hong Kong Polytechnic University
Hung Hom, Kowloon Hong Kong   Hung Hom, Kowloon Hong Kong.
                                          Email: albert.chan@

<u>Enclosures</u>: Questionnaire and return envelop

This questionnaire consists of 4 parts. Part A is a list of questions related to the profile of the respondents while the other parts relate to the respondent's opinion.

Instructions: Please answer each question by ticking (☑) the most appropriate option.

Part A: Profile of Respondent and Company

1.	Post of respondent	☐ Board of commissioner ☐ Board of director ☐ Head of department/division ☐ Other (Please state) _____
2.	Experience in the industry	☐ < 10 years　　☐ 10 - 20 years ☐ 21 - 30 years　☐ > 30 years
3.	Company's memberships	☐ AKI　　☐ GAPENSI　☐ BOTH
4.	Company's category	☐ State own　☐ National Private
5.	Year of company establishment	☐ < 10 years　☐ 10 - 20 years　☐ 21 - 30 years ☐ 31 - 40 years　☐ > 40 years
6.	Number of permanent staff	☐ < 250 staff　　☐ 251 − 500 staff ☐ 501 − 1000 staff　☐ > 1000 staff
7.	Type of company	☐ General contractor ☐ Specialist contractor (Please state) _____
8.	Having overseas projects	☐ YES　　☐ NO

Part B: Motivation for pursuing the overseas projects

1. The management decision to pursue overseas construction projects (OCPs) is usually underpinned by variety of strategic motivations. *Please indicate the level of importance of each motivational factor below which can encourage your company to expand the operation abroad according to a scale of 1 to 7 (1= the lowest and 7 = the highest).*

Motivational factors	1 the lowest	2	3	4	5	6	7 the highest
To increase profitability	☐	☐	☐	☐	☐	☐	☐
To balance growth	☐	☐	☐	☐	☐	☐	☐
To increase turnover	☐	☐	☐	☐	☐	☐	☐
To maintain shareholders' interest	☐	☐	☐	☐	☐	☐	☐
To expand/enlarge business	☐	☐	☐	☐	☐	☐	☐
To avoid saturation in domestic market	☐	☐	☐	☐	☐	☐	☐
To capitalize on booming market	☐	☐	☐	☐	☐	☐	☐
To capitalize on globalization	☐	☐	☐	☐	☐	☐	☐
To diversify company's risks	☐	☐	☐	☐	☐	☐	☐
To optimize use of resources	☐	☐	☐	☐	☐	☐	☐
To benefit competitive advantage	☐	☐	☐	☐	☐	☐	☐
To harness company expertise	☐	☐	☐	☐	☐	☐	☐
To actualize company's vision	☐	☐	☐	☐	☐	☐	☐
To respond project sponsor invitation	☐	☐	☐	☐	☐	☐	☐
To respond home government encouragement	☐	☐	☐	☐	☐	☐	☐
To gain international experience	☐	☐	☐	☐	☐	☐	☐

To be anchor player in host country	☐ ☐ ☐ ☐ ☐ ☐ ☐
Others, please state: _____ _____	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Part C: Entry Modes for overseas market expansion

Entry mode is an institutional arrangement which enables a company to penetrate into a foreign market. Base on the current situation and the experience of your company, *please indicate the importance of entry mode which prefer to support your company's expansion based on the scale of 1 to 7 (1= not important and 7 = extremely important).*

Entry mode	1 not important ⟶	2	3	4	5	6 extremely important	7
Strategic alliance (SA) - Create a mutual cooperation commitment in long term with other parties (local or overseas) for sharing resources, advantages and responsibilities.	☐	☐	☐	☐	☐	☐	☐
Local agent (LA) - Appoint an agent in host country where the agents provide some service such information about market conditions, projects, contracts and other assistance.	☐	☐	☐	☐	☐	☐	☐
Licensing (L) - Use other party's licenses in host country where the entrant has limited rights over the use of resources such as patents, technology, and management expertise.	☐	☐	☐	☐	☐	☐	☐
Joint Venture Company (JVC) - Establish new business entity permanently with foreign or local partners.	☐	☐	☐	☐	☐	☐	☐
Sole Venture Company (SVC) - Establish new company in overseas where the company's advantages and responsibilities fully owned by the founder.	☐	☐	☐	☐	☐	☐	☐
Branch Office (BO) - Open overseas branch which can carry out business activities either profit making or non-profit making.	☐	☐	☐	☐	☐	☐	☐
Representative Office (RO) - Open overseas representative office to carry out non-commercial business activities such as communication, promotion, or market research on behalf of the parent company.	☐	☐	☐	☐	☐	☐	☐
Joint Venture Project (JVP) - Cooperate with other companies to conduct a particular project in which the advantages and responsibilities are divided based on a contract.	☐	☐	☐	☐	☐	☐	☐
Sole Venture Project (SVP) - Compete directly against a project in which the advantages and responsibilities wholly owned company.	☐	☐	☐	☐	☐	☐	☐
BOT (Build-operate-transfer) /equity project - Finance and construct an infrastructure project in host country, operate it for a certain period and then hand over the ownership of project to the host government at the end of consensus.	☐	☐	☐	☐	☐	☐	☐
Others, please state: _____ _____	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐

Would you like to participate in an interview session?	☐ YES ☐ NO

"Thank you for your contribution and cooperation"

APPENDIX A2: Questionnaire Sheet (Indonesian version)

Perihal. *Survey penelitian tentang kontraktor Indonesia di proyek luar negeri*

Kepada Yth. ....

Direktur PT. ....
....

Dengan hormat,

Terlebih dahulu ijinkan saya untuk memperkenalkan diri. Saya, *Wahyudi P. Utama*, mahasiswa S3 yang sedang melaksanakan penelitian dalam rangka penyelesaian disertasi di Department of Building and Real Estate, The Hong Kong Polytechnic University (PolyU), Hong Kong.

Dalam dasawarsa terakhir, beberapa kontraktor nasional (BUMN dan Swasta) telah berekspansi dibeberapa negara di wilayah Timur Tengah, Afrika Utara dan Asia Tenggara. Sehubungan dengan itu, saya tertarik mengangkat topik ekspansi tersebut dengan judul disertasi "*The Overseas Construction Project Decision Making Using Fuzzy Neural Network for Indonesian Contractors*".

Penelitian ini bertujuan untuk:
1. Menginvestigasi motivasi yang mendasari kontraktor nasional mengejar Proyek Luar Negeri (PLN),
2. Menginvestigasi jenis *entry mode* yang diaplikasikan oleh kontraktor Indonesia untuk masuk ke PLN,
3. Mengeksaminasi faktor yang dipertimbangkan dalam memilih PLN potensial, dan
4. Membuat sebuah model system pendukung keputusan multi kriteria untuk mengambil keputusan salam PLN.

Memandang sangat sedikitnya informasi mengenai keterlibatan kontraktor nasional di PLN, penelitian ini mencoba berkontribusi untuk mengisi kekurangan informasi tersebut.

Sehubungan dengan hal tersebut, saya memohon bantuan Bapak/Ibu untuk menjadi salah seorang responden penelitian saya ini. Perusahaan Bapak/Ibu dipilih dengan pertimbangan adalah diantara perusahaan skala besar yang memiliki pengalaman atau berpotensi untuk berekspansi. Semua kerahasiaan informasi yang Bapak/Ibu berikan akan dijaga sepenuhnya dan hanya untuk tujuan penelitian ini saja.

Keberhasilan penelitian ini sangat bergantung pada kontribusi yang Bapak/Ibu berikan. Terima kasih sebelumnya saya ucapkan atas partisipasi Bapak/Ibu dalam penyelesaian studi saya ini. Saya juga sangat senang untuk berbagi hasil penelitian ini nantinya kepada Bapak/Ibu responden sebagai ucapan terima kasih. Jika ada hal-hal yang perlu ditanyakan, mohon menghubungi saya melalui email wahyudi.utama@   atau Hp. 0822 8178 .

Hormat saya,

Wahyudi P. Utama   Prof. Albert P.C. Chan
PhD. Student   Supervisor
Dept. Building and Real Estate   Dept. Building and Real Estate
The Hong Kong Polytechnic University   The Hong Kong Polytechnic University
Hung Hom, Kowloon Hong Kong   Hung Hom, Kowloon Hong Kong.
                                         Email: albert.chan@

Terlampir: Daftar pertanyaan dan amplop pengembalian

PERTANYAAN

Kuisioner ini terdiri dari 4 bagian. Bagian A adalah daftar pertanyaan yang berhubungan dengan profil responden sementara bagian lainnya berkaitan dengan opini.

Instruksi: **Centanglah (☑) pada kotak untuk jawaban yang sesuai.**

Part A: Profil Responden and Perusahaan

1.	Posisi responden	☐ Dewan komisaris ☐ Dewan direktur ☐ Kepala departemen/divisi ☐ Lainnya, nyatakan: _____
2.	Pengalaman diindustri konstruksi	☐ < 10 tahun ☐ 10 - 20 tahun ☐ 21 - 30 tahun ☐ > 30 tahun
3.	Keanggotaan organisasi	☐ AKI ☐ GAPENSI ☐ Keduanya
4.	Kategori perusahaan	☐ BUMN ☐ Swasta nasional
5.	Umur perusahaan	☐ < 10 tahun ☐ 10 - 20 tahun ☐ 21 - 30 tahun ☐ 31 - 40 tahun ☐ > 40 tahun
6.	Jumlah karyawan tetap	☐ < 250 staf ☐ 251 – 500 staf ☐ 501 – 1000 staf ☐ > 1000 staf
7.	Jenis perusahaan	☐ Kontraktor umum ☐ Kontraktor spesialis, nyatakan: _____
8.	Memiliki proyek di luar negeri	☐ YA ☐ TIDAK

Part B: Motivasi berekspansi ke luar negeri

1. Keputusan manajemen untuk mendapatkan proyek di luar negeri (PLN) selalunya dilandasi oleh beberapa motivasi strategis. Berikut ini adalah faktor yang memotivasi perusahaan untuk mengejar PLN. *Nyatakanlah tingkat kepentingan dari faktor motivasi berikut yang dapat mendorong perusahaan anda berekspansi ke luar negeri berdasarkan skala 1 (tidak penting) hingga 7 (sangat penting).*

Motivasi	1 tidak penting	2	3	4	5	6	7 sangat penting
Untuk meningkatkan keuntungan perusahaan	☐	☐	☐	☐	☐	☐	☐
Untuk menyeimbangkan pertumbuhan perusahaan	☐	☐	☐	☐	☐	☐	☐
Optimalisasi pengunaan sumberdaya perusahaan	☐	☐	☐	☐	☐	☐	☐
Untuk meningkatan penjualan jasa (*service turnover*)	☐	☐	☐	☐	☐	☐	☐
Karena undangan dari negara sponsor	☐	☐	☐	☐	☐	☐	☐
Adanya dukungan dan insentif dari pemerintah	☐	☐	☐	☐	☐	☐	☐
Menjaga keuntungan pemegang saham	☐	☐	☐	☐	☐	☐	☐
Difersifikasi (penganekaragaman) aktivitas	☐	☐	☐	☐	☐	☐	☐
Menghindari kejenuhan di pasar domestik	☐	☐	☐	☐	☐	☐	☐
Untuk memperluas pangsa pasar perusahaan	☐	☐	☐	☐	☐	☐	☐
Untuk diversifikasi risiko perusahaan	☐	☐	☐	☐	☐	☐	☐
Peningkatan skala ekonomi perusahaan	☐	☐	☐	☐	☐	☐	☐
Meningkatkan keunggulan kompetitif perusahaan	☐	☐	☐	☐	☐	☐	☐
Booming proyek di pasar luar negri	☐	☐	☐	☐	☐	☐	☐

	1	2	3	4	5	6	7
Penguatan visi perusahaan	☐	☐	☐	☐	☐	☐	☐
Globalisasi industri	☐	☐	☐	☐	☐	☐	☐
Mengukuhkan nama perusahaan di luar negeri	☐	☐	☐	☐	☐	☐	☐
Lainnya, nyatakan: _____	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐

Part C: Entry Modes untuk ekspansi pasar luar negeri

Entry mode adalah moda pranata yang memungkinkan perusahaan berekspansi ke luar negeri. Berdasarkan pengalaman dan kondisi perusahaan anda saat ini, tunjukkan *Entry mode* yang dapat diaplikasikan perusahaan anda yang memungkinan mendapatkan proyek lebih cepat berdasarkan skala kepentingan 1 (tidak penting) hingga 7 (sangat penting).

Entry mode	1 tidak penting	2	3	4	5	6	7 sangat penting
Strategic alliance (SA) - Membuat suatu komitmen kerjasama yang saling menguntungkan dalam jangka panjang dengan pihak lain (lokal maupun luar negeri) dengan cara berbagi sumberdaya, keuntungan dan tanggungjawab.	☐	☐	☐	☐	☐	☐	☐
Local agent (LA) - Menunjuk pihak lain (agen) di LN dimana agen menyediakan informasi-informasi mengenai kondisi pasar, proyek, kontrak dan bantuan lain.	☐	☐	☐	☐	☐	☐	☐
Licensing (L) - Menggunakan lisensi pihak lain di LN dimana perusahaan memiliki hak terbatas atas penggunaan sumberdaya seperti paten, merek dagang, teknologi dan kepakaran manajemen.	☐	☐	☐	☐	☐	☐	☐
Joint Venture Company (JVC) - Membentuk sebuah perusahaan patungan permanen dengan mitra di LN.	☐	☐	☐	☐	☐	☐	☐
Sole Venture Company (SVC) - Langsung membuka perusahaan di LN dimana tanggungjawab dimiliki sepenuhnya oleh manajemen perusahaan.	☐	☐	☐	☐	☐	☐	☐
Branch Office (BO) - Membuka kantor cabang di LN yang dapat melaksanakan aktivitas bisnis baik yang bersifat *profit-making* atau *non-profit making.*	☐	☐	☐	☐	☐	☐	☐
Representative Office (RO) - Membuka kantor perwakilan di LN untuk melaksanakan aktivitas non-komersial seperti komunikasi bisnis, promosi atas nama perusahaan induk.	☐	☐	☐	☐	☐	☐	☐
Joint Venture Project (JVP) - Bekerjasama dengan perusahaan di LN untuk mengerjakan sebuah proyek tertentu dimana keuntungan dan tanggungjawab dibagi berdasarkan kontrak yang disepakati.	☐	☐	☐	☐	☐	☐	☐
Sole Venture Project (SVP) - Berkompetisi langung untuk sebuah proyek di LN dimana keuntungan dan tanggungjawab sepenuhnya dimiliki perusahaan.	☐	☐	☐	☐	☐	☐	☐
BOT (Build-operate-transfer) /equity project - Perusahaan mendanai dan membangun suatu proyek infrastruktur di LN, mengoperasikan infrastruktur tersebut untuk jangka waktu tertentu dan kemudian menyerahkan kepemilikan infrastruktur tersebut kepada pemerintah setempat setelah masa konsensus tamat.	☐	☐	☐	☐	☐	☐	☐
Lainnya silahkan disebutkan: _____	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐
Apakah anda bersedia untuk diwawancarai?	☐ YA			☐ TIDAK			

"Terima kasih atas kontribusi dan kerjasama anda"

APPENDIX B1: 1st Round Delphi Survey (English version)

Mr. ……..

……………..
....

Dear Sir/Madam,

INVITATION TO PARTICIPATE IN A DELPHI SURVEY OF THE INTERNATIONAL FACTORS IN MAKING DECISION FOR OVERSEAS CONSTRUCTION PROJECTS

I write to request your assistance as a practitioner in Indonesia with knowledge and experience in overseas construction projects to complete the attached questions. This is part of my PhD research at The Hong Kong Polytechnic University under the supervision of Prof. Albert P.C. Chan. This research aims to develop a multi-criteria decision support system for making decision on overseas construction projects.

