

博 士 論 文

PPP Analytical Framework for Infrastructure Asset Allocation:
Kick-Off toward Socio-Economic Transition in Myanmar
(KSET/M)

(ミャンマーにおける社会経済開発のためのPPPインフラの分析枠組み)

チョーリン

Kyaw Linn

PPP Analytical Framework for Infrastructure Asset Allocation:
Kick-Off toward Socio-Economic Transition in Myanmar (KSET/M)

(ミャンマーにおける社会経済開発のためのPPPインフラの分析枠組み)

by

Kyaw Linn

B.Eng. (Yangon Institute of Technology) 1983

M.Eng. (Asian Institute of Technology) 2015

Dissertation submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

INTERNATIONAL STUDIES

in the

GRADUATE SCHOOL OF FRONTIER SCIENCES

of

The UNIVERSITY OF TOKYO

Committee in charge:

Associate Professor Takayuki Minato (Chair)

Professor Riki Honda

Associate Professor Maiko Sakamoto

Professor Tomonari Yashiro

Professor Bonaventura H.W. Hadikusumo

September 2019

Acknowledgements

Firstly, I would like to express my gratitude and appreciation to my excellent supervisor, Professor Takayuki Minato, who has opened this great opportunity for me to pursue my further academic achievement with the University of Tokyo. Without his physically and mentally invaluable supervision with patience throughout the course of my Ph.D. study, this degree would never have been completed.

I am also greatly indebted to the University of Tokyo, the Government of Japan, the Government of the Republic of Myanmar and Ministry of Construction to allow me to attend this Ph.D. (Ronpaku) program.

Secondly, I would like to express my warm thanks to U Kyi Zaw Myint, the Deputy Director General of the Department of Highways, U Kyaw Kaung Cho, the Deputy Director General of the Department of Bridge, U Soe Tun Naing, the Chief Engineer of the Department of Rural Road Development, U Thet Zaw Win and Daw Ei Ei Myo, the Directors of the Department of Highways, for their participations in valuable discussions during my study. My thanks also go to the Directors and Deputy Directors from both central and regional offices for their kind assistances in providing substantial information used in my thesis. The appreciation extends to my staff especially U Zaw Aye, Deputy Director and all others from my office for their kind assistance during the course of this research work. Lastly but not the least, I sincerely appreciate U Htet Kyaw Thu and Daw Yamin Theint, Junior Engineers of the Department of Highways, for their devotion in putting the various information together for my doing numerical analysis.

Finally, I would like to thank my parents for their unconditional love and all their best efforts in shaping me into a person as I am today. Special thanks again to my wife, Daw Ni Ni Aung, for her strong support and encouragement as my life partner. Thanks to all other members of my family for their good wills, encouragements, and prayers. For myself, I stood up and I think I finally made the right decision.

U Kyaw Linn, Nay Pyi Taw
2019

Dedication



To the whole Myanmar

List of Figures

Figure	Page
1-1 Asset Allocation and Asset Management	5
1-2 Road Network and Land-use Cycle	6
1-3 Four markets and 16 Sub-criteria	6
1-4 Background Information for Base EER	7
1-5 Total EER ^B and EER ^R	13
1-6 Total EER ^B and EER ^M	14
1-7 Total EER ^R and EER ^M	15
1-8 EER Achievement in terms of Budget	16
1-9 EER ^M and GRDP Growth Rate	17
1-10 EER ^M and Unemployment Rate	18
2-1 Fiscal Year Ratio of Deficiency and GDP Budget of Union	21
2-2 Alternative Transport Sector Investment (GFCF) Scenarios	25
2-3 Required Amount of Gross Fixed Capital Formation to Achieve GDP Growth Targets in Myanmar	26
2-4 Cost/Benefit before Risk Transfer	32
2-5 Cost/Benefit after Risk Transfer	33
3-1 Traditional, PFI, PPP, and the Other Form	39
3-2 PFI and PPP	39
3-3 Private and Gov's Roles	40
3-4 BOT, BTO, and BLT	41
5-1 Chain Effects of Socio-Economic Effects, Wisara	81
5-2 Location Map of Ring Roads	84
5-3 Chain Effects of Socio-Economic Effects, Ring Road	87
6-1 Four markets and 16 Sub-criteria	92
6-2 Background Information for Base EER (Yangon)	97
6-3 Total EER ^B and EER ^R	113
6-4 EER ^B and EER ^R for Urban Economy	115
6-5 EER ^B and EER ^R for Land Development	116
6-6 EER ^B and EER ^R for Real Estate	116
6-7 EER ^B and EER ^R for Infrastructure	116

