

A CAUSAL RELATIONSHIP FRAMEWORK FOR SUCCESS FACTORS AND
CRITERIA OF SOCIAL INFRASTRUCTURE IN MALAYSIA

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To my beloved PARENTS

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ABSTRACT

In Malaysia, the government has recently embarked on the Economic Transformation Program (ETP), which aims to transform the country into a high income nation by 2020. The provision of Social Infrastructure Project (SIP) is vital in supporting this transformation process. While there is research attempting to ameliorate understanding of successful delivery of economic infrastructure projects, the understanding of which structures have framed successful SIPs is still limited. SIP is one of the main criteria for enhancing the economic productivity through the creation of new sustainable communities. Despite the topic's importance, SIP studies seem to be absent from the research agenda, particularly with respect to the relationships between SIP success factors and criteria. Therefore, this study tends to bridge the research gap by first exploring the SIP success factors and their criteria from the view point of private sector. It is its contention that the Economic Planning Unit (EPU) is not predominantly involved in responding to the preliminary interview and survey. Principal Component Analysis (PCA) is employed to analyse data from a quantitative survey. Six dimensions of SIP success factors: Pre-construction Factor, Construction Factor, Post-construction Factor, Information Management Factor, Organizational Factor and Change Management Factor are sourced from 41 success factors, obtained both from preliminary interviews (with ten experienced practitioners who had wide knowledge of SIP) and literature review. Meanwhile, the SIP success criteria consist of Classical Criteria and Modern Criteria. Apart from exploring, this study moves one step further by examining the relationships between them. Structural Equation Modelling (SEM) is employed to examine data from a quantitative survey of a new population. The main outcome is a causal relationship framework of SIP success factors and criteria, namely SIP Success Model. The results demonstrate a significant positive relationship between the post-construction factor and both the classical and modern criteria. Understanding the relationships between SIP success factors and their criteria could help the government and decision makers to have a better planning and control of SIP by allocating reasonable resources to achieve the project success as measured by predetermined criteria. In addition, understanding what factors and government wants to achieve and then developing a model tailored to meet the social, financial and wider economic criteria are key to successful social infrastructure projects.

ABSTRAK

Kerajaan Malaysia sedang melaksanakan Program Transformasi Ekonomi (ETP) untuk mewujudkan negara berpendapatan tinggi pada tahun 2020. Penyediaan project infrastruktur social adalah penting untuk menyokong transformasi ekonomi Negara. Walaupun terdapat kajian untuk memperbaiki pemahaman dalam kejayaan penyampaian projek-projek infrastruktur sosial (SIP), pemahaman mengenai struktur yang telah menyebabkan kejayaan dalam SIP masih terhad. SIP adalah salah satu kriteria utama untuk meningkatkan produktiviti ekonomi melalui kewujudan masyarakat baru yang mampan. Walaupun topic ini penting, kajian SIP seolah-olah hilang daripada agenda penyelidikan, terutamanya berkenaan hubungan antara faktor-faktor kejayaan SIP dan criteria mereka. Oleh itu, kajian ini cenderung untuk merapatkan jurang penyelidikan dengan terlebih dahulu mengkaji faktor-faktor kejayaan dan kriteria SIP daripada perspektif sector swasta. Dengan itu, kajian ini tidak melibatkan Unit Perancang Ekonomi (EPU). Analisis Komponen Prinsipal (PCA) digunakan untuk menganalisis data kuantitatif. Enam faktor kejayaan SIP; Faktor Pra-pembinaan, Faktor Pembinaan, Faktor Pasca pembinaan, Faktor Maklumat Pengurusan, Faktor Organisasi dan Faktor Perubahan Pengurusan dikurangkan daripada 41 faktor kejayaan yang diperolehi daripada kedua-dua temu bual awal dan kajian literatur. Sementara itu, kriteria kejayaan SIP terdiri daripada Kriteria Klasik dan Kriteria Moden. Selain itu, kajian ini juga mengkaji hubungan antara kedua-dua aspek tersebut. 'Structural Equation Modelling' (SEM) digunakan untuk menganalisis data daripada kajian secara kuantitatif. Kejayaan Model SIP merupakan hasil utama hubungan antara factor kejayaan dan kriteria kejayaan SIP. Keputusan menunjukkan hubungan positif antara faktor pasca pembinaan dan kedua-dua kriteria klasik dan moden. Pemahaman tentang hubungan antara faktor-faktor kejayaan dan kriteria SIP boleh membantu kerajaan dan pembuat keputusan membuat perancangan yang lebih baik. Selain itu, kawalan terhadap SIP dapat dibuat dengan memperuntukkan sumber-sumber yang munasabah untuk mencapai kejayaan projek itu seperti yang diukur oleh kriteria yang telah ditetapkan. Di samping itu, memahami apakah faktor dan kejayaan yang mahu dicapai dan kemudian membangunkan model khusus yang memenuhi kehendak sosial, kewangan dan kriteria yang lebih luas adalah kunci kejayaan dalam projek-projek infrastruktur sosial.