For that purpose, this research adopts a **two-round Delphi survey** in order to share with us your knowledge and views on the determinant international factors in considering the overseas construction projects. This is Round one, and in the final round (i.e., Round two), you will be provided with controlled and anonymous feedback of all invited experts from round one and further be requested to review your opinions/ judgments in view of the consolidated opinions of all experts.

The questionnaire is simple, and takes (on average) between 15 minutes to complete. All responses to the survey will be treated in strict confidence and used solely for academic purposes. **I would be grateful if you could forward the questionnaire to potential practitioner/s who you feel would be able and willing to contribute to this research**.

The success of this research really depends on your contribution. I fully intend to share the findings of this study with the participants. Therefore, I am looking forward to your participation in this study and I thank you in advance. Please feel free to contact me through email at <u>wahyudi.utama@</u> if you have any inquiries.

Sincerely yours,

Wahyudi P. Utama   Prof. Albert P.C. Chan
PhD. Student   Supervisor
Dept. Building and Real Estate   Dept. Building and Real Estate
The Hong Kong Polytechnic University   The Hong Kong Polytechnic University
Hung Hom, Kowloon Hong Kong   Hung Hom, Kowloon Hong Kong.
                                         Email: albert.chan@

1st ROUND of DELPHI SURVEY

QUESTIONS

CODE:

Important Instructions:
1. Please, complete the questionnaire and;
2. The completed questionnaire will be collected in person by the research student in **2 weeks (and no later than 1/November/2015)**.
3. Please, provide your telephone number: …………………… and email address: ………………….
4. Please, email at: wahyudi.utama@   or contact me at 0811131   if you have any queries.

Part 1: Profile of Panelist

Please fill the blank

1.	Post of panelist	:
2.	Experience in the industry	:
3.	Number of involvement in OCPs	:
4.	Country explored in OCPs	:

Part 2: The following table provides the international factors in making decision on the overseas construction project

(A). Please, indicate **the important level of the international factors** based on a scale of 1 to 7 (**1= not important to 7 = very important**).

(B). Please, indicate **the frequency level of occurrence related to the factors** based on a scale of 1 to 7 (**1= very rare to 7 = very often**).

International factors	(A) The importance level							(B) Frequency level of risk occurrence						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Political stability and sensitiveness	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Legal environment	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Economic health and stability	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Cultural, custom and language differences	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Easiness and attitude toward foreign business	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Climate, weather and other natural condition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Availability of basic infrastructure	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Availability of local resources	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Importance of market	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Hostilities with neighboring country or region	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Cost of conducting business	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Client's reputation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Type of client	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

The existence of strict quality requirements	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Project location or distance from home country	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Project desirability to the host country	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Project scale/size	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Complexity of project	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Type of project	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Types of contract	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Quality and clarity of contract condition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Contractual duration	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Level of competition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Adverse site conditions	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Strict safety requirements	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Strict environmental regulations	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Relationship to stakeholders in host country	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Current workload and needs for work	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Company's tract record/experience	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Familiarity with host country	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Financial capability and support	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Others, please state: _____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

"Thank you for your contribution and cooperation"

APPENDIX B2: 1st Round Delphi Survey (Indonesian version)

THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學

DEPARTMENT OF
BUILDING & REAL ESTATE
建築及房地產學系
INTERNATIONAL · COLLABORATIVE · CONSTRUCTION

Oktober 2015

Perihal: *Undangan untuk berpartisipasi dalam survey Delphi untuk penelitian disertasi Pengambilan Keputusan untuk Proyek Konstruksi Luar Negeri.*

Kepada Yth. ....

…………..

....

Dengan hormat,

Bersama ini saya memohon bantuan Bapak sebagai seorang praktisi konstruksi di Indonesia dengan pengetahuan dan pengalaman pada proyek konstruksi di luar negeri. Ini merupakan bagian dari penelitian PhD saya dibawah bimbingan Prof. Albert P.C. Chan. Penelitian ini bertujuan untuk membangun sebuah system pendukung keputusan multi kriteria untuk mengambil keputusan pada proyek konstruksi luar negeri.

Untuk tujuan tersebut, penelitian ini menggunakan metode **survey Delphi 2 tahap** untuk memperoleh pengetahuan dan pandangan para pakar terhadap factor-faktor international yang menentukan dalam mempertimbangkan proyek konstruksi luar negeri. Ini adalah survey tahap pertama, dan pada tahap akhir (survey ke-2), anda akan diberikan hasil analisa tahap pertama dari semua pakar yang berkontribusi. Berdasarkan Analisa tersebut anda akan diminta untuk mempertimbangkan kembali jawaban anda di tahap satu untuk tujuan konsolidasi semua pendapat pakar yang terlibat.

Pertanyaan dalam angket ini tidak lebih dari 15 menit untuk menjawabnya. Semua jawaban yang diberikan akan dijaga kerahasiaan dan untuk tujaun akademis semata. **Saya dangat berharap jika Bapak bisa merekomendasikan angket ini pada rekan sejawat yang memiliki pengalaman di proyek luar negeri.**

Keberhasilan penelitian ini bergantung pada kontribusi yang Bapak berikan. Saya senang sekali untuk berbagi hasil penelitian ini nantinya dengan para kontributor. Jika ada pertanyaan yang ingin disampaikan, silahkan hubungi saya melalui email pada wahyudi.utama@ atau nomor 081113 . Terima kasih atas bantuan dan kerjasama yang diberikan.

Salam hormat,

Wahyudi P. Utama
PhD. Student
Dept. Building and Real Estate
The Hong Kong Polytechnic University
Hung Hom, Kowloon Hong Kong

Prof. Albert P.C. Chan
Supervisor
Dept. Building and Real Estate
The Hong Kong Polytechnic University
Hung Hom, Kowloon Hong Kong.
Email: albert.chan@

Terlampir: kuisioner

195

PERTANYAAN

KODE:

Instruksi penting:
1. Mohon lengkapi pertanyaan berikut
2. Pertanyaan yang telah diisi akan dikumpulkan oleh peneliti dalam 2 minggu atau setelah tanggal 1 November 2015.
3. Mohon tuliskan nomor kontak anda: ……………………… dan alamat email aktif: …………………..
4. Jika ada pertanyaan, mohon email ke: wahyudi.utama@   atau kontak ke nomor berikut (0811131   )

Bagian 1: Profil Panelis

Silahkan diisi pada bagian yang disediakan

1.	Posisi panelis	:
2.	Pengalaman di industri	:
3.	Jumlah keterlibatan di proyek luar negeri	:
4.	Negara yang pernah di eksplorasi untuk proyek luar negeri	:

Bagian 2: Berikut ini adalah table yang berisi Faktor-faktor international dalam mengambil keputusan pada proyek konstruksi di luar negeri.

(A). Silahkan pilih salah satu pilihan yang menunjukkan **tingkat kepentingan dari faktor-faktor international tersebut menurut skala 1 (tidak penting) hingga 7 (sangat penting).**

(B). Silahkan pilih salah satu pilihan yang menunjukkan **frekuensi kejadian risiko yang berhubungan dengan faktor-faktor tersebut menurut skala 1 (sangat jarang) hingga 7 (sangat sering)**

Faktor-faktor Internasional	(A) Derajat kepentingan							(B) Frekuensi kejadian risiko yang berhubungan denganfaktor tersebut						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Tingkat stabilitas politik	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Legal environment	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Stabilitas ekonomi	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Perbedaan budaya, kebiasaan dan bahasa	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Kemudahan dan pandangan terhadap bisnis asing	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Iklim, cuaca dan kondisi alam lainnya	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Ketersediaan infrastruktur dasar	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Ketersediaan sumberdaya lokal	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Kepentingan terhadap pasa	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Konflik dengan negara tetangga/regional	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Biaya menjalankan bisnis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Reputasi klien	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Jenis klien	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Persyaratan/permintaan yang ketat terhadap kualitas	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lokasi proyek / jarak dari Indonesia	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Kepentingan negara *host* terhadap proyek	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Skala/Ukuran proyek	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Tingkat kesukaran proyek	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Jenis proyek	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Jenis kontrak	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Kualitas dan kejelasan syarat-syarat kontrak	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Durasi kontrak	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Tingkat kompetisi	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Kondisi tapak yang tak jelasa	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Persyaratan/permintaan yang ketat untuk keselamatan	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Regulasi terhadap lingkungan yang ketat	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Hubungan baik dengan pemangku kepentingan di negara host	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Beban kerjaan dan kebutuhan akan kerja saat ini	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Track record dan pengalaman perusahaan	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pengetahuan terhadap negara host	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Kemampuan dan dukungan finansial	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lainnya, nyatakan:													
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

"Terima kasih atas kontribusi dan kerjasama anda"

APPENDIX C1: 2nd Round Delphi Survey (English version)

THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學

DEPARTMENT OF
BUILDING & REAL ESTATE
建築及房地產學系
INTERNATIONAL · COLLABORATIVE · CONSTRUCTION

December 2015

Mr. ……...

……………...
....

Dear Sir,

The 2nd round of Delphi survey on the International Factors in Making Decision for Overseas Construction Projects

We are very grateful for your participation and contribution in our 1st round Delphi survey. Please, this is the final round (i.e. 2nd round) and you are provided with controlled feedback of all invited experts and summary of results from 1st round.

Please, you are further requested to review or reconsider your opinions/ judgments/ scores in view of the consolidated opinions (mean scores) of all experts. Please, note that a **nil entry implies that you are happy with the original score in 1st round and no adjustment is necessary.** Your response will contribute a lot to this research.

We would be grateful if you are able to respond **within two week from today**. Thanking in anticipation of your kind assistance.

Sincerely yours,

Wahyudi P. Utama   Prof. Albert P.C. Chan
PhD. Student   Supervisor
Dept. Building and Real Estate   Dept. Building and Real Estate
The Hong Kong Polytechnic University The Hong Kong Polytechnic University
Hung Hom, Kowloon Hong Kong   Hung Hom, Kowloon Hong Kong.
                                     Email: albert.chan@

**STATISTICAL FEEDBACK OF ALL INVITED EXPERTS AND ADJUSTMENT OF
1 st ROUND SCORES**

CODE:

**The following table provides the international factors in making decision on the overseas
construction project**

Question (A).

Please, indicate **the important level of the international factors** based on a scale of 1 to 7 (**1= not
important to 7 = very important**).

International factors	Mean score of 11 panelists	Your score at 1st round	Your score at 2nd round — The importance level						
			1	2	3	4	5	6	7
Political stability and sensitiveness	6.73		☐	☐	☐	☐	☐	☐	☐
Legal environment	4.73		☐	☐	☐	☐	☐	☐	☐
Economic health and stability	5.64		☐	☐	☐	☐	☐	☐	☐
Cultural, custom and language differences	4.64		☐	☐	☐	☐	☐	☐	☐
Easiness and attitude toward foreign business	4.00		☐	☐	☐	☐	☐	☐	☐
Climate, weather and other natural condition	4.82		☐	☐	☐	☐	☐	☐	☐
Availability of basic infrastructure	4.91		☐	☐	☐	☐	☐	☐	☐
Availability of local resources	4.27		☐	☐	☐	☐	☐	☐	☐
Importance of market	4.36		☐	☐	☐	☐	☐	☐	☐
Hostilities with neighboring country or region	4.36		☐	☐	☐	☐	☐	☐	☐
Cost of conducting business	5.00		☐	☐	☐	☐	☐	☐	☐
Client's reputation	6.36		☐	☐	☐	☐	☐	☐	☐
Type of client	5.82		☐	☐	☐	☐	☐	☐	☐
The existence of strict quality requirements	4.18		☐	☐	☐	☐	☐	☐	☐
Project location or distance from home country	4.82		☐	☐	☐	☐	☐	☐	☐
Project desirability to the host country	4.18		☐	☐	☐	☐	☐	☐	☐
Project scale/size	6.18		☐	☐	☐	☐	☐	☐	☐
Complexity of project	5.45		☐	☐	☐	☐	☐	☐	☐
Type of project	5.73		☐	☐	☐	☐	☐	☐	☐
Types of contract	5.18		☐	☐	☐	☐	☐	☐	☐
Quality and clarity of contract condition	5.82		☐	☐	☐	☐	☐	☐	☐
Contractual duration	5.36		☐	☐	☐	☐	☐	☐	☐
Level of competition	4.45		☐	☐	☐	☐	☐	☐	☐
Adverse site conditions	4.27		☐	☐	☐	☐	☐	☐	☐
Strict safety requirements	4.18		☐	☐	☐	☐	☐	☐	☐
Strict environmental regulations	4.09		☐	☐	☐	☐	☐	☐	☐
Relationship to stakeholders in host	4.82		☐	☐	☐	☐	☐	☐	☐
Current workload and needs for work	4.91		☐	☐	☐	☐	☐	☐	☐
Company's tract record/experience	5.27		☐	☐	☐	☐	☐	☐	☐
Familiarity with host country	5.00		☐	☐	☐	☐	☐	☐	☐
Financial capability and support	5.45		☐	☐	☐	☐	☐	☐	☐

(B). Please, indicate **the frequency level of occurrence related to the factors** based on a scale of 1 to 7 (**1= very rare to 7 = very often**).

International factors	Mean score of 11 panelists	Your score at 1st round	Your score at 2nd round Frequency level of risk occurrence						
			1	2	3	4	5	6	7
Political stability and sensitiveness	3.64		☐	☐	☐	☐	☐	☐	☐
Legal environment	3.36		☐	☐	☐	☐	☐	☐	☐
Economic health and stability	4.82		☐	☐	☐	☐	☐	☐	☐
Cultural, custom and language differences	3.82		☐	☐	☐	☐	☐	☐	☐
Easiness and attitude toward foreign business	3.91		☐	☐	☐	☐	☐	☐	☐
Climate, weather and other natural condition	3.18		☐	☐	☐	☐	☐	☐	☐
Availability of basic infrastructure	2.82		☐	☐	☐	☐	☐	☐	☐
Availability of local resources	3.91		☐	☐	☐	☐	☐	☐	☐
Importance of market	3.64		☐	☐	☐	☐	☐	☐	☐
Hostilities with neighboring country or region	2.00		☐	☐	☐	☐	☐	☐	☐
Cost of conducting business	3.18		☐	☐	☐	☐	☐	☐	☐
Client's reputation	3.82		☐	☐	☐	☐	☐	☐	☐
Type of client	3.64		☐	☐	☐	☐	☐	☐	☐
The existence of strict quality requirements	3.36		☐	☐	☐	☐	☐	☐	☐
Project location or distance from home country	4.27		☐	☐	☐	☐	☐	☐	☐
Project desirability to the host country	2.09		☐	☐	☐	☐	☐	☐	☐
Project scale/size	5.91		☐	☐	☐	☐	☐	☐	☐
Complexity of project	6.09		☐	☐	☐	☐	☐	☐	☐
Type of project	5.09		☐	☐	☐	☐	☐	☐	☐
Types of contract	5.91		☐	☐	☐	☐	☐	☐	☐
Quality and clarity of contract condition	6.73		☐	☐	☐	☐	☐	☐	☐
Contractual duration	5.36		☐	☐	☐	☐	☐	☐	☐
Level of competition	4.09		☐	☐	☐	☐	☐	☐	☐
Adverse site conditions	4.09		☐	☐	☐	☐	☐	☐	☐
Strict safety requirements	2.27		☐	☐	☐	☐	☐	☐	☐
Strict environmental regulations	2.36		☐	☐	☐	☐	☐	☐	☐
Relationship to stakeholders in host country	2.64		☐	☐	☐	☐	☐	☐	☐
Current workload and needs for work	2.64		☐	☐	☐	☐	☐	☐	☐
Company's tract record/experience	2.09		☐	☐	☐	☐	☐	☐	☐
Familiarity with host country	3.45		☐	☐	☐	☐	☐	☐	☐
Financial capability and support	5.82		☐	☐	☐	☐	☐	☐	☐

"Thank you for your contribution and cooperation"

APPENDIX C2: 2nd Round Delphi Survey (Indonesian version)

Perihal: *Survey Delphi Tahap 2*

Kepada Yth. ....