6-8	Total EER^B and EER^M	117
6-9	EER^B and EER^M for Urban Economy	118
6-10	EER^B and EER^M for Land Development	119
6-11	EER^B and EER^M for Real Estate	119
6-12	EER^B and EER^M for Infrastructure	120
6-13	Total EER^R and EER^M	121
6-14	EER^R and EER^M for Urban Economy	121
6-15	EER^R and EER^M for Land Development	122
6-16	EER^R and EER^M for Real Estate	122
6-17	EER^R and EER^M for Infrastructure	123
6-18	Expected Economic Returns (EER^M) for Regions/States	124
6-19	EER Achievement in terms of Budget	125
6-20	EER^M and GRDP Growth Rate	127
6-21	EER^M and Unemployment Rate	129

List of Tables

Table	Page
1-1 Base EERs (EER ^B) for States/Regions (%)	8
1-2 Relative Scores	8
1-3 Calculation of Regional Weights: W ^R	9
1-4 Summary of Regional Weights: W ^R	9
1-5 Summary of Regional EER: EER ^R (%)	10
1-6 Market Weight (W ^M) by Pair-wise Comparison	11
1-7 Summary of Market Weights: W ^M	11
1-8 Summary of Market Expected Economic Return: EER ^M	12
2-1 Historical Earnings/ Expenditures and Deficiencies	22
2-2 Proportion of GFCF in the Transport Sector to GDP and Total GFCF (%)	24
2-3 Required Ratio of GFCF to GDP and Accumulated GFCF Amounts	26
2-4 Total Costs for Main Projects (2016-2030) of Ministry of Construction	27
2-5 Foreign Aids	28
2-6 Long-term Plan	29
2-7 Priority Implementation Project on Expressway (4-lane)	30
3-1 PPP Definitions by International Organizations	37
3-2 Comparison of Traditional Procurement and PPP Procurement	38
4-1 Myanmar PPP Projects; Strength and Weakness	52
4-2 PPP Case Studies in 10 Countries	53
4-3 Finance of Tokyo Bay Highway	61
4-4 Minimum Revenue Guarantee	65
5-1 Population Growth in Myanmar	77
5-2 Housing Requirements in Different Era	78
5-3 DUHD Plan for Next 15 years	78
5-4 YIRR Design Criteria	85
5-5 YORR Plan	86
6-1 Rating and Base EER	96
6-2 The Scoring System for the Urban Economic Market	98
6-3 The Scoring System for the Land Development Market	99

6-4	The Scoring System for the Real Estate Market	100
6-5	The Scoring System for the Infrastructure Market	101
6-6	Relative Scores	103
6-7	Values of the Random Index (RI) for Small Problems	104
6-8	Rating Examples	106
6-9	EER^B for States/Regions (%)	106
6-10	Calculation of Regional Weights: W^R	107
6-11	Summary of Regional Weights: W^R	108
6-12	Calculations of Regional Expected Return: EER^R	109
6-13	Summary of Regional Expected Economic Return: EER^R (%)	109
6-14	Calculation of Market Weight: W^M	110
6-15	Summary of Market Weights: W^M	111
6-16	Summary of Market Expected Economic Return: EER^M	112
6-17	Values of the EER^M and GRDP Growth Rate	126
6-18	Values of the EER^M and Unemployment Rate	128