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LIST OF SYMBOLS AND ABBREVIATIONS

SYMBOLS

D^2	-	Mahalanobis Distance
df	-	Degree of freedom
n	-	Number of questions
N	-	Sample size
R^2	-	Squared multiple correlations
χ^2	-	Chi square
v_i	-	Variance of scores on each question
V_{residual}	-	Residual variance in covariance matrix
V_{total}	-	Total variance in the covariance matrix
V_{test}	-	Total variance of overall scores on the entire test
δ	-	Degree of misspecification of the baseline model
δ_M	-	Degree of misspecification of the proposed model

ABBREVIATIONS

5MP	-	Fifth Malaysia Plan
6MP	-	Sixth Malaysia Plan
7MP	-	Seventh Malaysia Plan
8MP	-	Eighth Malaysia Plan
9MP	-	Ninth Malaysia Plan
10MP	-	Tenth Malaysia Plan
ADF	-	Asymptotically distribution-free estimation
AGFI	-	Adjusted Goodness of Fit Index

AMOS	-	Analysis of Moment Structure
ANN	-	Artificial neural network
BOT	-	Build, Operate and Transfer
BOOT	-	Build, Own, Operate and Transfer
CA	-	Cluster analysis
CCC	-	Certificate of Completion and Compliance
CEDA	-	Committee for Economic Development in Australia
CFA	-	Confirmatory factor analysis
CFI	-	Comparative Fit Index
CIDB	-	Construction Industry Development Board
CPM	-	Construction project management
CR	-	Critical Ratio
CSFs	-	Critical success factors
EFA	-	Exploratory factory analysis
GCCC	-	Gold Coast City Council
GDP	-	Gross domestic product
GFI	-	Goodness of Fit Index
GLS	-	Generalized least squares
GOF	-	Goodness of fit
IAI	-	Initiative for ASEAN Integration
ICJVs	-	International construction joint ventures
ISIC	-	International Standard Industrial Classification of All
Economic		
KMO	-	Kaiser-Meyer-Olkin
LISREL	-	Acronym for linear structural relations
LM	-	Lagrange Multiplier
MI	-	Modification index
ML	-	Maximum likelihood
MPC	-	Malaysia Productivity Corporation
MRT	-	Malaysia Rapid Transit
NAP 3	-	National Agriculture Policy III
NFI	-	Normed Fit Index
NNFI	-	Non-Normed Fit Index
OECD	-	Organization for Economic Co-operation and Development

P	-	Significance level
PCA	-	Principal component analysis
PFI	-	Private Finance Initiative
PPP	-	Public Private Partnership
RMR	-	Root Mean Squared Residual
RMSEA	-	Root Mean Square Error of Approximation
SAEO	-	Southeast Asia Economic Outlook
SASEC	-	South Asia Subregional Economic Corporation
SE	-	Standard Error
SEM	-	Structural Equation Modelling
SIPs	-	Social Infrastructure Projects
SLS	-	Scale free least squares
SPSS	-	Statistical Package for Social Science
SRMR	-	Standardized Root Mean Squared Residual
SRS	-	Simple random sampling
TLI	-	Tucker-Lewis Index
ULS	-	Unweighted least squares

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CHAPTER 1

INTRODUCTION

1.1 Introduction

According to the International Standard Industrial Classification of All Economic Activities (2008), the most adapted international reference for respective national activity classification, construction includes general construction and specialized construction activities for buildings and civil engineering works. More specifically, it includes new work, repair, additions and alterations, erection of prefabricated buildings or structures on the site and also construction of a temporary nature. The standard defined general construction as the construction of entire dwellings, office buildings, stores and other public and utility buildings, farm buildings and others, or the construction of civil engineering works such as motorways, streets, bridges, tunnels, railways, airfields, harbours and other water projects, irrigation systems, sewerage systems, industrial facilities, pipelines and electric lines, sport facility and others.

In general, the construction industry is the sector of economy which constructs, alters, repairs and demolishes buildings, civil engineering works and other similar structures. The construction industry also includes the assembly on site prefabricated components and building engineering services. Meanwhile, Morton

(2009) defines construction industry as an industry that consists of five major categories of work, namely general construction and demolition, construction and repair of buildings, civil engineering, installation of fixtures and fittings and building completion which involves painting, glazing, plastering and so on. As such, the construction industry can be simplified as an industry that covers a wide range of products, services and activities.

A retrospective look at the economic development in Malaysia signifies the contribution of the construction industry. From the diversifying of agricultural activities to the rapid industrialization, construction industry plays an important role. A notable reason is it provides the basic infrastructure to other industries such as mining and quarrying, hotels and restaurants, manufacturing and services, necessary public and physical infrastructure. The provision of public and physical infrastructure is an essential element to attract foreign investment, thereby providing capital, management and technology and access to foreign market. This outlines its importance in the construction industry.

Meanwhile, the construction industry contributes constantly to the overall Gross Domestic Product (GDP) of Malaysia. The statistic speaks for itself. The construction industry contributes to the overall GDP, in the range of 4.8 per cent in 1997 and 3.2 per cent in 2011. It is worth noting that the construction industry normally do not performs well when other sectors are performing reasonably well in the recent years (Sundaraj, 2006). This is due to the fact that the public sector, particularly with regard to infrastructure projects, form the highest proportion of national demand for the construction. This trend is especially true when there is an economy downturn because all the infrastructure projects have to be initiated early to rejuvenate the economy. The construction industry contribution to GDP is normally the lowest as compared to other sector like services, manufacturing, mining and quarrying as well as agriculture. However, the construction industry underpins the development of any nation.

Among various forms of construction, Duffield (2001) suggests public infrastructure as the most apparent form of construction as it interests society at large. As infrastructure is a key element to unlock potential economic activities for a nation, developing countries like Malaysia will continue to place emphasis on infrastructure development as part of economic transformation. The infrastructure development itself is widely accepted as a contributor towards developed nation. As there is growing interest in infrastructure worldwide, it is worth noting that recent studies (Grimsey and Lewis, 2002; Syuhaida and Aminah, 2009) tend to categorize infrastructure into economic and social infrastructure.