…………..
....

Dengan hormat,

Kami sangat berterima kasih atas partisipasi dan kontribusi anda dalam survey Delphi Tahap 1. Dalam survey. Dalam survey Tahap 2 ini anda kami berikan hasil dari jawaban pada Tahap 1 sebagai referensi bagi anda dalam mempertimbangkan jawaban selanjutnya.

Selanjutnya kami memohon partisipasi anda pada Tahap 2 ini dengan memberikan skor yang sesuai setelah mempertimbangkan rerata dari jawaban 11 panelis. Mohon diperhatikan bahwa anda diperbolehkan untuk merubah skor yang anda berikan pada survey Tahap 1.

Kami berharap agar angket inin dapat kami ambil kembali setelah 2 minggu (awal Januari 2016). Kami sangat berterima kasih atas kontribusi anda dalam penelitian ini.

Salam hormat,

Wahyudi P. Utama   Prof. Albert P.C. Chan
PhD. Student   Supervisor
Dept. Building and Real Estate   Dept. Building and Real Estate
The Hong Kong Polytechnic University The Hong Kong Polytechnic University
Hung Hom, Kowloon Hong Kong   Hung Hom, Kowloon Hong Kong.
                                      Email: albert.chan@

RERATA SKOR DARI SURVEY DELPHI TAHAP 1

KODE:

Dengan mempertimbangkan rerata skor jawaban dari 11 panelis, berilah skor untuk pertanyaan dibawah ini.

Pertanyaan (A): Silahkan pilih salah satu skala yang menunjukkan **tingkat kepentingan dari faktor-faktor international tersebut menurut skala 1 (tidak penting) hingga 7 (sangat penting).**

International factors	Rerata dari 11 panelis	Skor anda di Tahap 1	Pilihan anda di Tahap 2 Tingkat kepentingan						
			1	2	3	4	5	6	7
Tingkat stabilitas dan sensitivitas politik	6.73		☐	☐	☐	☐	☐	☐	☐
Legal environment	4.73		☐	☐	☐	☐	☐	☐	☐
Stabilitas ekonomi	5.64		☐	☐	☐	☐	☐	☐	☐
Perbedaan budaya, kebiasaan dan bahasa	4.64		☐	☐	☐	☐	☐	☐	☐
Kemudahan dan pandangan terhadap bisnis asing	4.00		☐	☐	☐	☐	☐	☐	☐
Iklim, cuaca dan kondisi alam lainnya	4.82		☐	☐	☐	☐	☐	☐	☐
Ketersediaan infrastruktur dasar	4.91		☐	☐	☐	☐	☐	☐	☐
Ketersediaan sumberdaya lokal	4.27		☐	☐	☐	☐	☐	☐	☐
Kepentingan terhadap pasa	4.36		☐	☐	☐	☐	☐	☐	☐
Konflik dengan negara tetangga/regional	4.36		☐	☐	☐	☐	☐	☐	☐
Biaya menjalankan bisnis	5.00		☐	☐	☐	☐	☐	☐	☐
Reputasi klien	6.36		☐	☐	☐	☐	☐	☐	☐
Jenis klien	5.82		☐	☐	☐	☐	☐	☐	☐
Persyaratan/permintaan yang ketat terhadap kualitas	4.18		☐	☐	☐	☐	☐	☐	☐
Lokasi proyek / jarak dari Indonesia	4.82		☐	☐	☐	☐	☐	☐	☐
Kepentingan negara *host* terhadap proyek	4.18		☐	☐	☐	☐	☐	☐	☐
Skala/Ukuran proyek	6.18		☐	☐	☐	☐	☐	☐	☐
Tingkat kesukaran proyek	5.45		☐	☐	☐	☐	☐	☐	☐
Jenis proyek	5.73		☐	☐	☐	☐	☐	☐	☐
Jenis kontrak	5.18		☐	☐	☐	☐	☐	☐	☐
Kualitas dan kejelasan syarat-syarat kontrak	5.82		☐	☐	☐	☐	☐	☐	☐
Durasi kontrak	5.36		☐	☐	☐	☐	☐	☐	☐
Tingkat kompetisi	4.45		☐	☐	☐	☐	☐	☐	☐
Kondisi tapak yang tak jelas	4.27		☐	☐	☐	☐	☐	☐	☐
Persyaratan/permintaan yang ketat untuk keselamatan	4.18		☐	☐	☐	☐	☐	☐	☐
Regulasi terhadap lingkungan yang ketat	4.09		☐	☐	☐	☐	☐	☐	☐
Hubungan baik dengan pemangku kepentingan di negara host	4.82		☐	☐	☐	☐	☐	☐	☐
Beban kerjaan dan kebutuhan akan kerja saat ini	4.91		☐	☐	☐	☐	☐	☐	☐
Track record dan pengalaman perusahaan	5.27		☐	☐	☐	☐	☐	☐	☐
Pengetahuan terhadap negara host	5.00		☐	☐	☐	☐	☐	☐	☐
Kemampuan dan dukungan finansial	5.45		☐	☐	☐	☐	☐	☐	☐

Pertanyaan (B): Silahkan pilih salah satu pilihan yang menunjukkan **frekuensi kejadian risiko yang berhubungan dengan faktor-faktor tersebut menurut skala 1 (sangat jarang) hingga 7 (sangat sering)**

International factors	Rerata dari 11 panelis	Skor anda di Tahap 1	Pilihan anda di Tahap 2 — Frekuensi kejadian risiko yang berhubungan denganfaktor tersebut						
			1	2	3	4	5	6	7
Tingkat stabilitas sensitivitas politik	3.64		☐	☐	☐	☐	☐	☐	☐
Legal environment	3.36		☐	☐	☐	☐	☐	☐	☐
Stabilitas dan kesehatan ekonomi	4.82		☐	☐	☐	☐	☐	☐	☐
Perbedaan budaya, kebiasaan dan bahasa	3.82		☐	☐	☐	☐	☐	☐	☐
Kemudahan dan pandangan terhadap bisnis asing	3.91		☐	☐	☐	☐	☐	☐	☐
Iklim, cuaca dan kondisi alam lainnya	3.18		☐	☐	☐	☐	☐	☐	☐
Ketersediaan infrastruktur dasar	2.82		☐	☐	☐	☐	☐	☐	☐
Ketersediaan sumberdaya lokal	3.91		☐	☐	☐	☐	☐	☐	☐
Kepentingan terhadap pasa	3.64		☐	☐	☐	☐	☐	☐	☐
Konflik dengan negara tetangga/regional	2.00		☐	☐	☐	☐	☐	☐	☐
Biaya menjalankan bisnis	3.18		☐	☐	☐	☐	☐	☐	☐
Reputasi klien	3.82		☐	☐	☐	☐	☐	☐	☐
Jenis klien	3.64		☐	☐	☐	☐	☐	☐	☐
Persyaratan/permintaan yang ketat terhadap kualitas	3.36		☐	☐	☐	☐	☐	☐	☐
Lokasi proyek / jarak dari Indonesia	4.27		☐	☐	☐	☐	☐	☐	☐
Kepentingan negara *host* terhadap proyek	2.09		☐	☐	☐	☐	☐	☐	☐
Skala/Ukuran proyek	5.91		☐	☐	☐	☐	☐	☐	☐
Tingkat kesukaran proyek	6.09		☐	☐	☐	☐	☐	☐	☐
Jenis proyek	5.09		☐	☐	☐	☐	☐	☐	☐
Jenis kontrak	5.91		☐	☐	☐	☐	☐	☐	☐
Kualitas dan kejelasan syarat-syarat kontrak	6.73		☐	☐	☐	☐	☐	☐	☐
Durasi kontrak	5.36		☐	☐	☐	☐	☐	☐	☐
Tingkat kompetisi	4.09		☐	☐	☐	☐	☐	☐	☐
Kondisi tapak yang tak jelasa	4.09		☐	☐	☐	☐	☐	☐	☐
Persyaratan/permintaan yang ketat untuk keselamatan	2.27		☐	☐	☐	☐	☐	☐	☐
Regulasi terhadap lingkungan yang ketat	2.36		☐	☐	☐	☐	☐	☐	☐
Hubungan baik dengan pemangku kepentingan di negara host	2.64		☐	☐	☐	☐	☐	☐	☐
Beban kerjaan dan kebutuhan akan kerja saat ini	2.64		☐	☐	☐	☐	☐	☐	☐
Track record dan pengalaman perusahaan	2.09		☐	☐	☐	☐	☐	☐	☐
Pengetahuan terhadap negara host	3.45		☐	☐	☐	☐	☐	☐	☐
Kemampuan dan dukungan finansial	5.82		☐	☐	☐	☐	☐	☐	☐

"Terima kasih atas kontribusi dan kerjasama anda"

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APPENDIX D1: Evaluation Form (English version)

Mr. ……..

………………...
....

Dear Sir,

INVITATION TO PARTICIPATE IN THE EVALUATION OF OVERSEAS CONSTRUCTION PROJECTS

I write to request your assistance as an expert in Indonesia with knowledge and experience in overseas construction projects to complete the attached questions. This is part of my PhD research at The Hong Kong Polytechnic University under the supervision of Prof. Albert P.C. Chan. This research aims to develop a multi-criteria decision support system for making decision on overseas construction projects.

This research adopts the Adaptive Neuro-Fuzzy Inference System, an integration of Neural Network and Fuzzy Logic. For that purpose, it is needed a dataset of previous overseas construction projects (OCPs). Due to the limitation to find such data, I have provided 10 simulation cases representing the real cases of OCPs. Based on the parameter given to each criteria of a cases, you are requested to examine five attributes and make a decision on the case. Kindly please read the attached assumtions and instruction sheet before making the evaluation.

The success of this research really depends on your contribution. I fully intend to share the findings of this study with the participants. Therefore, I am looking forward to your participation in this study and I thank you in advance. Please feel free to contact me through email at wahyudi.utama@ _____ if you have any inquiries.

Sincerely yours,

Wahyudi P. Utama
PhD. Student
Dept. Building and Real Estate
The Hong Kong Polytechnic University
Hung Hom, Kowloon Hong Kong

Prof. Albert P.C. Chan
Supervisor
Dept. Building and Real Estate
The Hong Kong Polytechnic University
Hung Hom, Kowloon Hong Kong.
Email: albert.chan@

Enclosure: instruction, definition and evaluation form

ASSUMTIONS AND INSTRUCTION FOR EVALUATION OF OVERSEAS PROJECTS

1. This evaluation form constitutes an initial examination on an overseas project.

2. There are 10 different simulation cases to be evaluated by each expert.

3. Each simulation case represents an overseas construction project (OCP).

4. Each case has different characteristic which is marked by grey colour on particular boxes. For example:

$X_{1.2}$ Complexity of project

Low	Medium	High

This sample indicates that the complexity of OCP under evaluation is Medium.

5. You are free to make your own perception on each parameter given on each attribute based on your knowledge and experience.

6. Based on highlighted parameter of attributes, please *circle* or *cross* the most appropriate number of 1 (the lowest) to 9 (the highest) as your evaluation marks on each attribute following each group of attributes. For example:

$X_{3.1}$	Type of client	Host gov.	Host private	Home private	Home gov.
$X_{3.2}$	Client's reputation	Poor	Medium	Good	Excellence	UI
	Client score (X_3)	**(lowest)** 1 – 2 – 3 – 4 – 5 – 6 – 7 – (8) – 9 **(highest)**

This sample indicates that based on highlighted parameter, you considered to give score 8 for attribute Client. The lower a score you mark for a criterion, the worst your perspective on the criterion, and vise versa.

7. After examining all attributes (5 groups), you are requested to make decision on the given OCP case. You are advised to refer and consider the scores you put on each attribute.

    GO means that *you decide to pursue the project* and *prepare the further actions or assessment* such as markup rate and other strategies.

    NOT GO means that you are not interested on the project.

    Please cross on the appropriate answer.

8. Please call me at 0811131   or email at wahyudi.utama@   if you have any inquiries.

EVALUATION FORM OF OPC

Project code: ……..

Important: *If the given parameters are not reasonable and realistic, you no need to complete the evaluation.*

UI = Unidentified

	Criteria and Attributes	Parameter			
$X_{1.1}$	Project scale/size	Small	**Medium**	Large	Mega
$X_{1.2}$	Complexity of project	Low	**Medium**	High	
$X_{1.3}$	Type of project	**Never done before**	Few experience	Many experience	
$X_{1.4}$	Level of competition	Low	Medium	**High**	UI
$X_{1.5}$	Project location or distance from home country	Near	**Medium**	Far	
$X_{1.6}$	Adverse site condition	Low	Medium	High	**UI**
	Project score (X_1)	**(lowest) 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 (highest)**			
$X_{2.1}$	Types of contract	**Local standard**	Combination	International std	UI
$X_{2.2}$	Quality and clarity of contract condition	Low	**Medium**	High	UI
$X_{2.3}$	Contractual duration	**Short**	Medium	Long	UI
	Contract score (X_2)	**(lowest) 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 (highest)**			
$X_{3.1}$	Type of client	**Host gov.**	Host private	Home private	Home gov.
$X_{3.2}$	Client's reputation	Poor	Medium	**Good**	Excellence	UI
	Client score (X_3)	**(lowest) 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 (highest)**			
$X_{4.1}$	Political stability and sensitiveness	Poor	Medium	**Good**	Excellence	UI
$X_{4.2}$	Legal environment	Poor	Medium	**Good**	Excellence	UI
$X_{4.3}$	Economic health and stability	Poor	**Medium**	Good	Excellence	UI
$X_{4.4}$	Cultural, custom and language differences	Low	**Medium**	High	
$X_{4.5}$	Easiness and attitude toward foreign business	Poor	Medium	**Good**	Excellence	UI
	Host country score (X_4)	**(lowest) 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 (highest)**			
$X_{5.1}$	Availability of local resources	**Poor**	Medium	Good	Excellence	UI
$X_{5.2}$	Cost of conducting business	Low	Medium	**High**	Very high	UI
$X_{5.3}$	Importance of market	Low	Medium	**High**	
$X_{5.4}$	Familiarity with host country	Low	**Medium**	High	
$X_{5.5}$	Financial capability and support	Poor	Medium	**Good**	Excellence	
	Business score (X_5)	**(lowest) 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 (highest)**			
	Decision (Y)	GO	NOT GO			

"Thank you for your contribution and cooperation"

APPENDIX D2: Evaluation Form (Indonesian version)

THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學

DEPARTMENT OF
BUILDING & REAL ESTATE
建築及房地產學系
INTERNATIONAL • COLLABORATIVE • CONSTRUCTION

Mei 2016

Perihal: *Undangan berpatisipasi dalam evaluasi proyek-proyek konstruksi di luar negeri*

Kepada Yth. ....

…………..
....