Abbreviations

AAGR	-	Average Annual Growth Rate
ADB	-	Asian Development Bank
BCR	-	Building Coverage Ratio
BECL	-	Bangkok Expressway Company Limited
BOO	-	Build–Own–Operate
BOOT	-	Build–Own–Operate—Transfer
BOT	-	Build–Operate—Transfer
BTL	-	Build–Transfer-Lease
BTO	-	Build–Transfer-Operate
CDC	-	Commonwealth Development Corporate
CNY	-	Chinese Yuan
DCA	-	Myanmar’s Department of Civil Aviation
DOH	-	Department of Highway, MOC, Myanmar
DOB	-	Department of Bridge, MOC, Myanmar
DRRD	-	Department of Rural Road and Development, MOC, Myanmar
DUDH	-	Department of Urban Development and Housing, MOC, Myanmar
EBRD	-	European Bank for Reconstruction and Development
EER	-	Expected Economic Return
EIRR	-	Economic Internal Rate of Return
ENR	-	Engineering News-Record
EU	-	European Union
EXAT	-	Expressway Authority of Thailand
FAR	-	Floor Area Ratio
FDOT	-	Florida Department of Transportation
FES	-	First Stage Expressway Toll System
GDP	-	Gross Domestic Product
GMS	-	Greater Mekong Subregion
IDB	-	Inter-American Development Bank
IFC	-	International Finance Corporation
IMF	-	International Monetary Fund

IsDB	-	Islamic Development Bank
JPY	-	Japanese yen
JICA	-	Japan International Cooperation Agency
KDI	-	Korea Development Institute
MIC	-	Myanmar Investment Commission
MMK	-	Myanmar Kyat
MOC	-	Ministry of Construction, Myanmar
MOEP	-	Ministry of Electric Power
MRG	-	Minimum Revenue Guarantee
MWSS	-	Metropolitan Waterworks and Sewerage System
NPC	-	National Privacy Commission
NPV	-	Net Present Value
ODA	-	Official Development Assistance
OECD	-	Organization for Economic Co-operation and Development
PFI	-	Private Finance Initiative
PPIAF	-	Public-Private Infrastructure Advisory Facility
PPP	-	Public Private Partnership
ROI	-	Return on Investment
SEMP	-	Socio-Economic Master Plan
SES	-	Second Stage Toll Expressway System
SEZ	-	Special Economic Zone
SOC	-	Social Overhead Capital
SPC	-	Special Purpose Company
TIFIA	-	Transportation Infrastructure Finance and Innovation Act
UNECE	-	United Nations Economic Commission for Europe
UNESCAP	-	United Nations Economic and Social Commission for Asia and Pacific
USD	-	US Dollars
WTE	-	Waste-to-Energy
YIRR	-	Yangon Inner Ring Road
YORR	-	Yangon Outer Ring Road

Acknowledgements	i
Dedication	ii
List of Figures	iii
List of Tables	v
Abbreviations	vii
Table of Contents	ix

Table of Contents

	page
Chapter 1: Executive Summary	1
1.1 Introduction -----	1
1.2 Motivation -----	3
1.3 Scope -----	4
1.4 Purpose -----	5
1.5 Methodology -----	6
1.6 The Outputs -----	12
1.6.1 Comparisons of EER^B , EER^R , and EER^M -----	12
1.6.2 Comparisons of EER^R and EER^M -----	14
1.7 An Application Example of Output -----	15
1.7.1 EER^M and Budget -----	15
1.7.2 Comparison of the EER^M and GRDP Growth Rate -----	16
1.7.3 Comparison of EER^M and Unemployment Rate -----	18
1.8 Conclusion -----	19
Chapter 2: Research Background	20
2.1 Union Budget -----	21
2.1.1 Expenditure of Union and Region/State -----	21
2.1.2 Transport Sector Investment in Myanmar -----	24
2.2 Master Plan and PPP Needs in Transportation Sector -----	27
2.3 Socio-Economic Considerations -----	31
2.4 Summary -----	34