In Malaysia, both social and economic infrastructures are already gaining focus. Syuhaida (2009) highlights that RM 28.3 billion has been allocated as construction expenditure especially for education and healthcare in the Eighth Malaysia Plan (8MP) and RM 20 billion for infrastructure development in the Ninth Malaysia Plan (9MP). At the same time, the Tenth Malaysia Plan (10MP) continue to focus on the provision of infrastructure to support the nation growth with the main focuses on constructing new hospitals, upgrading sports facilities and improving transportation network as well as construction of the Mass Rapid System (MRT) in Kuala Lumpur.

Despite the fact that the Government is well acknowledged of the importance of economic and social infrastructure provision to the economy, it has been criticized for being not performed up to the expected level. As a case in point, two failed social infrastructure projects are discussed. First, the Sultan Ismail Hospital was closed in September 2004 for 17 months due to a fungus problem. The hospital that cost around RM 557.8 million only reopened in February 2006. The incident caused not only the additional maintenance cost but also functionality per se.

Second, a RM 292 million stadium collapse incident occurred in June 2009 in Terengganu, Malaysia. There was no injury case reported. Moreover, the steel structure of the stadium roof under re-construction collapsed (again) in February

2013. Five workers were injured. In fact, these two projects are just a tip of the iceberg. There are many reasons that might be extracted from these failure projects. One of the reasons might be inconsistency during the execution stage that eventually led to design failure. There might also be the reason of incompetence of contractors as well as the inefficiency of communication among project team players.

As such, the government of Malaysia looks for alternative procurement methods to improve the public infrastructure while tabling the Ninth Malaysia Plan (9MP) (Syuhaida, 2009). The concern of public infrastructure project is exacerbated with limited public fund is being allocated for public infrastructure. Cases in point are the two mega construction projects undertaken in 2010 were the Ulu Jelai hydroelectric project (RM 2.1 billion) and the Polycrystalline Silicon Factory (RM 1.1 billion), which were located in Pahang and Sarawak. As it is the Government strategy to initiate mega projects to rejuvenate economy during major economy crisis, the total allocation for other types of infrastructure project such as Social Infrastructure Projects (SIPs) in the crisis time substantially decreases because of the budgetary constraint. Hence, apart from looking for an alternative procurement method, there is necessary to conduct a study looking into the issues of improving the successful delivery of public infrastructures, particularly the social infrastructure project.

1.2 Problem Statement

As the new century begins, the demand for good quality infrastructure development in Malaysia is on the increase. Chen (2002) points out that successful procurement and completion of infrastructure projects in Asian countries including Malaysia shall be a top priority by the government of these countries. However, with the belt-tightening budget for public projects, the government of Malaysia is now facing the problem of ensuring the successful delivery of these public projects.

Many studies have been conducted on public infrastructure of which include Syuhaida (2009), which establishes key performance indicators for Private Finance Initiative (PFI) in the provision of public infrastructure in Malaysia, Chan (2001), which studies time-cost relationship of public sectors projects in Malaysia, Lyles and Steensma (1996), which studies success factors of large-scale infrastructure projects in Asian Markets and Ugwu and Haupt (2007), which develop the key performance indicators for infrastructure sustainability. Existing studies focus mainly on examining the public infrastructure in the particular their contracting method.

As for the public infrastructure, general perception tends to categorize it into economic and social infrastructure. As a matter of fact, economic infrastructure such as bridges, highways and mega infrastructure projects easily captures the headline. This is due to the fact that the infrastructure instantly generates a positive spillover effect to the economy. In contrast, social infrastructure tends to be overlooked. As the name implies, social infrastructure projects (SIPs), hereinafter referred to as SIPs, are delivered in such a way to serve the community and to address the community's need as large.

SIPs are needed to serve the new community and thereby enhance the quality, image and desirability of a new place as well as its commercial value (Ekins, 2000). This view is reinforced by Teriman *et al.* (2011) who perceive SIPs is in response to the basic needs of communities and enhances the quality of life, equity, stability and social well being. The authors further posit that SIP and sustainable development are two interrelated concepts. This is in line with another finding of Chougill (1996) that the provision of sound and adequate infrastructure is of importance to achieve urban sustainability. Additionally, SIPs will be catalytic on other sector of a nation. Malaysia tourism sectors is a case in point where the number of foreign patients seeking treatment in the country generated about US\$27 million in 2004 and the figure is expected to stand at US\$56 million a year in national earning by 2010 (Economic and Social Commission for Asia and the Pacific, 2007).

Despite its importance, there are considerable challenges involved in the social infrastructure provision and delivery. For example, some large-scale SIPs have experienced considerable delays due to poor project governance and design errors (Love *et al.*, 2012a). Loosemore (2011) argued that SIPs usually involve relatively higher emotional attachment and public scrutiny, more prone to political interference and also higher abatement risks and lower service quality tolerances from the public. As many governments have encountered severe fiscal constraints due to declining revenue, the ongoing pressure on restraining public debt exposure have restricted future SIPs requiring government support in many counties.

In Malaysia, the government has recently embarked on the Economic Transformation Program (ETP), aiming to transform the country into a high income nation by 2020. To achieve this end, it requires a major step increase in rural and urban infrastructure investment (for example the National Key Results Areas (NKRAs) to alleviate growth constraints (Performance Management and Delivery Unit, 2010). One of the main challenges encountered by the Government is to replace the current resource consuming and environmentally straining activities with a sustainable development under the current unsustainable fiscal position in Malaysia (Naess, 2011).

The provision of SIPs is considered by the public to be significantly flawed with problems, such as delays in completion and poor quality standards (DAP, 2009). Most of the SIPs are procured under the government's belt-tightening budget. As a result, the government has employed private sectors to form a Public Private Partnership (PPP) to deliver SIPs. Seeing as SIPs are intrinsically perceived as being a smaller scale than economic infrastructure projects, PPP does not appear to be having a more defined revenue stream in SIPs than the latter, thereby PPP do not appear to have similar success in SIPs (Jefferies, 2006). Consequently, another procurement method called Private Finance Initiative (PFI) has been introduced to procure social infrastructure projects (Syuhaida, 2009).