Dengan hormat,

Bersama ini saya memohon bantuan Bapak sebagai seorang praktisi konstruksi di Indonesia dengan pengetahuan dan pengalaman pada proyek konstruksi di luar negeri. Ini merupakan bagian dari penelitian PhD saya dibawah bimbingan Prof. Albert P.C. Chan. Penelitian ini bertujuan untuk membangun sebuah system pendukung keputusan multi kriteria untuk mengambil keputusan pada proyek konstruksi luar negeri.

Penelitian ini menggunakan Adaptive Neuro-Fuzzy Inference System, gabungan dari system jaringan syaraf tiruan dan logika fuzzy. Untuk tujuan tersebut, dibutuhkan satu set data proyek-proyek konstruksi yang pernah dikerjakan oleh kontraktor Indonesia. Disebabkan kesukaran dalam mendapatkan data seperti itu, saya telah menyediakan 10 kasus simulasi yang mencerminkan kasus nyata dari proyek yang dimaksud. Berdasarkan parameter-parameter yang diberikan pada masing-masing kriteria dari kasus-kasus itu, anda diminta untuk menilai lima atribut dan mengambil satu keputusan yang sesuai. Mohon dibaca lembaran asumsi dan instruksi sebelum memulai evaluasi.

Keberhasilan penelitian ini bergantung pada kontribusi yang Bapak berikan. Saya senang sekali untuk berbagi hasil penelitian ini nantinya dengan para kontributor. Jika ada pertanyaan yang ingin disampaikan, silahkan hubungi saya melalui email pada wahyudi.utama@   atau nomor 0811131   . Terima kasih atas bantuan dan kerjasama yang diberikan.

Salam hormat,

Wahyudi P. Utama   Prof. Albert P.C. Chan
PhD. Student   Supervisor
Dept. Building and Real Estate   Dept. Building and Real Estate
The Hong Kong Polytechnic University   The Hong Kong Polytechnic University
Hung Hom, Kowloon Hong Kong   Hung Hom, Kowloon Hong Kong.
                                        Email: albert.chan@

Terlampir: lembaran asumsi dan insstruksi dan formulir evaluasi

ASUMSI DAN INSTRUKSI UNTUK MENGEVALUASI PROYEK-PROYEK KONSTRUKSI LUAR NEGERI

1. Formulir ini merupakan sebuah penilaian awal terhadap satu proyek luar negeri.

2. Ada 10 kasus simulasi yang berbeda untuk anda evaluasi.

3. Masing-masing kasus mewakili satu pryek konstruksi luar negeri.

4. Masing-masing kasus memiliki karakteristik yang berbeda yang ditandai dengan warna abu-abu pada kotak tertentu. Contoh:

$X_{1.2}$ Kompleksitas proyek	Rendah	Sedang	Tinggi

Contoh ini menunjukkan bahwa kompleksitas dari proyek tersebut adalah Sedang.

5. Anda diberi kebebasan untuk berpersepsi ke atas masing-masing kriteria yang diberikan berdasarkan pengetahuan dan pengalaman anda.

6. Berdasarkan parameter yang ditetapkan atas kriteria-kriteria, silahkan Lingkari atau Silangi angka yang anda rasa paling sesuai (1 untuk paling rendah hingga 9 untuk yang paling tinggi) sebagai skor evaluasi anda pada masing-masing atribut. Contoh:

$X_{3.1}$ Jenis klien	Host gov.	Host private	Home private	Home gov.
$X_{3.2}$ Reputasi klien	Buruk	Sedang	Baik	Terpercaya	UI
Skore Klien (X_3)	**(terendah) 1 – 2 – 3 – 4 – 5 – 6 – 7 – (8) – 9 (tertinggi)**			

Contoh di atas menunjukkan bahwa berdasarkan parameter yang diberikan, anda mempertimbangkan untuk memberikan nilai 8 untuk atribut Klien. Semakin rendah anda menilai sebuah kriteria, berarti kondisi atribute yang diberikan tidak ideal dengan perspektif anda.

7. Setelah menilai kelima atribut tersebut, anda diminta untuk mengambil keputusan ke atas kasus proyek konstruksi luar negeri yang diberikan. Anda disarankan untuk merujuk dan mempertimbangkan skor-skor yang telah anda berikan pada masing-masing atribut.

   GO berarti bahwa anda memutuskan untuk mempertimbangkan proyek tersebut dan mempersiapkan langkah atau asesmen selanjutnya seperti perhitungan mark up dan analisa starategi lainnya.

   NOT GO berarti bahwa anda tidak tertarik pada proyek tersebut.

   Silahkan Silangi salah satu dari kedua pilihan tersebut.

8. Jika anda memiliki keraguan, silahkan hubungi nomor 0811131   atau email ke wahyudi.utama@

FORMULIR EVALUASI

Kode proyek: ……..

Penting: *Jika parameter-parameter yang diberikan tidak masuk akal atau tidak realistis, anda tidak perlu memberikan evaluasi pada kasus yang bersangkutan.*

UI = Unidentified (Tidak teridentifikasi/tidak diketahui)

Kriteria dan Atribut	Parameter			
$X_{1.1}$ Skala/ukuran proyek	Kecil	**Sedang**	Besar	Mega
$X_{1.2}$ Kompleksitas proyek	Rendah	**Sedang**	Tinggi	
$X_{1.3}$ Jenis proyek	**Tdk ada pengalaman**	Sedikit pengalaman	Banyak pengalaman	
$X_{1.4}$ Level kompetisi	Rendah	Sedang	**Tinggi**	UI
$X_{1.5}$ Lokasi proyek dan jarak dari negara asal	Dekat	**Sedang**	Jauh	
$X_{1.6}$ Kondisi tapak yang tidak jelas	Rendah	Sedang	Tinggi	**UI**

Skor proyek (X_1)   (terendah) 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 (tertinggi)

$X_{2.1}$ Jenis kontrak	**Standard lokal**	Kombinasi	Stdr international	UI
$X_{2.2}$ Kualitas dan kejelasan syarat-syarat kontrak	Rendah	**Sedang**	Tinggi	UI
$X_{2.3}$ Durasi kontrak	**Pendek**	Sedang	Panjang	UI

Skor kontrak (X_2)   (terendah) 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 (tertinggi)

$X_{3.1}$ Jenis klien	**Pemerintah negara host**	Swasta negara host	Swasta negara asal	Pemerintah negara asal
$X_{3.2}$ Reputasi klien	Buruk	Sedang	**Baik**	Excellence	UI

Skor klien (X_3)   (terendah) 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 (tertinggi)

$X_{4.1}$ Tingkat stabilitas dan sensitivitas politik	Buruk	Sedang	**Baik**	Excellence	UI
$X_{4.2}$ Legal environment	Buruk	Sedang	**Baik**	Excellence	UI
$X_{4.3}$ Stabilitas dan kesehatan ekonomi	Buruk	**Sedang**	Baik	Excellence	UI
$X_{4.4}$ Perbedaan budaya, kebiasaan dan bahasa	Rendah	**Sedang**	Tinggi	
$X_{4.5}$ Kemudahan dan pandangan terhadap bisnis asing	Buruk	Sedang	**Baik**	Excellence	UI

Skor negara host (X_4)   (terendah) 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 (tertinggi)

$X_{5.1}$ Ketersediaan sumberdaya lokal	**Buruk**	Sedang	Baik	Excellence	UI
$X_{5.2}$ Biaya menjalankan bisnis	Rendah	Sedang	**Tinggi**	Sangat tinggi	UI
$X_{5.3}$ Kepentingan pasar	Rendah	Sedang	**Tinggi**	
$X_{5.4}$ Pengetahuan terhadap negara host	Rendah	**Sedang**	Tinggi	
$X_{5.5}$ Kemampuan dan dukungan keuangan	Buruk	Sedang	**Baik**	Excellence	

Skor bisnis (X_5)   (terendah) 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 (tertinggi)

Keputusan (Y) | GO | NOT GO |

"Terima kasih atas partisipasi dan kontribusi anda"

REFERENCES

Abdul-Aziz, A. R. (1991). *Global strategies of construction firms.* Doctoral dissertation, University of Reading, The United Kingdom.

Abdul-Aziz, A. R. (1994). Global strategies: A comparison between Japanese and American construction firms. *Construction Management and Economics,* 12(6), 473-484.

Abdul-Aziz, A. R. (2001). Unraveling of BOT scheme: Malaysia's indah water consortium. *Journal of Construction Engineering and Management,* 127(6), 457-460.

Abowitz, D. A. and Toole, T. M. (2009). Mixed method research: Fundamental issues of design, validity, and reliability in construction research. *Journal of Construction Engineering and Management*, 136(1), 108-116.

Adeli, H. (2001). Neural networks in civil engineering: 1989–2000. *Computer-Aided Civil and Infrastructure Engineering*, 16(2), 126-142.

Adeli, H. and Karim, A. (1997). Scheduling/cost optimization and neural dynamics model for construction. *Journal of Construction Engineering and Management*, 123(4), 450-458.

Adeli, H. and Park, H. S. (1996). Hybrid CPN–Neural Dynamics Model for Discrete Optimization of Steel Structures. *Computer-Aided Civil and Infrastructure Engineering*, 11(5), 355-366.

Adeli, H. and Wu, M. (1998). Regularization neural network for construction cost estimation. *Journal of Construction Engineering and Management*, 124(1), 18-24.

Adler, M. and Ziglio, E. (1996) *Gazing into the oracle: the Delphi method and its application to social policy and public health*, London: Jessica Kingsley Publishers.

Adya, M. and Collopy, F. (1998). How effective are neural networks at forecasting and prediction? A review and evaluation. *J. Forecasting*, 17, 481-495.

Agarwal, S. and Ramaswami, S. N. (1992). Choice of foreign market entry mode: Impact of ownership, location and internalization factors. *Journal of International Business Studies*, 1-27.

Ahmad, I. and Minkarah, I. (1988). Questionnaire survey on bidding in construction. *Journal of Management in Engineering*, 4(3), 229-243.

Ahmad, S. Z. and Kitchen, P. J. (2008). International expansion strategies of Malaysian construction firms: entry mode choice and motives for investment. *Problems and Perspectives in Management*, 3(3), 15-23.

Akadiri, O. P. (2011). *Development of a multi-criteria approach for the selection of sustainable materials for building projects*. Doctoral dissertation, University of Wolverhampton, The United Kingdom.

Akintoye, A. (2000). Analysis of factors influencing project cost estimating practice. *Construction Management and Economics*, 18, 77-89.

Akintoye, A. and Skitmore, M. (1992). Pricing approaches in the construction industry. *Industrial Marketing Management*, 21(4), 311-318.

Akintoye, A., Bowen, P. and Hardcastle, C. (1998). Macro-economic leading indicators of construction contract prices. *Construction Management & Economics,* 16(2), 159-175.

Aksoy, A., Ozturk, N. and Sucky, E. (2012). A decision support system for demand forecasting in the clothing industry. *International Journal of Clothing Science and Technology*, 24(4), 221-236.

Al-Khattab, A., Anchor, J. and Davies, E. (2007). Managerial perceptions of political risk in international projects. *International Journal of Project Management*, 25(7), 734-743.

Al-Tabtabai, H. and Alex, A. P. (2000). Modeling the cost of political risk in international construction projects. *Project Management Journal*, 31(3), 4-13.

Amadeo, K. (2012). *What is the Gross National Product?* Retrieved on August 10th, 2014 from http://useconomy.about.com/od/glossary/g/GNP.htm.

Ameyaw, E. E. (2014). *Risk allocation model for public private partnerships water supply projects in Ghana*. Doctoral dissertation, The Hong Kong Polytechnic University, Hong Kong.

Ameyaw, E. E. and Chan, A. P. (2015). Evaluating key risk factors for PPP water projects in Ghana: a Delphi study. *Journal of Facilities Management*, 13(2), 133-155.

Arditi, D. and Gutierrez, A. E. (1991). Performance of US contractors in foreign markets. *Construction Management and Economics,* 9(5), 431-449.

Arditi, D. and Tokdemir, O. B. (1999). Comparison of case-based reasoning and artificial neural networks. *Journal of Computing in Civil Engineering*, 13(3), 162-169.

Arditi, D., Oksay, F. E. and Tokdemir, O. B. (1998). Predicting the outcome of construction litigation using neural networks. *Computer‑Aided Civil and Infrastructure Engineering*, 13(2), 75-81.

Ashley, D. B. and Bonner, J. J. (1987). Political risks in international construction. *Journal of Construction Engineering and Management,* 113(3), 447-467.

Asnan, H. and Morledge, R. (2003). *Application of Delphi method on critical success factors in joint venture projects in the Malaysian construction industry.* In Proceeding: The 1st Scottish Conference for Postgraduate Researchers of the Built and Natural Environment. Glasgow, Scotland: Glasgow Caledonian University, pp. 41-49.

Astuti, E. D. (2009). *Pengantar jaringan saraf tiruan: Teori dan aplikasi.* Wonosobo, Indonesia: Star Publishing.

Atsalakis, G. S and Valavanis, K. P. (2009). Forecasting stock market short-term trnds using a neuro-fuzzy based methodology. *Expert Systems with Applications*, 36, 10696-10707.

Awil, A. and Abdul-Aziz, A. R. (2012). International markets: Malaysian construction contractors and the stage theory. *Australasian Journal of Construction Economics and Building*, 2(1), 94-106.

Babbie, E. R. (1990). *Survey research methods.* Belmont, California: Wadsworth Pub. Co.

Baccarini, D. (1996). The concept of project complexity—a review. *International Journal of Project Management,* 14(4), 201-204.

Badan Pembinaan Konstruksi (2012). *Mengintip pasar konstruksi di Timor Leste dan ASEAN dalam rangka memperluas pasar konstruksi Indonesia.* Buletin Badan Pembinaan Konstruksi, ed. 4th. Jakarta: BP Konstruksi.

Badger, W. and Mulligan, D. (1995). Rationale and benefits associated with international alliances. *Journal of Construction Engineering and Management,* 121(1), 100-111.

Baek, I. M., Bandopadhyaya, A. and Du, C. (2005). Determinants of market-assessed sovereign risk: Economic fundamentals or market risk appetite? *Journal of International Money and Finance,* 24(4), 533-548.

Bageis, A. S. and Fortune, C. (2009). Factors affecting the bid/no bid decision in the Saudi Arabian construction contractors. *Construction Management and Economics,* 27(1), 53-71.

Bailey, D. and Thompson, D. (1990). How to develop neural-network applications. *AI Expert*, 5(6), 38-47.

Baker, M. (1997). Membership categorization and interview accounts. In: Silverman, D. ed. *Qualitative Research: Theory, Method and Practice.* London: Sage. 130-143.

Ball, M. and Wood, A. (1995). How many jobs does construction expenditure generate? *Construction Management and Economics*, 13(4), 307-318.

Baloi, D. and Price, A. D. (2003). Modelling global risk factors affecting construction cost performance. *International Journal of Project Management*, 21(4), 261-269.

Barkema, H. G. and Vermeulen, F. (1997). What differences in the cultural backgrounds of partners are detrimental for international joint ventures? *Journal of International Business Studies*, 845-864.

Bhutto, A. W., Harijan, K., Qureshi, K., Bazmi, A. A. and Bahadori, A. (2015). Perspectives for the production of ethanol from lignocellulosic feedstock–A case study. *Journal of Cleaner Production*, 95, 184-193.

Bland, J. M. and Altman, D. G. (1997). Statistics notes: Cronbach's alpha. *Bmj*, 314(7080), 572.

Boddy, R and Smith, G. (2009). *Statistical methods in practice: for scientists and technologists.* Chichester, U.K.: Wiley.

Bojadziev, G. and Bojadziev, M. (2007). *Fuzzy logic for business, finance, and management.* Advance in Fuzzy Systems - Application and Theory, Vol. 23. 2nd ed. Singapore: World Scientific Publishing.