Chapter 3: PPP Definitions, Scheme, and Practices	35
3.1 Introduction -----	35
3.2 Myanmar's Standing -----	35
3.3 PPP Definitions -----	37
3.4 Traditional, PFI, PPP, and the Other Form of Procurement -----	38
3.5 ENR Review -----	42
3.6 Summary -----	44
3.6.1 Advantages of PPP -----	44
3.6.2 Limitations of PPP -----	46
Chapter 4: PPP Case Studies	48
4.1 Myanmar PPP Implementation -----	48
4.2 PPP's in Different Countries -----	52
4.2.1 Australia -----	53
4.2.2 Canada -----	54
4.2.3 China -----	56
4.2.3.1 China -----	56
4.2.3.2 Chinese Taipei -----	58
4.2.4 Japan -----	60
4.2.5 Korea -----	61
4.2.6 Philippines -----	65
4.2.7 Singapore -----	67
4.2.8 Thailand -----	69
4.2.9 United Kingdom -----	73
4.2.10 United State -----	74
4.3 Summary -----	75
Chapter 5: Socio-Economic Outcomes of Projects	76
5.1 Housing Redevelopment Project -----	76
5.1.1 Key Features -----	76
5.1.2 Wisara Project -----	78
5.1.3 Analysis of Socio-Economic Values from Wisara Project -----	81
5.2 Metropolitan Highway Project -----	83

5.2.1 Key Features -----	83
5.2.2 Yangon Ring Road Projects (YIRR and YORR) -----	84
5.2.3 Analysis of the Socio-Economic Effects from Ring Road Projects ----	86
5.3 Summary -----	88
Chapter 6: An Analytical Framework -----	90
6.1 Introduction -----	90
6.2 The Model Concept -----	90
6.3 The Analytical Framework -----	95
6.3.1 Background Information and Base EER -----	95
6.3.2 Pair-wise Comparisons between the Sub-criteria, for each Region ---	102
6.4 Example Analysis -----	104
6.4.1 Base EER: EER^B -----	106
6.4.2 Pair-wise Comparisons between Sub-criteria for States/Regions: W^R -	107
6.4.3 Regional Expected Economic Return: EER^R -----	108
6.4.4 Pair-wise Comparisons among States/Regions for Markets: W^M -----	110
6.4.5 Market Expected Economic Return: EER^M -----	112
6.5 The Outputs -----	113
6.5.1 Comparisons of EER^B and EER^R -----	113
6.5.2 Comparisons of EER^B and EER^M -----	117
6.5.3 Comparisons of EER^R and EER^M -----	120
6.6 An Application Example of Output -----	124
6.6.1 EER^M and Budget -----	124
6.6.2 Comparison of the EER^M and Gross Regional Domestic Product (GRDP) Growth Rate -----	126
6.6.3 Comparison of EER^M and Unemployment Rate -----	128
6.7 Findings -----	129
6.8 Conclusion -----	130
Chapter 7: Conclusions -----	133
7.1 Thesis Summary -----	133
7.2 Contributions -----	142
References -----	146
Appendices -----	154

Chapter 1

Executive Summary

1.1 Introduction

This paper focuses on socio-economic development in Myanmar and presents an analytical framework for evaluating the socio-economic benefits of public–private partnerships (PPPs) as a means of infrastructure procurement. The concept of PPP comes into existence when the private sector participates in the financing, construction, operation, and maintenance of infrastructure under concessions provided by the public. It is a business procurement method that aims to improve public services as it reduces the government's financial burden by incorporating the private sector's knowhow.

Myanmar transitioned from a military government to an elected government in 2011. Subsequently, the government embarked aggressively on a series of economic, political, and social reforms that have resulted in unparalleled development and economic growth. While much has been achieved (over a limited period), stakeholders have recognized the need to enhance and upgrade Myanmar's public infrastructure, which they believe to be the basis for sustained development and growth. However, substantial participation from the private sector is required to achieve this goal, because the private sector is in a better position to provide funding, knowhow, and expertise in the development, management, and operation of Myanmar's public infrastructure. The government may, therefore, look to PPPs as an effective tool for mobilizing private sector investment in a way that aligns with the government's development goals. Myanmar's investment laws and ad hoc ministry-level procurement and implementation policies have been adopted to remedy the absence of a clearly defined PPP framework. However, it has become apparent that a streamlined, effective, and predictable legal framework is necessary to facilitate and encourage private sector participation in public infrastructure development. An appropriate legal framework would not only incentivize investment from the public and private sector but also enable both sectors to properly allocate risk, receive adequate returns, delineate roles and responsibilities, and monitor compliance with obligations.