The provision of SIPs via existing procurement methods is considered as a two-edged sword. Different procurement methods yield different results. Of these procurement methods, there is yet a study showing the best way to procure SIPs. As quoted by the China famous politician, Deng Xiaoping (1961) that “No matter whether it is a white cat or a black cat. It is a good cat so long as it catches mice”, it inspires some thoughts. Apart from procurement approaches, how the public infrastructure in Malaysia can be effectively undertaken to ensure its success delivery? Understanding what factors and government wants to achieve and then developing tailored models that meet the social, financial and wider economic criteria are key to successful social infrastructure projects. While there is no lack of study attempting to ameliorate understanding of successful delivery of economic infrastructure projects, our understanding of which structures have framed successful SIPs is still limited.

In summary, plenty of questions arise in line with the provision of social infrastructure projects in Malaysia. How the success factors and criteria of the social infrastructure projects can be defined? How the relationship between them can be examined? Thus, this study is significant to be carried out so that the success factors and success criteria of social infrastructure projects in Malaysia can be defined and their relationships can be assessed thoroughly.

1.3 Aim and Objectives

The public infrastructure project success determinants and measurement criteria are employed as baseline in this study due to Malaysian government’s intention to create a prosperous society, which can be achieved by having world class infrastructure ready. Thus, in ensuring the successful execution of an infrastructure project, relevant project success related variables namely, project success determinants as well as measurement criteria are essential. Yet, since knowledge of

the infrastructure project success framework is scarce in Malaysia, a causal relationship framework is to be developed in promoting the interest in the project success area. Therefore, with the aim of the study in examining the causal relationship between success factors and its criteria of social infrastructure in Malaysia, a study is conducted with the following objectives:

- i. To review and identify the relevant social infrastructure concepts, success factors and success criteria;
- ii. To analyse the level of understanding on the social infrastructure concepts in Malaysia among the stakeholders;
- iii. To evaluate the relationship between social infrastructure project success factors and success criteria; and
- iv. To establish a causal relationship framework for success factors and criteria of social infrastructure project in Malaysia.

1.4 Methodology

The flow of study is shown in Figure 1.1.