Bon, R. (1992). The future of international construction: Secular patterns of growth and decline. *Habitat International, 16*(3), 119-128.

Boussabaine, A. H. (1996). The use of artificial neural networks in construction management: a review. *Construction Management & Economics*, 14(5), 427-436.

BPS (Badan Pusat Statistik) (2006). *Pertumbuhan ekonomi Indonesia tahun 2005*. Berita Resmi Statistik No 9/IX/15 Februari 2006. Badan Pusat Statistik Republik Indonesia.

BPS (Badan Pusat Statistik) (2007). *Pertumbuhan ekonomi Indonesia tahun 2006.* Berita Resmi Statistik No. 10/02/Th. X, 16 Februari 2007. Badan Pusat Statistik Republik Indonesia.

BPS (Badan Pusat Statistik) (2008). *Pertumbuhan ekonomi Indonesia tahun 2007.* Berita Resmi Statistik No. 10/02/Th. XI, 15 Februari 2008. Badan Pusat Statistik Republik Indonesia.

BPS (Badan Pusat Statistik) (2009). *Pertumbuhan ekonomi Indonesia tahun 2008.* Berita Resmi Statistik No. 11/02/Th. XII, 16 Februari 2009. Badan Pusat Statistik Republik Indonesia.

BPS (Badan Pusat Statistik) (2010). *Pertumbuhan ekonomi Indonesia tahun 2009.* Berita Resmi Statistik No.12/02/Th. XIII, 10 Februari 2010. Badan Pusat Statistik Republik Indonesia.

BPS (Badan Pusat Statistik) (2011). *Pertumbuhan ekonomi Indonesia tahun 2010.* Berita Resmi Statistik No.12/02/Th. XIV, 7 Februari 2011. Badan Pusat Statistik Republik Indonesia.

BPS (Badan Pusat Statistik) (2012). *Pertumbuhan ekonomi Indonesia tahun 2011.* Berita Resmi Statistik No.13/02/Th. XV, 6 Februari 2012. Badan Pusat Statistik Republik Indonesia.

BPS (Badan Pusat Statistik) (2013). *Pertumbuhan ekonomi Indonesia tahun 2012.* Berita Resmi Statistik No.14/02/Th. XVI, 5 Februari 2013. Badan Pusat Statistik Republik Indonesia.

BPS (Badan Pusat Statistik) (2014). *Pertumbuhan ekonomi Indonesia tahun 2013.* Berita Resmi Statistik No.16/02/Th. XVII, 5 Februari 2014. Badan Pusat Statistik Republik Indonesia.

Brink, C. (2004). *Measuring political risk: risks to foreign investment*. England, USA: Ashgate Publishing Ltd.

Bubshait, A. and Almohawis, S. A. (1994). Evaluating the general conditions of a construction contract. *International Journal of Project Management*, 12(3), 133-136.

Buckley, P. J. and PN Ghauri, P. N. (1999). *The Internationalization of the firm, 2nd ed.* London: Thomson Learning.

Budiwibowo, A., Trigunasyah, B., Abidin, I. S. and Soeparto, H. G. (2009). Competitiveness of the Indonesian construction industry. *Journal of Construction in Developing Countries,* 14(1), 51-68.

Bu-Qammaz, A. S., Dikmen, I. and Birgonul, M. T. (2009). Risk assessment of international construction projects using the analytic network process. *Canadian Journal of Civil Engineering*, 36(7), 1170-1181.

Canuto, A. M. D. P. (2001). *Combining neural networks and fuzzy logic for applications in character recognition*. Doctoral dissertation, University of Kent at Canterbury.

Cattaneo, O. (2010). *International trade in services: new trends and opportunities for developing countries*. World Bank Publications.

Caves, R. E. (1982). *Multinational Enterprise and Economic Analysis*. New York: Cambridge University Press.

Center of Public Communication. (2012). *Perluasan pasar konstruksi ke ASEAN dan Timor Leste*. Retrieved on Apr 9, 2014 from www.pu.go.id/main/view_pdf/7658.

Cespedes, F. V. (1988). Channel management is general management. *California Management*, 31(1), 98-119.

Chan, A. P.C., Chan, D. W., Chiang, Y. H., Tang, B. S., Chan, E. H., and Ho, K. S. (2004). Exploring critical success factors for partnering in construction projects. *Journal of Construction Engineering and Management*, 130(2), 188-198.

Chan, A. P. C. and Cheung, E. (2014). *Public Private Partnerships in International Construction: Learning from Case Studies.* New York: Routledge and The Hong Kong Institute of Surveyors.

Chan, A. P. C. and Tam, C. M. (2000). Factors affecting the quality of building projects in Hong Kong. *International Journal of Quality & Reliability Management*, 17(4/5), 423-442.

Chan, A. P. C., Chan, D. W. and Yeung, J. F. (2009). Overview of the application of "fuzzy techniques" in construction management research. *Journal of Construction Engineering and Management,* 135(11), 1241-1252.

Chan, A. P. C., Yeung, J. F., Yu, C. C., Wang, S. Q. and Ke, Y. (2010). Empirical study of risk assessment and allocation of public-private partnership projects in China. *Journal of Management in Engineering*, 27(3), 136-148.

Chan, A. P. C., Yung, E. H., Lam, P. T., Tam, C. M. and Cheung, S. O. (2001). Application of Delphi method in selection of procurement systems for construction projects. *Construction Management & Economics*, 19(7), 699-718.

Chan, D. W. and Kumaraswamy, M. M. (2002). Compressing construction durations: lessons learned from Hong Kong building projects. *International Journal of Project Management*, 20(1), 23-35.

Chan, E. and Tse, R. (2003). Cultural considerations in international construction contracts. *Journal of Construction Engineering and Management,* 129(4), 375-381.

Chan, E. H., Suen, H. C. and Chan, C. K. (2006). MAUT-based dispute resolution selection model prototype for international construction projects. *Journal of Construction Engineering and Management,* 132(5), 444-451.

Chao, L. C. and Skibniewski, M. J. (1994). Estimating construction productivity: neural-network-based approach. *Journal of Computing in Civil Engineering*, 8(2), 234-251.

Chen, C. (2005). *Entry strategies for international construction markets*. Doctoral dissertation, Pennsylvania State University., USA.

Chen, C. (2008). Entry mode selection for international construction markets: The influence of host country related factors. *Construction Management and Economics,* 26(3), 303-314.

Chen, C. and Messner, J. I. (2009). Entry mode taxonomy for international construction markets. *Journal of Management in Engineering,* 25(1), 3-11.

Chen, C. and Messner, J. I. (2010). Permanent versus Mobile Entry Decisions in International Construction Markets: Influence of Home Country–and Firm-Related Factors. *Journal of Management in Engineering*, 27(1), 2-12.

Chen, C. and Messner, J. I. (2011). Characterizing entry modes for international construction markets: Paving the way to a selection model. *Engineering, Construction and Architectural Management,* 18(6), 547-567.

Chen, C. and Orr, R. (2009). Chinese contractors in Africa: Home government support, coordination mechanisms, and market entry strategies. *Journal of Construction Engineering and Management, 135*(11), 1201-1210.

Chen, C., Chiu, P., Orr, R. and Goldstein, A. (2007). *An empirical analysis of Chinese construction firms' entry into Africa.* In Proceeding: The International Symposium on Advancement of Construction Management and Real Estate, 8-13.

Cheng, M., Tsai, H. and Chuang, K. (2011). Supporting international entry decisions for construction firms using fuzzy preference relations and cumulative prospect theory. *Expert Systems with Applications,* 38(12), 15151-15158.

Chinyio, E. A., Olomolaiye, P. O., Kometa, S. T. and Harris, F. C. (1998). A needs-based methodology for classifying construction clients and selecting contractors. *Construction Management & Economics*, 16(1), 91-98.

Chua, D., Wang, Y. and Tan, W. (2003). Impacts of obstacles in east Asian cross-border construction. *Journal of Construction Engineering and Management,* 129(2), 131-141.

Contractor, F. J. (2012). Why do multinational firms exist? A theory note about the effect of multinational expansion on performance and recent methodological critiques. *Global Strategy Journal,* 2(4), 318-331.

Contractor, F. J. and Lorange, P. (1988). *Why should firms cooperate? The strategy and economics basis for cooperative ventures*. In Cooperative strategies in international business, Ed. Contractor, F. J. and Lorange, P. Lexington, USA: Lexington Books, 3-30.

Corona-Nakamura, M. A., Ruelas, R., Ojeda-Magana, B. and Andina, D. (2008). Classification of domestic water consumption using an ANFIS model. In Proceeding: World *Automation Congress, 2008, IEEE, WAC 2008.* 1-9.

Creswell, J. W. (2007). *Qualitative inquiry and research design: choosing among the five approaches*, 2nd (ed.). Californio, USA: Sage Publications,

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297-334.

Crosthwaite, D. (1998). The internationalization of British construction companies 1990-96: An empirical analysis. *Construction Management & Economics,* 16(4), 389-395.

Crosthwaite, D. (2000). The global construction market: A cross-sectional analysis. *Construction Management & Economics,* 18(5), 619-627.

Cuervo, J. C. and Pheng, L. S. (2003). Ownership advantages/disadvantages of Singapore transnational construction corporations. *Construction Management & Economics*, 21(1), 81-94.

Czaja, R. and Blair, J. (1996). *Designing surveys: a guide to decisions and procedures.* Thousand Oaks, California: Pine Forge Press.

Czinkota, M.R. and Ronkainen, I.A. (2004). *International Marketing*, 7th ed. Mason, Ohio: Thomson Learning.

Czinkota, M.R., Ronkainen, I. A., Ilkka, A. and Moffet, M. H. (2000). *International Business*. Orlando, Florida: Dryden Press.

Rocha, A. D., Christensen, C. H. and Cunha, C. E. D. (1990). Aggressive and passive exporters: a study in Brazilian furniture industry. *International Marketing Review.* 795) 6-15.

Dalkey, N., Brown, B. and Cochran, S. (1970). Use of self-ratings to improve group estimates: Experimental evaluation of Delphi procedures. *Technological Forecasting*, 1(3), 283-291.

Dawood, N. (1998). Estimating project and activity duration: a risk management approach using network analysis. *Construction Management and Economics*, 16(1), 41-48.

De Neufville, R., Scholtes, S. and Wang, T. (2006). Real options by spreadsheet: parking garage case example. *Journal of infrastructure systems*, 12(2), 107-111.

Debnath, J., Biswas, A., Sivan, P., Sen, K. N. and Sahu, S. (2016). Fuzzy inference model for assessing occupational risks in construction sites. *International Journal of Industrial Ergonomics*, 55, 114-128.

Deng, X., and Low, S. P. (2013). Exploring Critical Variables That Affect Political Risk Level in International Construction Projects: Case Study from Chinese Contractors. *Journal of Professional Issues in Engineering Education & Practice*, 140(1).

DeVellis R. (2003). *Scale development: theory and applications: theory and application*. Thousand Okas, CA: Sage.

Dikmen, I. and Birgonul, M. (2004). Neural network model to support international market entry decisions. *Journal of Construction Engineering and Management,* 130(1), 59-66.

Dikmen, I. and Birgonul, M. T. (2006). A review of international construction research: Ranko bon's contribution. *Construction Management and Economics,* 24(7), 725-733.

Dikmen, I., Birgonul, M. T. and Gur, A. K. (2006). A case-based decision support tool for bid mark-up estimation of international construction projects. *Automation in Construction,* 17(1), 30-44.

Dikmen, I., Birgonul, M. T. and Han, S. (2007). Using fuzzy risk assessment to rate cost overrun risk in international construction projects. *International Journal of Project Management,* 25(5), 494-505.

Dikmen, I., Birgonul, M. T., Ozorhon, B. and Sapci, N. E. (2010). Using analytic network process to assess business failure risks of construction firms. *Engineering, Construction and Architectural Management,* 17(4), 369-386.

Drew, D. and Skitmore, M. (1997). The effect of contract type and size on competitiveness in bidding. *Construction Management & Economics*, 15(5), 469-489.

Drew, D., Skitmore, M. and Lo, H. P. (2001). The effect of client and type and size of construction work on a contractor's bidding strategy. *Building and Environment*, 36(3), 393-406.

Du, H., Wang, R., Deng, D. and Liu, Y. (2012). *Clothing Comfort Evaluation Model Based on Adaptive Fuzzy Neural Network*. In Proceeding: Fourth International Conference on Digital Home (ICDH), 2012, IEEE. 128-132.

Dunning, J. H. (1988). The eclectic paradigm of international production: A restatement and some possible extensions. *Journal of International Business Studies,* 1-31.

Dunning, J.H. (2014). *The Globalization of Business (Routledge Revivals): The Challenge of the 1990s*. Routledge.

Ebrat, M. and Ghodsi, R. (2014). Construction project risk assessment by using adaptive-network-based fuzzy inference system: An empirical study. *KSCE Journal of Civil Engineering*, 18(5), 1213-1227.

Edmonds, G. A. (1979). Construction industry in developing countries, *The International Labor Review,* 118, 355.

Ekeledo, I. and Sivakumar, K. (1998). Foreign market entry mode choice of service firms: a contingency perspective. *Journal of the academy of marketing science*, 26(4), 274-292.

Ekici, B. B. and Aksoy, U. T. (2011). Prediction of building energy needs in early stage of design by using ANFIS. *Expert Systems with Applications*, 38(5), 5352-5358.

Enshassi, A., Arain, F. and Al-Raee, S. (2010). Causes of variation orders in construction projects in the Gaza Strip. *Journal of Civil Engineering and Management*, 16(4), 540-551.

Escrig-Olmedo, E., Fernández-Izquierdo, M. Á., Ferrero-Ferrero, I., León-Soriano, R., Muñoz-Torres, M. J. and Rivera-Lirio, J. M. (2013). Using fuzzy logic and

neural networks to classify socially responsible organisations. *Journal of Environmental Planning and Management*, 56(2), 238-253.

Eybpoosh, M., Dikmen, I. and Talat Birgonul, M. (2011). Identification of risk paths in international construction projects using structural equation modeling. *Journal of Construction Engineering and Management,* 137(12), 1164-1175.

Fatemi, A. M. (1984). Shareholder benefits from corporate international diversification. *Journal of Finance,* 39(5), 1325-1344.

Fayek, A. (1998). Competitive bidding strategy model and software system for bid preparation. *Journal of Construction Engineering and Management*, *124*(1), 1-10.

Fayek, A. R. and Oduba, A. (2005). Predicting industrial construction labor productivity using fuzzy expert systems. *Journal of Construction Engineering and Management*, 131(8), 938-941.

Fellows, R. F. and Liu, A. M. (2008). *Research methods for construction*. 3rd ed. Sussex, UK: Wiley-Blackwell.

Fellows, R., Hancock, M. and Seymour, D. (1994). Conflict resulting from cultural differentiation: an investigation of the new engineering contract. *CIB Report*, 259-259.

Field, A. (2009). *Discovering statistics using SPSS*. 2nd ed., Sage Publications.

Flanagan, R. and Norman, G. (1982). An examination of the tendering pattern of individual building contractors. *Building Technology and Management*, 20(4), 25-8.

Foster, G. (1986). *Financial statement analysis,* 2nd ed. London: Prentice-Hall.

Gad, G., Kalidindi, S., Shane, J. and Strong, K. (2011). Analytical framework for the choice of dispute resolution methods in international construction projects based on risk factors. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction,* 3(2), 79-85.

Galavi, H. and Shui, L. T. (2012). Neuro-fuzzy modelling and forecasting in water resources. *Scientific Research and Essays*, 7(24), 2112-2121.