The private sector cannot be expected to bear complete responsibility for development. Successful development of privatized infrastructure relies on equitable allocation of specific risks to parties who are best able to manage and control each type of risk. The government's risk must evolve into what it is best capable of doing—managing macroeconomic policies and creating an environment conducive to participation by international investors.

Indeed, governments now find themselves in the same position as the companies they are trying to attract: there is competition for scarce financial resources in a global market where funds are allocated to the participants who can demonstrate a bankable strategy. Failure by a government to develop an economic and regulatory environment that is acceptable internationally will lead to delayed development of national infrastructure and lost opportunities for economic growth.

The privatization of infrastructure is still in its early days, with many projects still in the development or construction phase. However, certain emerging trends will influence the future development of this process:

- The private sector can structure infrastructure projects such that finance can be raised from commercial banks on a limited-recourse basis.
- The private sector is better equipped than the public sector to manage the provision and operation of infrastructure. This is particularly true during the initial construction phase and is achieved principally through incentives and penalties for private sector operators.
- Establishing any new regulatory structure is a time-consuming process. However, the private sector can enter the process during the early stages of regulatory development through the use of concession-based schemes, where the obligations of the parties are governed through contract law.
- The critical path in the development of privately operated infrastructure projects is the availability of debt. Significant amounts of equity are available either directly through equity capital markets or through the many specialist infrastructure equity funds established over the last two years. Provision of debt is often a limitation in a project, and this is due to the high amounts necessary (usually at least twice the equity amount). Maturities constrained by the lender's own deposit base and country or sector limits

constraining international bank lending only add to the limitation.

- Lenders are risk-averse since they do not share in the upside of the transaction. When a series of concessionary projects are offered, the pricing for the off-taker decreases as international participants become accustomed to the country, and competition to participate in the sector increases. This has been demonstrated in the power sector in the Philippines and, more recently, in Indonesia. Governments must recognize that this may be inevitable and therefore resist the temptation to renegotiate early deals when cheaper deals appear later. Environmental risks play an increasingly important role in the assessment of a project by the private sector. By managing environmental risks in efficiently, a private sector participant can gain a competitive advantage.

In Myanmar, many development projects are currently in the planning stage. These include the Thilawa Industrial Park with assistance from Japanese investors, the Yangon Inner Ring / Outer Ring Route (YIRR and YORR) as a route to the Greater Mekongan Subregion (GMS) Economic Corridor, the development of a large-scale Special Economic Zone (SEZ) such as Dawei, or the New Yangon City (NYC) project. In these projects, not only infrastructure but also all the four government markets are combined, and hence, decision-making for asset allocation is critical. Such decision-making involves combining PPP with Official Development Assistance (ODA) effectively. This necessitates an analysis of the expected economic return (EER) from infrastructure, land, real estate, and economic development simultaneously. The author of this paper, currently the Deputy Minister in the Ministry of Construction (MOC) in Myanmar, is a top decision-maker. Therefore, the analytical framework presented in this paper is based on the premise that recommendations from this research would be implemented in government investment decisions. Thus, the research has substantial value in terms of social and practical implications.

1.2 Motivation

Myanmar is a culturally and ethnically diverse country, comprising more than 135 ethnic groups across its regions. It is one of the poorest countries in East Asia and

the Pacific region. The Myanmar government aspires to ultimately unite the country and its peoples. However, given this diversity and certain other cultural considerations, political unification may be a distant possibility. Instead, the country may seek economic unification, in which case a harmonious social transition through development projects becomes a crucial element. This is the inherent motivation in this thesis.

The background to this research consists of three elements: lack of a union budget, future infrastructure investment needs, and considerations for the socio-economic transition to a harmonious unification of the country.

At present, Myanmar's GDP stands at approximately 73 trillion kyat (\$60 billion), and the debt-to-GDP ratio is about 5%. The share of infrastructure investment in the government budget is decreasing by the year. However, despite such financial conditions, the renewal and maintenance of aging infrastructure are essential for socio-economic development. In the 15-year plan from 2015 onwards, more than 300 roads and bridges are proposed to be built, and \$30 billion may be needed for this purpose. Myanmar is a multi-ethnic country comprising 135 ethnic groups, and it is essential that the budget is allocated to 15 provinces and regional governments properly in order to ensure nationally harmonized socio-economic development. This paper presumes that PPP it is implemented in combination with other funding schemes such as ODA.