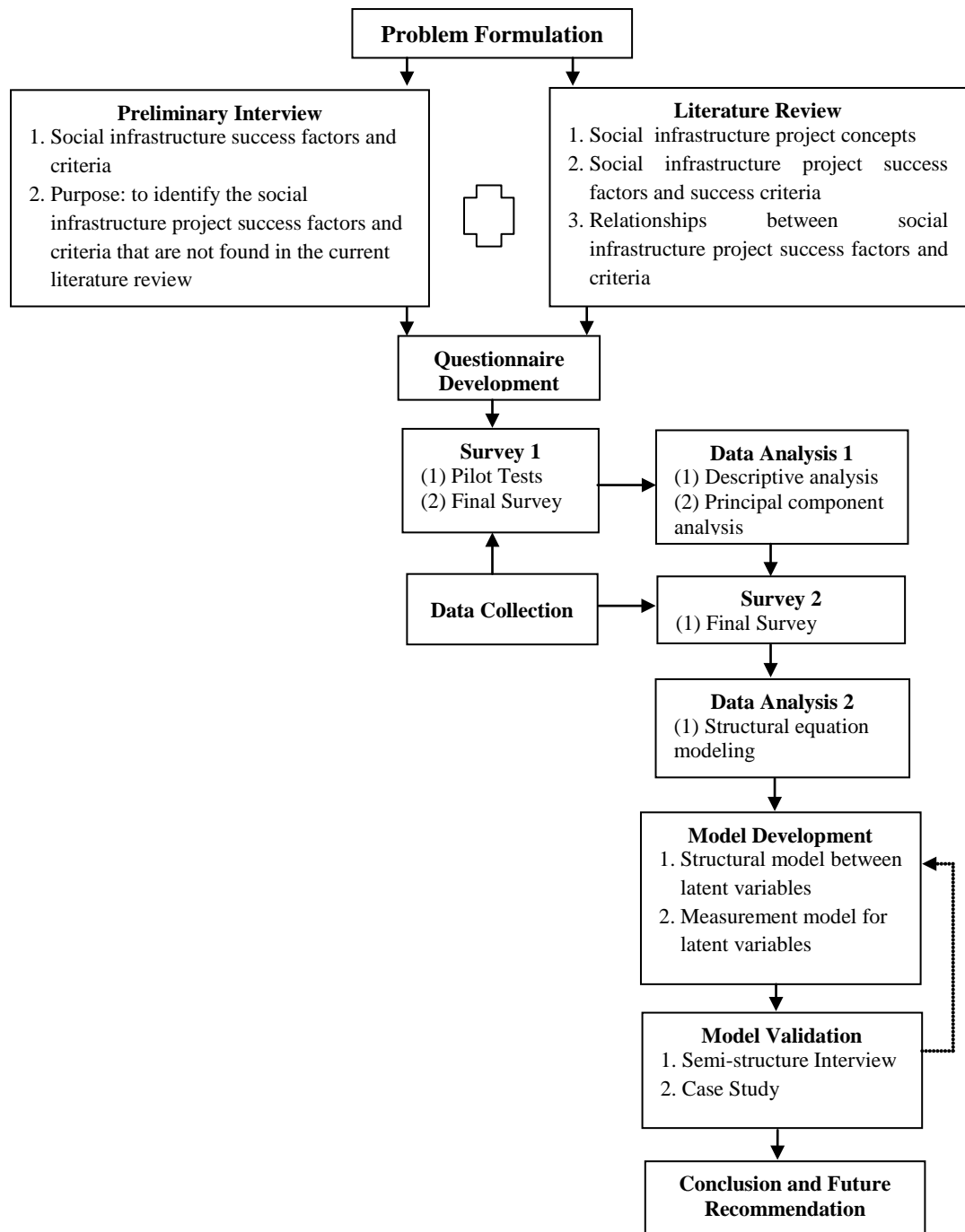


Figure 1.1 : Flow chart of research methodology

1.4.1 Problem Formulation

A broad area of problems especially those related to the public infrastructure project is studied. It was found that the public infrastructure project is not without criticism. This study tends to address those problems from the perspective of construction engineering and management. In the meantime, the concepts of project success is significant in improving the efficiency of undertaking projects. Therefore, the issues of applying project success concepts to social infrastructure projects in Malaysia are studied.

Discussion found in the problem statement section pointed out that there was necessary to have the Malaysia's version of public infrastructure project, with particular respect to social infrastructure projects (SIPs) success factors and its criteria to enhance the sustainability of new communities, thereby enhance the productivity of the nation towards the mission of becoming a high income country by 2020. To achieve this end, sustainable community and productivity are two interrelated concepts, which play a pivotal role in transforming a developing nation into high income nation.

Problems in relation to the success of SIPs are addressed. In addition to the success of SIPs, the respective SIPs success factors and its criteria are first explored. Subsequently, the relationships between the SIPs success factors and criteria are examined. This brings together a causal relationship framework of SIPs success, which graphically depicts the relationships between SIPs success factors, SIPs success and SIPs success criteria.

1.4.2 Literature Review

Having identified the problems in relation to the SIPs, a comprehensive literature review is conducted. The review covered mainly four topics: the issues related to SIPs, project success factors, project success criteria and relationships between success factors and criteria. The following paragraphs consider each of the topics.

The literature review begins with issues related to SIPs. Before discussing SIPs, the definition, classification, theory and development of infrastructure are reviewed. The review sufficiently captures the overall picture on the provision of infrastructure, if not all. Subsequently, the meaning, philosophical review of SIPs research and previous work conducted on SIPs are reviewed. The review pointed out that there is comparably little research to date about the SIPs, with majority of them focused on addressing the SIPs under the Public Private Partnership (PPP). The review on SIPs suggests there is necessary to broaden the horizon of SIPs, where the project success topic of SIPs is considered as one of those studies that could expand the perspective of SIPs domain.

Next, the project success topics: success factors, success criteria and relationships between success factors and criteria are reviewed. As for the project success factors, factors on general construction project and factors on a specific construction project or specific construction context are reviewed. Meanwhile, as for the project success criteria, it can be concluded that the real issues of time, cost and quality determine the success of a project, with the latest findings added the stakeholder satisfaction as one of the important criteria. Finally, the relationships between success factors and criteria are reviewed. It can be noted that little research to date assessing the relationship. With the advancement of computer technology, this could be served as a new research area.

A review on SIPs from the aspect of the definition and philosophical nature is needed as to clarify the current confusion on the SIPs. This is due to the fact that SIPs is needed to create sustainable communities, and therefore, should represent the stand alone research area to draw more attention so as to fill the research gap. Meanwhile a reviews on success factors, criteria and relationships between them are significant in feeding the construction of the questionnaire. It represents the input data of the survey instrument used to explore the project success topic.

1.4.3 Data Collection

There are two types of data involved in research, namely primary data and secondary data. As for primary data, the data set was collected by a researcher for the specific purpose or analysis under consideration. Meanwhile, if it was collected by someone else for some other purposes, it is therefore secondary data. This study begins with the review or collection of secondary data set in order to establish the study's aim and objectives. The process of data collection in this study involves five stages: (1) preliminary interview, (2) questionnaire development, (3) pilot study, (4) questionnaire refinement and (5) final survey questionnaire. The following subsections consider each of the stages.

1.4.3.1 Preliminary Interview

The preliminary interview is conducted to identify the underlying dimensions (project success factors and criteria) that are not found in the existing literatures. The preliminary interview adopted standardized open-ended interviews. This type of interview is structured in terms of wording and arrangement of the questions. All

respondents are asked the same questions in the same sequence and can facilitate a faster interview process that can be easily analyzed and also reduces the biases within the study (Gall *et al.*, 2003). As a preliminary qualitative data collection, the standardized open-ended interviews were conducted with ten experienced practitioners who had wide knowledge of SIPs. Meanwhile, the respondents, selected through purposive sampling (Powell, 1991), are required to answer four predetermined questions in half an hour. More specifically, the respondents were chosen based on: (1) review of their completed project (whether involved in partially or completed SIPs) and (2) appointments were made for interview by calling to the respective companies.

The preliminary interview contributes to the questionnaire development in the sense that it (the respondents) identifies or suggests 16 project success factors: transparency of the tendering process which is under scrutiny of the human beings; selection of competent facility team through contractor's own connection; project planner's competencies; pre-preparation of work planning; contractor's financial standing; contractor's competencies; project management team's competencies; site supervisor's role and responsibilities; sufficient number of site supervisor; good public relation of stakeholders; well coordinated and disciplined stakeholders; scheduling, control system and responsibilities; contractor's responsibility; credibility of principal submitting person and respective submitting person; technical personnel's competencies in handling refurbishment/repair structural work and periodic inspection of building.

The 16 project success factors are to be incorporated into the survey instrument. Of the 16 project success factors, ten success factors are retained as an observed factor in the final causal relationship. This signifies the contribution of the preliminary interview.