Geringer, J. M. (1991). Strategic determinants of partner selection criteria in international joint ventures. *Journal of International Business Studies*, 41-62.

Gibson Jr, G. E. and Walewski, J. (2004). *Risks of international projects: Reward or folly?* Industry Study Association. Working paper. Retrieved on December 2nd, 2014 from http://isapapers.pitt.edu/53/1/2004-17_Gibson.pdf.

Giritli, H., Sozen, Z., Flanagan, R. and Lansley, P. (1990). International contracting: A Turkish perspective. *Construction Management and Economics,* 8(4), 415-430.

Global Construction Perspective and Oxford Economics (2015). *Global Construction 2030: A global forecast for the construction industry by 2030.* London, UK: Global Construction Perspective and Oxford Economics.

Goh, A. T. and Chua, C. G. (2012). Geotechnical Applications of Bayesian Neural Networks. *Metaheuristics in Water, Geotechnical and Transport Engineering*, 271.

Golmohammadi, D. (2011). Neural network application for fuzzy multi-criteria decision making problems. *International Journal of Production Economics*, 131(2), 490-504.

Goswami, S and Sarkar, M. (2014). Achieving Sustainable Growth - The Biggest Challenge. *Global Research Analysis*, 3(4), 28-29.

Government of Timor Leste. (2011). *Timor Leste Strategic Development Plan 2011-2030.* Retrieved on February 15th, 2014 from http://timor-leste.gov.tl/wp-content/uploads/2011/07/Timor-Leste-Strategic-Plan-2011-20301.pdf.

Government of Timor Leste. (2013). *2013 General State Budget.* Retrieved on February 15th, 2014 from http://www.laohamutuk.org/econ/OGE13/12OGE13.htm.

Griffin, R. (2010). *Diversify, diversify: Why spreading the risk is key to global investment.* Retrieved on March 20th, 2016 from http://www.independent.co.uk/money/spend-save/diversify-diversify-why-spreading-the-risk-is-key-to-global-investment-2034116.html

Guneri, A. F., Ertay, T. and Yucel, A. (2011). An approach based on ANFIS input selection and modeling for supplier selection problem. *Expert Systems with Applications,* 38, 14907-14917.

Gunhan, S. (2003). *Foreign market entry decision model for construction companies.* Doctoral dissertation, Illinois Institute of Technology, Chicago, US.

Gunhan, S. and Arditi, D. (2005a). Factors affecting international construction. *Journal of Construction Engineering and Management,* 131(3), 273-282.

Gunhan, S. and Arditi, D. (2005b). International expansion decision for construction companies. *Journal of Construction Engineering and Management,* 131(8), 928-937.

Gurney, K. (1997). *An introduction to neural networks.* Florida, USA: CRC press.

Hair, J. F., Anderson, R. E., Tatham, R. L. and Black, W. C. (2010). *Multivariate data analysis,* 6th ed. New Jersey, USA: Prentice Hall.

Hair, J. F., Hult, G. T. M., Ringle, C. M. and Sarstedt, M. (2017). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM),* 2nd ed. Thousand Oaks, CA: Sage.

Hallowell, M. (2008) A formal model of construction safety and health risk management. Ph.D dissertation, Oregon State Univ., Corvallis, Ore.

Hallowell, M. R. and Gambatese, J. A. (2010). Population and initial validation of a formal model for construction safety risk management. *Journal of Construction Engineering and Management*, *136*(9), 981-990.

Han, S. H, Diekmann, J. and Ock, J. (2005). Contractor's risk attitudes in the selection of international construction projects. *Journal of Construction Engineering and Management,* 131(3), 283-292.

Han, S. H, Park, S., Kim, D., Kim, H. and Kang, Y. (2007). Causes of bad profit in overseas construction projects. *Journal of Construction Engineering and Management,* 133(12), 932-943.

Han, S. H. (1999). *Risk-based Go/No-Go decision making model for international construction projects: The Cross-impact analysis approach*. Doctoral dissertation, University. of Colorado at Boulder, Boulder, USA.

Han, S. H. and Diekmann, J. E. (2001a). Approaches for making risk-based Go/No-go decision for international projects. *Journal of Construction Engineering and Management,* 127(4), 300-308.

Han, S. H. and Diekmann, J. E. (2001b). Making a risk-based bid decision for overseas construction projects. *Construction Management and Economics,* 19(8), 765-776.

Han, S. H., Diekmann, J., Lee, Y. and Ock, J. H. (2004). Multicriteria financial portfolio risk management for international projects. *Journal of Construction Engineering and Management,* 130(3), 346-356.

Han, S. H., Kim, D. Y. and Kim, H. (2007). Predicting profit performance for selecting candidate international construction projects. *Journal of Construction Engineering and Management,* 133(6), 425-436.

Han, S. H., Kim, D. Y., Kim, H. and Jang, W. (2008). A web-based integrated system for international project risk management. *Automation in Construction; 8th International Conference on Computer-Aided Engineering,* 17(3), 342-356.

Hart, P. E. and Oulton, N. (1996). Growth and size of firms. *The Economic Journal*, 1242-1252.

Hastak, M. and Shaked, A. (2000). ICRAM-1: Model for international construction risk assessment. *Journal of Management in Engineering,* 16(1), 59-69.

Hegazy, T. and Moselhi, O. (1994). Analogy-based solution to markup estimation problem. *Journal of Computing in Civil Engineering*, 8(1), 72-87.

Hill, C. W., Hwang, P. and Kim, W. C. (1990). An eclectic theory of the choice of international entry mode. *Strategic Management Journal,* 11(2), 117-128.

Hill, C.W.L. (2000). Global business today, McGraw-Hill, New York, U.S.

Hipel, K. W., Radford, K. J. and Fang, L. (1993). Multiple participant-multiple criteria decision making. *Systems, Man and Cybernetics, IEEE Transactions on*, 23(4), 1184-1189.

Holt, G. D. (1998). Which contractor selection methodology? *International Journal of Project Management*, 16(3), 153-164.

Hon, C. K., Chan, A. P., and Wong, F. K. (2010). An analysis for the causes of accidents of repair, maintenance, alteration and addition works in Hong Kong. *Safety Science*, 48(7), 894-901.

Hsu, C. and Sandford, B. A. (2007) The Delphi technique: making sense of consensus. *Practical Assessment Research & Evaluation*, 12(10), 1-8.

Huda, M., and Wibowo, M. A. (2013). Strategies, Performance, Sustainability and Competitiveness Model: Small and Medium Construction Services Industries in Indonesia. *World Applied Sciences Journal*, 25(8), 1186-1196.

Husaini, H. W. (2015). *Pemerintah akan pangkas jumlah perusahaan kontraktor umum.* Retrieved on January 22nd, 2015 from http://www.cnnindonesia.com/ekonomi/20150122170913-92-6604/pemerintah-akan-pangkas-jumlah-perusahaan-kontraktor-umum/.

Ibbs, C. W., Ashley, D. B., Neil, J. M. and Feiler, F. W. (1987). An implementation strategy for improving project control systems. In *Project Controls: Needs and Solutions*, ASCE, 101-112.

Iraji, M. S., Aboutalebi, M., Seyedaghaee, N. R. and Tosinia, A. (2012). Students classification with adaptive neuro fuzzy. *International Journal of Modern Education and Computer Science*, 4(7), 42.

Jaafari, A. (1984). Construction management know-how for transnational projects. *International Journal of Project Management*, 2(4), 198-206.

Jang, J.S. (1993). ANFIS: adaptive-network-based fuzzy inference system. *IEEE transactions on systems, man, and cybernetics*, 23(3), 665-685.

Jarkas, A. M., Mubarak, S. A. and Kadri, C. Y. (2014). Critical Factors Determining Bid/No Bid Decisions of Contractors in Qatar. *Journal of Management in Engineering*.

Jato-Espino, D., Castillo-Lopez, E., Rodriguez-Hernandez, J. and Canteras-Jordana, J. C. (2014). A review of application of multi-criteria decision making methods in construction. *Automation in Construction,* 45, 151-162.

Javernick-Will, A. and Levitt, R. E. (2010). Mobilizing institutional knowledge for international projects. *Journal of Construction Engineering and Management*, 136(4), 430-441.

Johanson, J. and Vahlne, J. E. (1977). The internationalization process of the firm: a model of knowledge development and increasing foreign market commitments. *Journal of International Business,* 8(1), 23-32.

Joshi, R. M. (2009). *International business*. Oxford, UK: Oxford University Press.

Jung, W., Han, S. and Lee, K. (2012). Country portfolio solutions for global market uncertainties. *Journal of Management in Engineering,* 28(4), 372-381.

Kaming, P. F., Olomolaiye, P. O. and Holt, G. D. (1997). Factors influencing construction time and cost overruns on high-rise projects in Indonesia. *Construction Management & Economics*, *15*(1), 83-94.

Kangari, R. (1988). Business failure in construction industry. *Journal of construction Engineering and Management*, 114(2), 172-190.

Kangari, R. and Lucas, C. L. (1997). *Managing international operations: A guide for engineers, architects, and construction managers.* New York: American Society of Civil Engineers.

Kapila, P. and Hendrickson, C. (2001). Exchange rate risk management in international construction ventures. *Journal of Management in Engineering,* 17(4), 186-191.

Karim, A. and Adeli, H. (1999). CONSCOM: An OO construction scheduling and change management system. *Journal of Construction Engineering and Management*, 125(5), 368-376.

Kartam, N., Al-Mutairi, N., Al-Ghusain, I. and Al-Humoud, J. (2004). Environmental management of construction and demolition waste in Kuwait. *Waste Management* 24(10), 1049-1059.

Kaynak, E. and Dalgic, T. (1992). Internationalization of Turkish construction companies-a lesson for third-world countries. *Columbia Journal of World Business,* 26(4), 60-75.

Ke, Y., Wang, S., Chan, A. P., and Cheung, E. (2011). Understanding the risks in China's PPP projects: ranking of their probability and consequence. *Engineering, Construction and Architectural Management*, 18(5), 481-496.

Khameneh, N. B., Arabalibeik, H., Salehian, P. and Setayeshi, S. (2012). Abnormal red blood cells detection using adaptive neuro-fuzzy system. In *MMVR*, 30-34.

Kim, W. J. and Lyn E. D. (1986). Excess market value, the multinational corporation and Tobin's q-ratio. *Journal of International Business Studies*, 17(1):,119-125.

Kim, D., Ashuri, B. and Han, S. (2013). Financial valuation of investments in international construction markets: Real-options approach for market-entry decisions. *Journal of Management in Engineering,* 29(4), 355-368.

Kim, D., Han, S. and Kim, H. (2008). Discriminant analysis for predicting ranges of cost variance in international construction projects. *Journal of Construction Engineering and Management,* 134(6), 398-410.

Kline P. (1994). *An easy guide to factor analysis.* New York: Routledge.

Klir, G. J., and Yuan, B. (1995). *Fuzzy set and fuzzy logic*. Englewood Cliffs, USA: Prentice Hall.

Konstruksi. (2012). *Kontraktor nasional sanggup berkiprah di dunia konstruksi internasional.* Retrieved on April 9th, 2014 from http://www.majalahkonstruksi.com/?p=78.

Korhonen, P., Moskowitz, H. and Wallenius, J. (1992). Multiple criteria decision support-A review. *European Journal of Operational Research*, 63(3), 361-375.

Krosnick, J. A. and Fabrigar, L. R. (1997). Designing rating scales for effective measurement in surveys. *Survey measurement and process quality*, 141-164.

Kuo, R. J. (1998). A decision support system for the stock market through integration of fuzzy neural networks and fuzzy Delphi. *Applied Artificial Intelligence*, *12*(6), 501-520.

Kurnaz, S., Cetin, O. and Kaynak, O. (2010). Adaptive neuro-fuzzy inference system based autonomous flight control of unmanned air vehicles. *Expert Systems with Applications*, 37(2), 1229-1234.

Kusumadewi, S. (2002). *Analisis & design sistem fuzzy (Menggunakan Toolbox Matlab).* Yogyakarta, Indonesia: Graha Ilmu.

Kusumadewi, S. and Purnomo, H. (2004). *Aplikasi logika fuzzy untuk pendukung keputusan*. Yogyakarta, Indonesia: Graha Ilmu.

Lam, K. C. and Chow, W. S. (1999). The significance of financial risks in BOT procurement. *Building Research & Information*, 27(2), 84-95.

Lam, P. T., Chan, A. P.C., Wong, F. K., and Wong, F. W. (2007). Constructability rankings of construction systems based on the analytical hierarchy process. *Journal of Architectural Engineering*, 13(1), 36-43.

Lam, K. C., Tang, C. M. and Lee, W. C. (2005). Application of the entropy technique and genetic algorithms to construction site layout planning of medium-size projects. *Construction Management and Economics*, 23(2), 127-145.

Lam, K., Hu, T., Thomas Ng, S., Skitmore, M. and Cheung, S. (2001). A fuzzy neural network approach for contractor prequalification. *Construction Management & Economics,* 19(2), 175-188.

Latief, Y., Wibowo, A. and Iswara, W. (2013). Preliminary cost estimation using regression analysis incorporated with adaptive neuro fuzzy inference system. *International Journal of Technology*, 1, 63-72.

Le, Y., Shan, M., Chan, A. P. and Hu, Y. (2014). Investigating the causal relationships between causes of and vulnerabilities to corruption in the Chinese public construction sector. *Journal of Construction Engineering and Management*.

Lee, A. S. (1991). Integrating positivist and interpretive approaches to organizational research. *Organization Science*, 2(4), 342-365.

Leftwich, R. B. (1974). US Multinational companies: Profitability, financial leverage and income tax rates. *Survey of Current Business*, 5, 27-36.

Leisch, F., Jain, L. C. and Hornik, K. (1998). Cross-validation with active pattern selection for neural-network classifiers. *IEEE Transactions on Neural Networks*, 9(1), 35-41.

Li, H., Jin, Z., Li, V., Liu, G. and Skitmore, R. M. (2013). An entry mode decision-making model for the international expansion of construction enterprises. *Engineering, Construction and Architectural Management,* 20(2), 160-180.

Lin, C. T. and Chen, Y. T. (2004). Bid/no-bid decision-making–a fuzzy linguistic approach. *International Journal of Project Management*, 22(7), 585-593.

Lin, C. T. and Lee, C. G. (1996). *Neural fuzzy systems*. Eaglewood Cliffs, USA: PTR Prentice Hall.

Ling, F. Y. Y. (2005). Global factors affecting margin-size of construction projects. *Journal of Construction Research,* 6(01), 91-106.

Ling, F. Y. Y. and Hoang, V. T. P. (2010). *Political, economic, and legal risks faced in international projects: Case study of Vietnam* American Society of Civil Engineers.

Ling, F. Y. Y. and Hoi, L. (2006). Risks faced by Singapore firms when undertaking construction projects in India. *International Journal of Project Management,* 24(3), 261-270.

Ling, F. Y. Y. and Lim, H. L. (2007). Foreign firms' financial and economic risk in China. *Engineering, Construction and Architectural Management,* 14(4), 346-362.

Ling, F. Y. Y. and Low, S. P. (2007). Legal risks faced by foreign architectural, engineering, and construction firms in China. *Journal of Professional Issues in Engineering Education and Practice,* 133(3), 238-245.

Ling, F. Y. Y., William Ibbs, C. and Cuervo, J. C. (2005). Entry and business strategies used by international architectural, engineering and construction firms in China. *Construction Management and Economics,* 23(5), 509-520.