1.3 Scope

Infrastructure development may be classified into asset allocation and asset management. Assets here include not only property or facility but also capital, information, technology, and the necessary personnel. Asset allocation refers to deciding the best mix or portfolio of assets in terms of amount, location, priority, timing, at the first stage of a facility's life cycle. On the other hand, asset management may be defined as the process that focuses on the later stages of the facility's life cycle, specifically operation, maintenance, and rehabilitation (Figure 1-1). This paper relates to asset allocation and supports the government's viewpoint of view in providing the analytical framework through which investment priority is recognized.

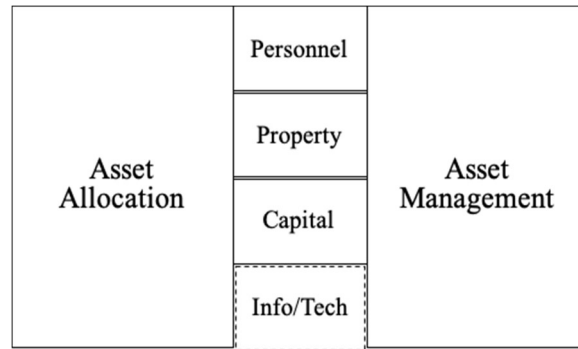


Figure 1-1. Asset Allocation and Asset Management

1.4 Purpose

The purpose of this paper is to analyze the attractiveness of investment in four areas (infrastructure, land, real estate, and urban economy) by PPP as the socio-economic benefit values, which is referred to as EER of Urban Economy Development (U), Land Development (L), and Real Estates Development (R) at the same time. In this research, these four areas are termed as “government markets,” or simply, markets. This paper then hypothesizes that synergy in urban utilities through infrastructure development are achieved by considering maximum socio-economic value-addition from effective and efficient investment in the four markets.

The presumption of the government markets depends on the road network and land-use cycle, as shown in Figure 1-2. The figure depicts the road network and land-use cycle and shows that infrastructure development improves economic conditions, leading to higher land values, which in turn put pressure for changes in land use, ultimately aiding in land development. Therefore, construction of new buildings and increased real estate activity in the area is evident. This generates traffic and causes traffic congestion. Such traffic conditions lead to a deterioration of service levels on the road network. Hence, the need for additional road infrastructure arises. In this way, infrastructure investment can be an arterial improvement that may result in deterioration of service levels. If the service level becomes unsatisfactory, further road construction becomes necessary and the cycle repeats until development stalls.

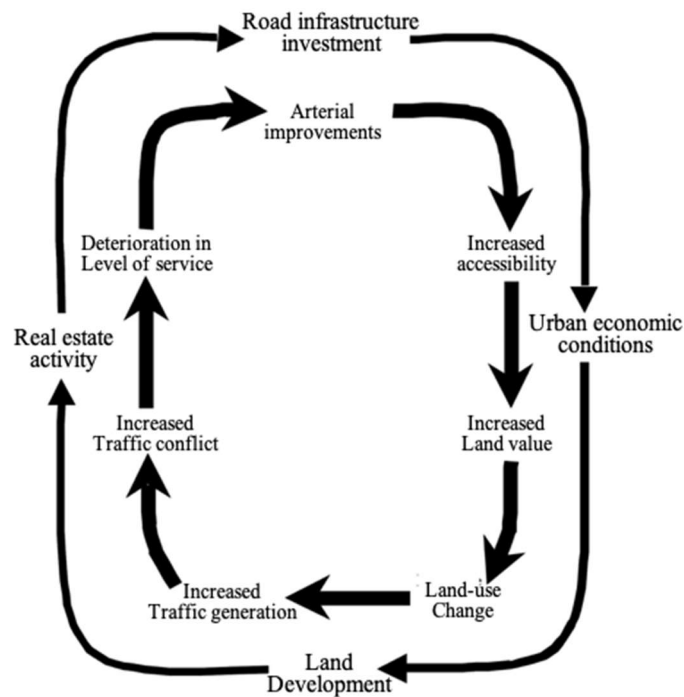


Figure 1-2. Road Network and Land-use Cycle

1.5 Methodology

The analytical framework of this paper starts with defining sub-criteria for each market as a measure to compute the EER. Each market is further individually categorized by its four sub-criteria as indexes. Thus, there are 16 sub-criteria in total.