1.4.3.2 Questionnaire Development

As the objectives of this study to examine the relationships between SIPs success factors and its criteria, the relevant data are collected through self-administered questionnaires. Before the relationship examination can be carried out, the success factors and criteria are reduced to a smaller dimension. This is because of there are 41 success factors (large numbers of factors) obtained both from the preliminary interview and literature review and the SIPs represents a new research area, and therefore, step to reduce the dimension of factors should be prioritised in place. To solve the problems, there are two rounds of survey questionnaires, also known as the Survey 1 and the Survey 2 throughout this study, to explore and examine the relationship, respectively.

The Survey 1 consists of demographic of respondents in Part A, five SIPs concepts in Part B and 41 project success factors and six project success criteria in Part C. The five SIPs concepts are to serve the objective of analysing the level of understanding of SIPs concepts in Malaysia. Meanwhile, the 41 factors and 6 criteria are to be explored to reduce their dimension, using a principal component analysis (PCA) technique.

Meanwhile, the Survey 2 consists of demographic of respondents in Part A, project success factors in Part B and criteria in Part C. The findings of the Survey 1, using principal component analysis (PCA) significantly contributes to the construction of the Survey 2. Therefore, the findings of principal component analysis, which performed on the success factors of the social infrastructure projects in Malaysia, made up for Part B of the Survey 2. Meanwhile, its findings of success criteria made up for Part C of the Survey 2. The Survey 2 questionnaire is mainly to be conducted to examine the relationship of SIPs success factors and criteria. The technique is known as confirmatory factor analysis, which requires different sample data from the exploratory factor analysis.

1.4.3.3 Pilot Study

A pilot study is usually conducted prior to the administration of the final version of the survey. The aim of a pilot study is to check if the questions are understood correctly by respondents and to test the adequacy of questionnaire in relation to response rate. Pilot studies conducted in this study involve interviews and piloted survey. The following paragraphs consider the interviews and piloted survey, respectively.

The questionnaire is first reviewed by academic supervisors and practitioners to ensure the clarity and relevancy of the questions included in the survey. As the survey was followed closely by academic supervisors and the preliminary interview was in place, little amendment is needed in terms of languages and relevancy of the questions. However, there is a problem encountered related to the SIPs criteria in the second round of the survey. Logically, the SIPs criteria: client's satisfaction and public's satisfaction should have been measured from the respective client and public. This creates a new respondent population using the same survey and thereby it is impossible for the relationship examination to be proceeded. Having discussed further with academic supervisors and refereeing to Sweeney (2009) who adopts the same research methodology, an assumption is made to address the problem. It is assumed that to what extent the respondents believe their client and their customer (the public) would satisfy with the involved project.

Subsequently, the pilot study is accomplished by administrating the survey to 100 SIPs stakeholders in Perak in December 2011. The pilot study took place in Perak because the government is trying to transform the state from a tin mine-based to a mind-based economy under the Economic Transformation Program (ETP). The pilot study provided useful information, such as the response rate, the reliability and missing data. As for the response rate, a low response rate of 20 per cent is noted. Although a low response rate was expected, measures were taken to ensure that the question that addressed the demographic profile of the respondents involved multiple

choices for convenience. The Cronbach's reliability test for the pilot study was 0.72, which is sufficiently above the threshold value of 0.70. Finally, it was found that of the 20 returned questionnaires, three consisted of incomplete data, which indicates that the final administration of the distributed survey should be relatively large in number in consideration of the low response rate and the missing data.

1.4.3.4 Questionnaire Refinement and Final Questionnaire

Even though not much amendment is needed, the questionnaires are re-designed in a simple way and every questionnaires including the age and genders changed to multiple choice questions to facilitate the response rate. Considering the low response rate, the survey is conducted in both paper-based and online questionnaires (www.surveymonkey.com). Both surveys are anonymous. For the web-based survey, the data is downloaded from the survey database. The Survey 1 is conducted in 2012 (January – May) whilst the Survey 2 is conducted in 2012 (May – November).

The Survey 1 distributed 500 quantitative questionnaires, meanwhile the Survey 2 administrated 800 quantitative questionnaires. The Survey 1 and Survey 2 received a complete questionnaire of 145 sets and 213 sets accordingly, representing 29 per cent and 27 per cent, respectively. As for the Survey 2, it is in line with recommended sample size (more than 200) for structural equation modelling (SEM) analysis (Kelloway, 1998). The targeted respondents are those involved in completed or partially completed SIPs in Malaysia.

Meanwhile, the simple random sampling (SRS) method is employed for the survey data collection in this study because it is the purest form of probability sampling. Simple random sampling is a sampling method in which every individual

has a known probability of being selected. Since there is a relatively complete list of construction companies in yellow pages found in Malaysia, the sample sizes are randomly drawn from this database. Provided the project's specific constraint (those involved in completed or partially completed SIPs) is met, each member of the population has an equal chance of being selected. The project's specific constraint can be accomplished through the review of completed project of companies, which available in their respective website.

1.4.4 Data Analysis

Statistical Package for Social Sciences (SPSS 18.0 for Windows) is employed to perform the exploratory factor analysis. The analysis is quantified through Principal Component Analysis (PCA) technique. Before reducing the factors and criteria, the Cronbach's alpha test are conducted to make sure the internal consistency of variables. As the SIPs represent a new research and it is found that a large number of factors influences the successful outcome of SIPs, PCA are employed to reduce the dimension of SIPs success factors. As mentioned earlier, six dimensions of factors and two dimensions of criteria are obtained. This further provides information for the development of the second round survey questionnaire.