Ling, F. Y. Y., William Ibbs, C. and Kumaraswamy, M. (2005). Enablers that help foreign architectural, engineering, and construction firms win construction contracts in China. *Journal of Management in Engineering,* 21(2), 63-69.

Liu, M. and Ling, F. Y. Y. (2003). Using fuzzy neural network approach to estimate contractors' markup. *Building and Environment*, 38(11), 1303-1308.

Logue, D. E. (1982). An experiment in international diversification. *The Journal of Portfolio Management*, 9(1), 22-27.

Lopez-Rojas, E. A. and Axelsson, S. (2012). Money laundering detection using synthetic data. *Proceeding at the 27th Annual Workshop of the Swedish Artificial Intelligence Society (SAIS).* Örebro; Sweden, 14-15 May 2012, Linköping University Electronic Press, No. 071, 33-40.

Love, P. E., Holt, G. D. and Li, H. (2002). Triangulation in construction management research. *Engineering Construction and Architectural Management*, 9(4), 294-303.

Lundin, E., Kvarnström H. and Jonsson E. (2002) A Synthetic Fraud Data Generation Methodology. In: Deng R., Bao F., Zhou J., Qing S. (eds) *Information and Communications Security. ICICS 2002*. Lecture Notes in Computer Science, vol 2513. Springer, Berlin, Heidelberg.

Luo, Y. (2001). Determinants of entry in an emerging economy: A multilevel approach. *Journal of Management Studies*, 38(3), 443-472.

Luo, Y., and Tung, R. L. (2007). International expansion of emerging market enterprises: A springboard perspective. *Journal of international business studies*, *38*(4), 481-498.

Luu, V. T., Kim, S. and Huynh, T. (2008). Improving project management performance of large contractors using benchmarking approach. *International Journal of Project Management*, 26(7), 758-769.

Madu, B.C. (2013). Vision: the relationship between a firm's strategy and business model. *Journal of Behavioral Studies in Business*, 6*, 1-9.

Maguire, L. P., Roche, B., McGinnity, T. M. and McDaid, L. J. (1998) Predicting a chaotic time series using a fuzzy neural network. *Inform Sciences*, 112 (1-4), 125-136.

Mahalingam, A. and Levitt, R. (2005). Understanding and mitigating challenges on global projects: the role of the freelance expatriate. *Proceeding at The ASCE Construction Research Congress*. ASCE, 248-253.

Maisel, R. and Persell, C. H. (1996). *How sampling works*. Thousand Oaks, California: Pine Forge Press.

Malhotra, R. and Malhotra, D. K. (2010). Evaluating consumer loans using neural networks. *Omega*, 31(2), 83-96.

Manoliadis, O., Tsolas, O. and. Kakou, A. (2006). Sustainable construction and drivers of change in Greece: a Delphi study. *Construction Management and Economics,* 24(2), 113–120.

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Maqsoom, A., Charoenngam, C., Masood, R., and Awais, M. (2014). Foreign market entry considerations of emerging economy firms: An example of Pakistani contractors. *Procedia Engineering*, 77, 222-228.

Martino, J. (1973) *Method of technological forecasting, assessing the future and policy planning*. Gordon and Breach Science Publisher, New York.

Marzouk, M. and Amin, A. (2013). Predicting construction materials prices using fuzzy logic and neural networks. *Journal of Construction Engineering and Management*, 139(9), 1190-1198.

Mastorocostas, P., Varsamis, D., Mastorocostas, C. and Hilas, C. (2005). A Recurrent Fuzzy Filter for Adaptive Noise Cancellation. *Proceeding of Computational Intelligence for Modelling, Control and Automation, and International Conference on Intelligent Agents, Web Technologies and Internet Commerce*, IEEE International Conference, vol. 1, 408–413.

Mat Isa, C.M., Adnan, H., Endut, I.R. and Basrah, N. (2006), "Malaysian contractors' opinions towards international market expansion", *Proceeding of International Conference in the Built Environment in the 21st Century*, Universiti Teknologi MARA, Kuala Lumpur, 13-15 June, Vol. 1, pp. 287-97.

Mawhinney, M. (2001). *International construction*. London: Blackwell Science Ltd.

Maznah, C.M., Hamimah A., Rohani I.E. and Noraliza B. (2006). Malaysian Contractors' Opinions Towards International Market Expansion. *Proceedings at International Conference in the Built Environment in the 21st Century (ICiBE)*, June 13th -15th, 2006, Kuala Lumpur, Malaysia.

McQueen, R. A. and Knussen, C. (2002). *Research methods for social science: A practical introduction*. Pearson Education.

Mendoza, G. A. and Martins, H. (2006). Multi-criteria decision analysis in natural resource management: a critical review of methods and new modelling paradigms. *Forest Ecology and Management*, 230(1), 1-22.

Menzies, J.L. and Orr, S.C. (2014). Internationalization to China: A Model for Australian Architectural, Engineering and Construction Firms. *International Journal of Construction Education and Research*, *10*(3), 201-221.

Messner, J. I. (1994). *An information framework for evaluating international construction projects*. Doctoral dissertation, Pennsylvania State University, USA.

Ming, S. (2015). *Holistic Evaluation of Corruption Issues in The Chinese Public Construction Sector*. PhD dissertation, The Hong Kong Polytechnic University, Hong Kong.

Moffatt, S., White, M., Mackintosh, J. and Howel, D. (2006). Using quantitative and qualitative data in health services research–what happens when mixed method findings conflict? *BMC Health Services Research*, 6(1), 28.

Moleong, L. J. (2010). *Metodologi Penelitian Kualitatif: Edisi Revisi*. Bandung, Indonesia: PT. Remaja Rosdakarya.

Momaya, K. and Selby, K. (1998). International competitiveness of the Canadian construction industry: a comparison with Japan and the United States. *Canadian Journal of Civil Engineering*, 25(4), 640-652.

Morova, N., Serin, S., Terzi, S. and Saltan, M. (2013). Prediction of the pavement serviceability ratio of rigid highway pavements by artificial neural networks. *Journal of Advanced Technology Sciences*, 2(1), 12-25.

Moselhi, O., Hegazy, T. and Fazio, P. (1991). Neural networks as tools in construction. *Journal of Construction Engineering and Management*, 117(4), 606-625.

Moselhi, O., Hegazy, T. and Fazio, P. (1992). Potential applications of neural networks in construction. *Canadian Journal of Civil Engineering*, 19(3), 521-529.

Moselhi, O., Hegazy, T. and Fazio, P. (1993). DBID: analogy-based DSS for bidding in construction. *Journal of Construction Engineering and Management*, 119(3), 466-479.

Moshiri, S. and Cameron, N. (2000). Neural Network Versus Econometric Models in Forecasting Ination. *J. Forecast*, 19, 201-217.

Muller, R. and Turner, J. R. (2007). Matching the project manager's leadership style to project type. *International Journal of Project Management*, 25(1), 21-32.

Munn, P. and Drever, E. (1990). Using questionnaires in small-scale research: A teachers' guide, SCRE, Edinburgh.

Mutti, D. N. C. and Flanagan, R. (2008). International construction and Brazilian contractors' operation. *Construction Information Quarterly,* 10(1), 19-24.

Nanus, B. (1996). Leading the vision team. *The Futurist*, 30(3), 21-23

Naoum, S. G. (2012). *Dissertation research and writing for construction students*. New York, USA: Routledge.

Nauck, D., Klawonn, F. and Kruse, R. (1997). Foundation of neural neuro-fuzzy systems. Sussex, UK: John Wiley & Sons Ltd.

Nayak, P. C., Sudheer, K. P., Rangan, D. M. and Ramasastri, K. S. (2005). Short-term flood forecasting with a Neurofuzzy model. *Water Resources Research*, 41(4).

Neo, R. B. (1976). *International construction contracting*. Hampshire, England: Gower Press Ltd.

Netemeyer, R. G., Bearden, W. O., and Sharma, S. (2003). *Scaling procedures: Issues and applications*, SAGE Publications Inc.

Ng, S. T., Luu, D. T., Chen, S. E. and Lam, K. C. (2002). Fuzzy membership functions of procurement selection criteria. *Construction Management & Economics,* 20(3), 285-296.

Ngowi, A. B., Pienaar, E., Talukhaba, A. and Mbachu, J. (2005). The globalisation of the construction industry—a review. *Building and Environment,* 40(1), 135-141.

Nielsen, K. R. (2012). Cross-Cultural Interviewing and Counseling: Client-Oriented Perspective between Japanese and American Partners. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, 5(1), 22-26.

Niskanen, V. S. (2004). *Soft computing methods in human sciences*. New York: Springer.

Nunnally, J. and Bernstein, L.(1994). *Psychometric theory*. New York: McGraw-Hill Higher, INC.

Odusote, O. and Fellows, R. (1992). An examination of the importance of resource considerations when contractors make project selection decisions. *Construction Management and Economics,* 10(2), 137-151.

OECD. (1997). *OECD Main Economic Indicators -Other Methodological Analysis Publications*. Retrieved on February 14th, 2012 from http://www.oecd.org/dataoecd/49/4/2372435.pdf.

Ofori, G. (2000). Globalization and construction industry development: Research opportunities. *Construction Management & Economics,* 18(3), 257-262.

Ofori, G. (2003). Frameworks for analysing international construction. *Construction Management and Economics,* 21(4), 379-391.

Ofori, G. and Chan, G. (2001). ISO 9000 Certification of Singapore construction enterprises: its costs and benefits and its role in the development of the industry. *Engineering, Construction and Architectural Management*, 8 (2): 145-157

Olcer, M. G. and Akyol, D. E. (2014). A MADM based decision support system for international contracting rating. *Journal of Intelligent & Fuzzy Systems,* 27, 2163-2175.

Oman, C. (1984). New *forms of international investment in developing countries*. Paris: OECD.

Oo, B. L., Lo, H. P. and Lim, B. T. H. (2012). The effect of bidding success in construction bidding. *Engineering, Construction and Architectural Management*, 19(1), 25-39.

Oster, S.M. (1999). *Modern Competitive Analysis*, 3rd ed., Oxford University Press, New York.

Oxford Economics. (2012). *Global industry forecast - construction*. Oxford, United States: Oxford Economics Ltd.

Ozorhon, B., Arditi, D., Dikmen, I. and Birgonul, M. (2010). Performance of international joint ventures in construction. *Journal of Management in Engineering,* 26(4), 209-222.

Ozorhon, B., Arditi, D., Dikmen, I. and Birgonul, M. T. (2007). Effect of host country and project conditions in international construction joint ventures. *International Journal of Project Management,* 25(8), 799-806.

Ozorhon, B., Arditi, D., Dikmen, I. and Birgonul, M. T. (2008). Implications of culture in the performance of international construction joint ventures. *Journal of Construction Engineering and Management,* 134(5), 361-370.

Ozorhon, B., Dikmen, I. and Birgonul, M. (2006). Case-based reasoning model for international market selection. *Journal of Construction Engineering and Management,* 132(9), 940-948.

Pamulu, M. S. (2010). *Strategic management practices in the construction industry: A study of Indonesian enterprises*. Doctoral dissertation. Queensland University of Technology, Brisbane, Australia.

Pan, Y. and Tse, D. K. (2000). The hierarchical model of market entry modes. *Journal of International Business Studies,* 535-554.

Pandya, A. M. and Rao, N. V. (1998). Diversification and firm performance: an empirical evaluation. *Journal of Financial and Strategic Decisions*, 11(2), 67-81.

Patel, D. and Parekh F. (2014). Flood Forecasting using Adaptive Neuro-Fuzzy Inference System. *International Journal of Engineering Trends and Technology*, 12(10), 510-514.

Pheng, L. S. (1996). *Theory and practice of construction export marketing*. Burlington, UK: Ashgate Publishing Company.

Pheng, L. S. and Hongbin, J. (2003). Internationalization of Chinese construction enterprises. *Journal of Construction Engineering and Management*, 129(6), 589-598.

Pheng, L. S. and Hongbin, J. (2004). Estimation of international construction performance: Analysis at the country level. *Construction Management and Economics,* 22(3), 277-289.

Polat, G., Bingol, B. N. and Uysalol, E. (2014). Modeling Bid/No bid decision using adaptive neuro fuzzy inference system (ANFIS): a case study. *Proceeding at Construction Research Congress 2014: Construction in a Global Network.* ASCE, 1083-1092.

Polat, K. and Gunes, S. (2007). An expert system approach based on principal component analysis and adaptive neuro-fuzzy inference system to diagnosis of diabetes disease. *Digital Signal Processing,* 17, 702-710.

Portas, J. and AbouRizk, S. (1997). Neural network model for estimating construction productivity. *Journal of Construction Engineering and Management*, 123(4), 399-410.

Porter, M. E. (1990). *The Competitive Advantage of Nations.* New York, US: Free Press.

Powell, C. (2003). The Delphi technique: myths and realities. *Journal of advanced nursing*, 41(4), 376-382.

PT Mitra Jaya Setia. (2013). *Cooperation of PT Mitra Jaya Setia group with Waskita Karya for Timor Leste.* Retrieved on April 9th, 2014 from https://www.mitrasetiajaya.com/cooperation.html

PT Waskita Karya. (2014). 2014 Annual report. Jakarta: PT Waskita Karya.

PT Wijaya Karya. (2009). *Proyek Wika di Aljazair jadi Rp 800 M*. Retrieved on April 9th, 2014 from http://www.wika.co.id/id/latest-news/the-wika%E2%80%99s-projects-in-alger-become-idr-800-billion/

PT Wijaya Karya. (2011). *Evacuation of WIKA's manpower done gradually*. Retrieved on April 9th, 2014 from http://www.wika.co.id/latest-news/evacuation-of-wikas-labors-done-gradually/

PT Wijaya Karya. (2014). 2014 Annual report. Jakarta: PT Wijaya Karya.

Pusbin SDI. (2014). *Center of Investment Resources Development, Ministry of Public Work, Republic of Indonesia*. Retrieved on February 10th, 2014 from http://pusbinsdi.net/.

Quak, S. K. (1989) Cover Story: Seeking niches in the international construction market. Construction Markets Digest, CIDB Singapore, 2-11.

Raftery, J., Pasadilla, B., Chiang, Y., Hui, E. C. and Tang, B. (1998). Globalization and construction industry development: Implications of recent developments in the construction sector in Asia. *Construction Management & Economics,* 16(6), 729-737.

Rajendran, S. and Gambatese, J. A. (2009) Development and initial validation of sustainable construction safety and health rating system. *Journal Construction Engineering Management,* 135(10), 1067-1075.

Refenes, A. N. (1995). *Neural network design considerations*, in Refenes, A. N. ed. Neural networks in the Capital Market, New York: John Wiley.

Reuber, A.R. and Fischer, E. (1997). The influence of the management team's international experience on the internationalization behaviors of SMEs. *Journal of International Business Studies*, 807-825.

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Roland, G. and Verdier, T. (2003). Law enforcement and transition. *European Economic Review,* 47(4), 669-685.

Rooke, J., Seymour, D. and Fellows, R. (2004). Planning for claims: an ethnography of industry culture. *Construction Management and Economics*, 22(6), 655-662.

Root, F. R. (1994). *Entry Strategies for International Markets.* Lexington, USA: Lexington Books.

Rowe, G. and Wright, G. (1999). The Delphi technique as a forecasting tool: issues and analysis. *International Journal of Forecasting*, 15(4), 353-375.

Saaty, T. L. (2005). The analytic hierarchy and analytic network processes for the measurement of intangible criteria and for decision-making. In *Multiple criteria decision analysis: state of the art surveys* (pp. 345-405). New York: Springer.

Samarasinghe, S. (2007). *Neural networks for applied science and engineering*. Florida, USA: Auerback Publications.