Market	Sub Criteria
Urban Economy	1. Attraction (BA) 2. <i>Agglo. Econ (AE)</i> 3. Maturity (MM) 4. Exposure (ME)
Land	1. Stimulus (DS) 2. Potential (DP) 3. Activities (DA) 4. Illegal Use (IL)
Real Estate	1. Market Demand(MD) 2. Building Plans (BP) 3. Rental Rates (RR) 4. Vacancy Rates (VR)
Infrastructure	1. Provision (MP) 2. Traffic Demand (TD) 3. Leakage/ Inflow (LI) 4. Transport Costs(TC)

Figure 1-3 Four Markets and 16 Sub-criteria

In computing EERs, there are five stages and two pair-wise comparisons. The first comparison is the weighting of sub-criteria for states/regions. The second is the weighting of states/regions for each market.

Stage 1: Assigning Base EER, EER^B

Stage 2: Computing Regional Weights, W^R

Stage 3: Computing Regional EER, EER^R

Stage 4: Computing Market Weights, W^M

Stage 5: Computing Market EER, EER^M

Stage 1: The computational process starts with assigning base EERs of sub-criteria, denoted as EER^B , by region. EER^B is the attractiveness of investment. There are 16 sub-criteria for 15 states/regions; therefore, the number of inputs is 240 ($=16 \times 15$) in based on Table 6-2 to 6-5 and estimated for all the sub-criteria, region by region. The inputs are subjective, but background information, as shown in Figure 1-4, is available for the decision-maker. The figure, for example, shows investment in the hotel and tourism includes huge potential attractiveness, which is almost 100%. In the same way, it demonstrates that the rating for the Urban market may be large. This is because there are already important infrastructure such as International Airport, Harbor in Yangon therefore the Yangon is Finical Hub for Myanmar as precondition for Urban Development. On the other hand, the base EER for the infrastructure market in Yangon may not be necessary because some of the necessary infrastructures have been already implemented. Therefore, its rating may be 2.

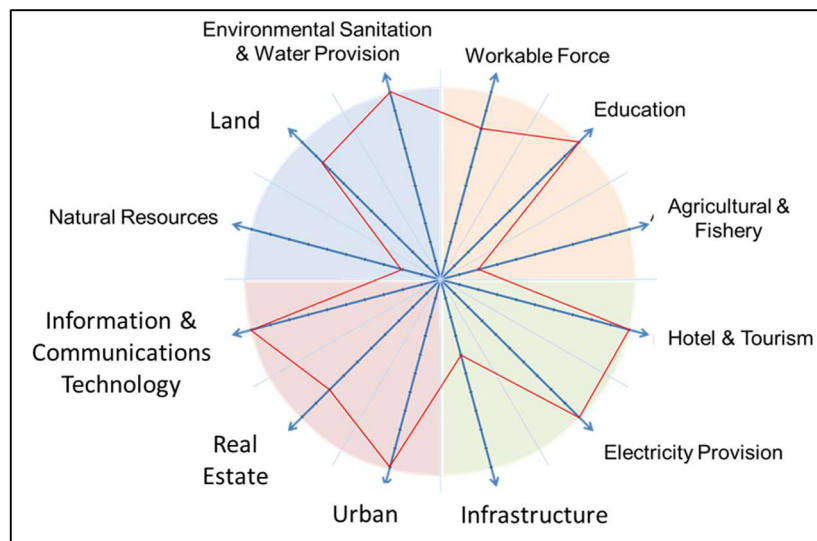


Figure 1-4. Background Information for Base EER

Table 1-1. Base EERs (EER^B) for States/Regions (%)