Analysis of Moment Structure (AMOS 18 for Windows) is employed to perform the structural equation modelling (SEM) technique on the data obtained through the second round of the survey questionnaire. SEM is a multivariate analysis technique which encompasses various statistical methods including the confirmatory factor analysis, multiple regression, path analysis and analysis of variances. Because the focus of this study is to develop a causal relationship framework of SIPs success, path analysis and confirmatory factor analysis are employed. Five important Goodness-of-fit test: ratio of Chi-square to the degree of freedom, Goodness-of-fit Index (GFI), Root Mean Square Error of Approximation (RMSEA), Tucker-Lewis

Index (TLI) and Comparative Fit Index (CFI) are assessed. It is found that the ratio of Chi-square to the degree of freedom and the TLI are slightly outside of the acceptance criteria. In overall, it indicates that the data fit well with the proposed SIPs Success Model.

1.4.5 Model Development

It is worth stressing that the model development involves a great deal of processes. First, the data obtained from preliminary interview and the current literature is reduced. This is done through the technique PCA, with the aid of computer software SPSS 18.0 for Windows. This is followed by the evaluation of relationships between SIPs success factors and criteria. This is done through the SEM technique, with the aid of computer software AMOS 18 for Windows. AMOS is the popular SEM software because of its commands are user friendly. Several SIPs models are formulated based on the findings from PCA. With the AMOS, data obtained from the second round of the survey can be imposed into the formulated models. Finally, based on the GOF tests, the most fitted model is selected. The model is subjected to the model validation, which is discussed in the following section.

1.4.6 Model Validation

The developed model needs to be validated in order to determine its reasoning based on professional's viewpoint in Malaysia. The validation involves the semi-structured interview with respondents, preferably the currently active and highly experienced SIPs stakeholders. The respondents are professionals that are not involved in previous questionnaire survey in order to maintain the originality of this

study. The targeted respondents do not favour either government or private sector. Although the criteria for respondents are pre-determined, there is no fixed candidate as targeted. So long as the respondent is highly experienced (working experience in the construction industry for at least 15 years and above) in the construction industry, the respondent should be approached for validating viewpoint of the developed model. Six questions are directed to the selected five practitioners. In overall, the semi-structured interview conducted pointed out viewpoints from the SIPs stakeholders in Malaysia to improve the model. It can be safely claimed that the final model is valid from the theoretical and practical aspect because it follows established in its development. In addition, a SIPs success index is developed to further validate the model. Three hospitals case studies, which are obtained from a previous study, are assessed with the SIPs success index. Results indicate that the SIPs success index manages to assess the most successful case study, which is uniform with finding as in the study.

1.5 Scope of the Study

Social infrastructure was referred to the facilities, services and networks of a community that cater to basic social needs (William and Pocock, 2010). From the definition, SIPs can be categorized as either hard or soft social infrastructure. Many studies (Bigotte and Antunes, 2007; Choguill, 1996) define 'hard' SIPs to include housing, health, education and community facilities. Meanwhile, the 'soft' aspects include the social environment, services and programs, health, education, employment, training and public safety (William and Pocock, 2010), social planning around economic perspective (Lang, 1990) and elements that influence the final individuals' time allocation between market and diverse activities (Chin and Chou, 2004).

Because this study emphasizes on the construction and engineering management point of view, it focuses on the ‘hard’ aspect of SIPs. This study defines SIPs as the health facilities (such as hospitals), education facilities (such as schools) and community support facilities (such as prisons and museums). The ‘soft’ aspects of SIPs, more popularly known as the social infrastructure, are beyond the scope of this study. Despite the fact that the importance of the ‘soft’ aspect of SIPs should not be nullified, it is the ‘hard’ aspect of SIPs that matters the most to a new community. A case in point, there is no way to deliver education without a physical school.

In addition to the perspective of construction and engineering management, it is the contention of this study that the Economic Planning Unit (EPU) is not predominantly involved in responding to the preliminary interview and survey. The justification is that this study focuses on the view point of private sector. Despite the fact that the public sector is the largest client of the construction industry, active involvement of private sector in the infrastructure development has risen steadily in the last decade and is likely to play an even larger role in future. Therefore, their view point is significant in capturing and potentially disseminating skill and knowledge.

A work by Jefferies (2006) has shown that the PPP does not appear to be having similar success in SIPs than the economic infrastructure, this study does not favour a specific procurement approach large because there are only limited studies conducted in the SIPs domain. In other words, the knowledge of SIPs is still in its infancy stage in Malaysia. Figure 1.2 summarizes the knowledge of SIPs.

As can be seen in Figure 1.2, previous efforts on SIPs focus on the aspect of definition, classification, risk assessment and management, PPP, planning, design error analysis and philosophical stance. It is clear that the SIPs success factors, criteria and relationship between them are missing from the research agenda. There is only a study conducted to investigate the critical success factors of a stadium project. Nevertheless, the study is context-drive with little applicability.