Sandelowski, M. (2000). Combining qualitative and quantitative sampling, data collection and analysis techniques in mixed method studies. *Research in Nursing & Health,* 23, 246-255.

Saunders, M. N., Saunders, M., Lewis, P. and Thornhill, A. (2009). *Research methods for business students,* 5th (ed.) Harlow. India: Pearson Education.

Savin, D., Alkass, S. and Fazio, P. (1996). Construction resource leveling using neural networks. *Canadian Journal of Civil Engineering*, *23*(4), 917-925.

Savin, D., Alkass, S. and Fazio, P. (1998). Calculating weight matrix of neural network for resource leveling. *Journal of Computing in Civil Engineering*, 12(4), 241-248.

Schirmer, H. J. (1996). Global expansion: A growing dilemma. *Journal of Management Engineering*, 12(5), 28–31.

Sekaran, U. and Bougie, R. (2009). Research methods for business: A skill-building approach, 5th ed. Chichester, UK: Wiley.

Sengur, A. (2008). An expert system based on linear discriminant analysis and adaptive neuro-fuzzy inference system to diagnosis heart valve diseases. *Expert Systems with Applications*, 35(1), 214-222.

Senouci, A. B. and Adeli, H. (2001). Resource scheduling using neural dynamics model of Adeli and Park. *Journal of Construction Engineering and Management*, 127(1), 28-34.

Seymour, H. (1987). *The multinational construction industry*. Kent: Croom Helm Ltd.

Shaked, I. (1986). Are multinational corporations safer? *Journal of International Business Studies*, 83-106.

Shash, A. A. (1993). Factors considered in tendering decisions by top UK contractors. *Construction Management and Economics,* 11(2), 111-118.

Shash, A. A. (1998). Subcontractors' bidding decisions. *Journal of Construction Engineering and Management,* 124(2), 101-106.

Shash, A. A. and Abdul-Hadi, N. H. (1992). Factors affecting a contractor's mark-up size decision in Saudi Arabia. *Construction Management and Economics*, 10(5), 415-429.

Shen, L., Li, H. and Li, Q. (2002). Alternative concession model for build operate transfer contract projects. *Journal of Construction Engineering and Management,* 128(4), 326-330.

Shen, L., Wu, G. and Ng, C. (2001). Risk assessment for construction joint ventures in china. *Journal of Construction Engineering and Management,* 127(1), 76-81.

Shen, L., Zhao, Z. and Drew, D. (2006). Strengths, weaknesses, opportunities, and threats for foreign-invested construction enterprises: A china study. *Journal of Construction Engineering and Management,* 132(9), 966-975.

Siang, J. J. (2009). *Jaringan syaraf tiruan dan pemogramannya menggunakan Matlab*. Yogyakarta, Indonesia: Penerbit Andi.

Singh, D. and Tiong, R. L. (2005). A fuzzy decision framework for contractor selection. *Journal of Construction Engineering and Management,* 131(1), 62-70.

Skapura, D. M. (1996). *Building neural networks*. New York, USA: ACM Press,

Skitmore, R. M. (1986). *A Model of the Construction Project Selection and Bidding Decision,* Doctoral dissertation, University of Salford.

Sonmez, R. and Rowings, J. E. (1998). Construction labor productivity modeling with neural networks. *Journal of Construction Engineering and Management*, *124*(6), 498-504.

Sonmez, R., Ergin, A. and Birgonul, M. (2007). Quantitative methodology for determination of cost contingency in international projects. *Journal of Management in Engineering,* 23(1), 35-39.

Srisaeng, P., Baxter, G. S. and Wild, G. (2015). An adaptive neuro-fuzzy inference system for forecasting Australia's domestic low cost carrier passenger demand. *Aviation*, 19(3), 150–163.

Stone, E. F. (1978). *Research methods in organizational behavior*. Santa Monica: Goodyear Publishing Company.

Strassmann, W. P. (1970). The Construction Sector in Economic Development. *Scottish Journal of Political Economy*, 17(3), 391-409.

Strassmann, W. P. and Wells, J. (1988) *Introduction*. In Strassman, P. and Wells, J. eds, Global Construction Industry, London: Croom Helm, 1–21.

Streiner D. (2003). Starting at the beginning: an introduction to coefficient alpha and internal consistency. *Journal of Personality Assessment*. 80(1), 99-103.

Sudheer, C. and Mathur, S. (2010). Modeling uncertainty analysis in flow and solute transport model using Adaptive Neuro Fuzzy Inference System and particle swarm optimization. *KSCE Journal of Civil Engineering,* 14(6), 941-951.

Suliman, A. M. T. (2007). Links between justice, satisfaction and performance in the workplace: a survey in the UAE and Arabic context. *Journal of Management Development*, 26(4), 294-311.

Sun, G., Wang, Y., Mei, X. and Huang, Y. (2012). Analysis on Durability of Coastal Concrete Dam Based on ANFIS. *Water Resources Informatization*, 2, 009.

Sun, M. and Meng, X. (2009). Taxonomy for change causes and effects in construction projects. *International Journal of Project Management*, 27(6), 560-572.

Sutrisna, M. (2004). *Developing knowledge based system for the valuation of variation on civil engineering works*. Doctoral dissertation, University of Wolverhampton, UK.

Tabish, S. Z. S. and Jha, K. N. (2011). Identification and evaluation of success factors for public construction projects. *Construction Management and Economics*, 29(8), 809-823.

Tan, D. J. and Ghazali, F. M. (2011). *Critical Success Factors for Malaysian Contractors in International Construction Projects Using Analytical Hierarchy Process*. EPPM, Singapore, 20-21 Sep 2011, pp. 127-138

Tan, W. (2002). *Practical research methods*. Singapore: Prentice Hall.

Tan, Y., Shen, L., Langston, C. and Liu, Y. (2010). Construction project selection using fuzzy TOPSIS approach. *Journal of Modelling in Management,* 5(3), 302-315.

Tang, L. C. M., Atkinson, B. and Zou, R. R. (2012). An entropy-based SWOT evaluation process of critical success factors for international market entry: A case study of a medium-sized consulting company. *Construction Management and Economics,* 30(10), 821-834.

Tatoglu, E. and Glaister, K. W. (2000). Strategic motives and partner selection criteria in international joint ventures in Turkey: Perspectives of Western firms and Turkish firms. *Journal of Global Marketing*, 13(3), 53-92.

Tavakol, M. and Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, 2, 53-55.

Taylan, O and Karagozoglu, B. (2009) An adaptive neuro-fuzzy model for prediction of student's academic performance, *Computers and Industrial Engineering* 57 (3) 732–741.

Teale, M., Dispenza, V., Flynn, J. and Currie, D. (2003). Management decision-making: Toward an integrative approach. Essex, UK: Prentice Hall.

Tellis, W. (1997). Application of a case study methodology. *The Qualitative Report,* 3(3), 1-17.

Teo, E., Chan, S. and Tan, P. (2007). Empirical investigation into factors affecting exporting construction services in SMEs in Singapore. *Journal of Construction Engineering and Management, 133*(8), 582-591.

Thipparat, T. (2011). *Construction Supply Chain Management Evaluation Using an Adaptive Neuro Fuzzy Inference System.* In Proceeding: Second International Conference on Construction and Project Management, Singapore.

Timetric's Construction Intelligence Center (2016). *Outlook global construction industry getting brighter.* Retrieved on June 4th, 2016 from https://timetric.com/info/media-center/press-releases/2016/04/07/outlook-global-construction-industry-getting-brighter/

Tjandra, I. K. (2004). *Organisational learning in construction. The case of construction firms in Jakarta, Indonesia.* Doctoral dissertation, National University of Singapore. Singapore.

Tse, R. Y. and Ganesan IV, S. (1997). Causal relationship between construction flows and GDP: Evidence from Hong Kong. *Construction Management & Economics,* 15(4), 371-376.

Turner, J. R. and Simister, S. J. (2001). Project contract management and a theory of organization. *International Journal of Project Management*, 19(8), 457-464.

Twarowska, K. and Kąkol, M. (2013). *International Business strategy-reasons and forms of expansion into foreign markets.* In Proceeding: International Conference of Management, Knowledge and Learning. June Zadar, Croatia, 1005-1011.

United Nations Center for Transnational Corporations (UNCTC) (1989). *Transnational Corporations in the Construction and Design Engineering industry,* United Nation, New York.

Utama, W. P., Chan, A. P. C., Zahoor, H., and Gao, R. (2014). *Indonesian Contractors in Overseas Construction Projects: Southeast Asia, the Middle East and Africa.* In Proceeding: ICCREM 2014: pp. 535-546

Utama, W.P., Chan, A.P.C., Gao, R. and Zahoor, H. (2017). Making international expansion decision for construction enterprises with multiple criteria: a literature review approach. *International Journal of Construction Management*, http://dx.doi.org/10.1080/15623599.2017.1315527.

Utama, W.P., Chan, A.P.C., Zahoor, H. and Gao, R. (2016). Review of research trend in international construction projects: a bibliometric analysis. *Construction Economics and Building*, 16(2), 71-82.

Veal, A. J. (2005). *Business research method: A managerial approach.* French Forest, NSW, Australia: Person Education.

Vellido, A., Lisboa, P. J. and Vaughan, J. (1999). Neural networks in business: a survey of applications (1992-1998). *Expert Systems with Applications*, 17(1), 51-70.

Venkatesan, B., Ragupathy, U. S., Vidhyalakshmi, P. and Vinoth, B. (2012). *Inspection of faults in textile web materials using wavelets and ANFIS.* In Proceeding: International Conference on Machine Vision and Image Processing 2012, IEEE. 189-192.

Vidogah, W. and Ndekugri, I. (1998). A review of the role of information technology in construction claims management. *Computers in Industry*, 35(1), 77-85.

Walia, N., Singh, H. and Sharma, A. (2015). ANFIS: Adaptive Neuro-Fuzzy Inference System-A Survey. *International Journal of Computer Applications*, 123(13), 32-38.

Walker, D. H. T. (1997). Choosing an appropriate research methodology. *Construction Management and Economics*, 15(2), 149-159.

Wang, R. C. and Liang, T. F. (2004). Project management decisions with multiple fuzzy goals. *Construction Management and Economics*, 22(10), 1047-1056.

Wang, S. Q., Dulaimi, M. F. and Aguria, M. Y. (2004). Risk management framework for construction projects in developing countries. *Construction Management and Economics,* 22(3), 237-252.

Wang, S. Q., Tiong, R. L., Ting, S. K. and Ashley, D. (1999). Political risks: analysis of key contract clauses in China's BOT project. *Journal of construction engineering and management*, 125(3), 190-197.

Wang, W., Hawash, K. I. M. and Perry, J. G. (1996). Contract type selector (CTS): a KBS for training young engineers. *International Journal of Project Management*, 14(2), 95-102.

Wanous, M., Boussabaine, H. A. and Lewis, J. (2000). To bid or not to bid: A parametric solution. *Construction Management and Economics,* 18(4), 457-466.

Wanous, M., Boussabaine, H. A. and Lewis, J. (2003). A neural network bid/no bid model: the case for contractors in Syria. *Construction Management and Economics*, 21(7), 737-744.

Warsawski, A. (1996). Strategic planning in construction companies. *Journal of Construction Engineering and Management*, 122(2), 133-140.

Willard, D. (2012). *Improving quality management system implementation in Indonesian construction companies.* Doctoral dissertation. Queensland University of Technology, Brisbane, Australia.

Williams, T. P. (1994). Predicting changes in construction cost indexes using neural networks. *Journal of Construction Engineering and Management*, 120(2), 306-320.

Wong, E. T., Norman, G. and Flanagan, R. (2000). A fuzzy stochastic technique for project selection. *Construction Management & Economics,* 18(4), 407-414.

World Bank (2016). The World Bank in Indonesia. Retrieved on December 14th, 2015 from http://www.worldbank.org/en/country/indonesia.

Wu, J. D., Hsu, C. C. and Chen, H. C. (2009). An expert system of price forecasting for used cars using adaptive neuro-fuzzy inference. *Expert Systems with Applications*, 36(4), 7809-7817.

Xenidis, Y. and Angelides, D. (2005). The financial risks in build-operate-transfer projects. *Construction Management and Economics,* 23(4), 431-441.

Xia, B., Chan, A. P. C. and Yeung, J. F. (2011). Developing a fuzzy multicriteria decision-making model for selecting design-build operational variations. *Journal of Construction Engineering and Management*, 137(12), 1176-1184.

Xia, B., and Chan, A. P. (2010). Key competences of design-build clients in China. *Journal of Facilities Management*, 8(2), 114-129.

Xia, B. and Chan, A. P. (2012). Measuring complexity for building projects: a Delphi study. *Engineering, Construction and Architectural Management*, 19(1), 7-24.

Xiao, H. (2002). *A comparative study of contractor performance based on Japanese, UK and US construction practice*. PhD Dissertation, SEBE, University of Wolverhampton, Wolverhampton.

Xu, T. and Greenwood, D. (2006). Using design-and-build as an entry strategy to the Chinese construction market. *International Journal of Project Management, 24*(5), 438-445.

Yan, H., Zou, Z. and Wang, H. (2010). Adaptive neuro fuzzy inference system for classification of water quality status. *Journal of Environmental Sciences*, 22(12), 1891-1896.

Ye, K., Jiang, W. and Shen, L. (2008). Project competition intensity (PCI) in the construction market: a case study in China. *Construction Management and Economics*, 26(5), 463-470.

Yeh, I. C. (1998). Quantity estimating of building with logarithm-neuron networks. *Journal of Construction Engineering and Management*, 124(5), 374-380.

Yeung, J. F. (2007). *Developing of Partnering Performance Index (PPI) for Construction Projects - A Fuzzy Set Theory Approach*. Doctoral dissertation, The Hong Kong Polytechnic University, Hong Kong.

Yeung, J. F., Chan, A. P. and Chan, D. W. (2007). The definition of alliancing in construction as a Wittgenstein family-resemblance concept. *International Journal of Project Management*, 25(3), 219-231.

Yeung, J. F., Chan, A. P., Chan, D. W. and Li, L. K. (2007). Development of a partnering performance index (PPI) for construction projects in Hong Kong: A delphi study. *Construction Management and Economics,* 25(12), 1219-1237.

Yin, R.K. (2003) Case study research: Design and Methods, 3rd ed. California, USA: Sage Publications.

Yuan, Z., Wang, L. N. and Ji, X. (2014). Prediction of concrete compressive strength: Research on hybrid models genetic based algorithms and ANFIS. *Advances in Engineering Software*, 67, 156-163.

Zadeh, L. A. (1965). Fuzzy Sets. *Information and Control*, 8, 338-353.

Zainal, Z. (2007). Case study as a research method. *Jurnal Kemanusiaan,* 9, 1-6.

Zhang, G. P. and Qi, M. (2005). Neural network forecasting for seasonal and trend time series. *European Journal of Operational Research*, 160(2), 501-514.

Zhang, H. and Tam, C. M. (2003). Fuzzy decision-making for dynamic resource allocation. *Construction Management and Economics*, 21(1), 31-41.

Zhao, Z. Y., Shen, L. Y. and Zuo, J. (2009). Performance and strategy of Chinese contractors in the international market. *Journal of Construction Engineering and Management,* 135(2), 108-118.

Zhi, H. (1995). Risk management for overseas construction projects. *International Journal of Project Management, 13*(4), 231-237.

Zhuang, L., Ritchie, R. and Zhang, Q. (1998). Managing business risks in China. *Long Range Planning,* 31(4), 606-614.

Zimmermann, H. J. (2001). *Fuzzy set theory and its applications*, *4th ed*. Boston, USA: Kluwer-Nijhoff.