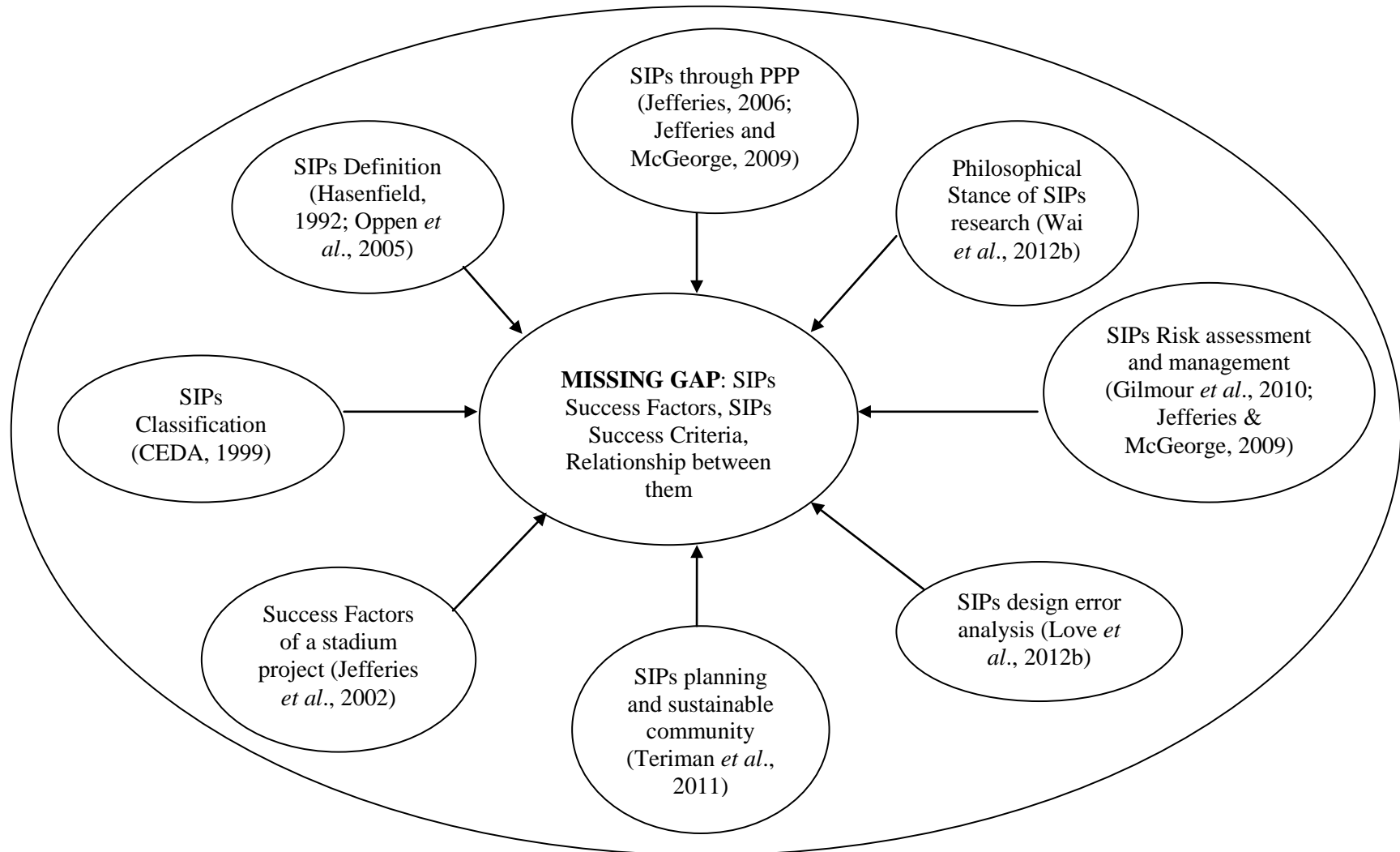


Figure 1.2: Social infrastructure domain

As such, the scope of this study is to explore the SIPs success factors and criteria. In the meantime, this study moves one step further by examining the relationships between them. This study is limited to the physical provision of SIPs, with an emphasis being placed on the human perspective on the context.

1.6 Structure of the Study

This study consists of seven chapters. In the current chapter, the Chapter 1, problem statement, aim and objectives, research methodology, scope of the study and the structure of the study are outlined. In the Chapter 2, infrastructure with particular emphasis placed upon on the definition, classification, theory and development aspect are reviewed. In addition, social infrastructure projects (SIPs), which represent the main context of this study are also reviewed. Two main aspects of social infrastructure are reviewed: previous work on SIPs and the philosophical review of the SIPs.

Meanwhile in the Chapter 3, project success topics are reviewed. The project success topics cover project success factors, success criteria and their relationships. At the end of the Chapter 3, all the success factors and success criteria are summarized in a respective table. This chapter highlights that the literature review conducted on project success topics revealed there is little research conducted on examining the relationships between the success factors and criteria.

In the Chapter 4, the research methodology of this study is discussed. To achieve the objectives of this study, general descriptive analysis, principal component analysis (PCA) and structural equation modelling (SEM) are employed. Subsequently, each of the data analysis is discussed. Apart from discussing the methods used to achieve the objectives of this study, this chapter presents the

preliminary findings such as response rate, gender, age, working experience in the construction industry, highest academic qualification and profession of the respondents obtained from survey questionnaires. It is worth noting that two rounds of survey questionnaires, also known as the Survey 1 and the Survey 2 throughout this study, are administered.

Meanwhile, in Chapter 5, the findings and results of principal component analysis (PCA) are presented and discussed. This is a very important step because the findings are significant in feeding the construction and administration of the Survey 2. Therefore, the procedures of principal component analysis are strictly followed. In particular, the tests such as Kaiser-Meyer-Olkin (KMO) and Bartlett's measure are used to determine the suitability of principal component analysis for the dataset.

In Chapter 6, the findings and results of structural equation modelling (SEM) are presented. The main reason to employ this technique is outlined. Issues related to structural equation modelling technique such as its strategies, reliability and validity, normality and estimates technique are discussed. The findings and results discussion is conducted in such a way that the result should be in line with the findings from the previous work. On the whole, supports are found in the findings and results obtained from the techniques.

Finally in the Chapter 7, this study is summarized. In addition, this chapter also presents a section that each objective of this study is further discussed to clarify whether the objective is achieved. The significance of this study is presented to highlight its contributions. Subsequently, the limitations of this study are also presented to enhance the originality of this study. It also outlines the recommendations for future study.

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