State/Region	Urban Economy (U)				Land (L)				Real Estate (R)				Infrastructure (I)			
	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
Kachin	80	20	20	20	20	100	40	20	20	80	20	20	20	40	20	20
Sagaing	80	40	60	80	40	100	20	20	40	100	100	40	40	20	20	20
Mandalay	60	80	80	100	80	100	100	40	40	100	100	100	40	60	40	40
Chin	20	20	60	20	20	100	20	20	20	40	40	40	80	80	20	20
Magwe	60	40	60	60	40	100	80	100	40	60	40	100	40	40	20	60
Shan	60	20	80	60	40	60	80	80	40	100	100	40	80	40	20	40
Rakhine	60	20	60	60	20	40	40	100	20	40	100	20	40	40	40	40
Naypyitaw	40	20	60	40	40	20	20	20	20	20	60	40	60	80	40	20
Kayah	40	40	60	40	20	100	60	20	20	100	80	60	60	20	20	80
Bago	20	60	60	40	20	20	100	20	40	20	80	100	40	60	20	40
Yangon	100	100	100	100	80	100	60	100	60	60	100	100	60	40	20	40
Ayeyarwaddy	80	60	60	100	40	20	20	20	40	20	40	40	40	40	40	20
Mon	60	20	60	80	80	40	60	20	20	100	100	60	40	40	40	60
Kayin	40	40	40	60	20	20	20	20	20	20	100	60	60	40	20	20
Tanintharyi	100	80	60	80	60	100	60	20	40	80	60	40	40	20	40	100

Stage 2: This is the first pairwise comparison between the 16 sub-criteria for the 15 states/regions, individually. Therefore, there are 15 matrix tables; each consists of 16x16 rows and columns. These weights are termed as “Regional Weights,” denoted as W^R . In the pair-wise comparison, the value of a_{jk} could be any number between 1 and 5. Evidently, $a_{jj}=1$ for all j . The relative importance between two criteria is measured according to a numerical scale from, for example, 1 to 5, as shown in Table 6-6, (Table 1-2).

Table 1-2. Relative Scores

Value of a_{jk}	Interpretation
1	j and k are equally important
2	j is slightly more important than k
3	j is more important than k
4	j is strongly more important than k
5	j is absolutely more important than k

In the comparison, if $a_{jk} > 1$, then the j th criterion is more important than the k th criterion; while if $a_{jk} < 1$, then the j th criterion is less important than the k th criterion. If two criteria have the same importance, then the entry a_{jk} is 1. The entries a_{jk} and a_{kj} satisfy the following constraint:

$$a_{jk} \cdot a_{kj} = 1$$

Table 1-3. Calculation of Regional Weights: W^R

(Yangon)

Criteria	Urban				Land				Real Estate				Infra				Geometric Average	Priority Vector
	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC		
BA	1.00	0.50	0.50	0.50	1.80	0.50	1.60	0.50	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	0.909	0.0541
AE	2.00	1.00	0.50	0.50	1.80	0.50	1.60	0.50	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	0.991	0.0590
MM	2.00	2.00	1.00	0.50	1.80	0.50	1.60	0.50	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	1.081	0.0643
ME	2.00	2.00	2.00	1.00	1.80	0.50	1.60	0.50	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	1.179	0.0701
DS	0.56	0.56	0.56	0.56	1.00	0.44	1.75	0.44	1.75	1.75	0.44	0.44	1.75	1.50	1.25	1.50	0.865	0.0515
DP	2.00	2.00	2.00	2.00	2.25	1.00	1.60	0.50	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	1.303	0.0775
DA	0.63	0.63	0.63	0.63	0.57	0.63	1.00	0.38	0.50	0.50	0.38	0.38	0.50	1.67	1.33	1.67	0.661	0.0393
IL	2.00	2.00	2.00	2.00	2.25	2.00	2.67	1.00	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	1.467	0.0873
MD	0.63	0.63	0.63	0.63	0.57	0.63	2.00	0.63	1.00	0.50	0.38	0.38	0.50	1.67	1.33	1.67	0.744	0.0443
BP	0.63	0.63	0.63	0.63	0.57	0.63	2.00	0.63	2.00	1.00	0.38	0.38	0.50	1.67	1.33	1.67	0.812	0.0483
RR	2.00	2.00	2.00	2.00	2.25	2.00	2.67	2.00	2.67	2.67	1.00	0.50	1.60	1.40	1.20	1.40	1.706	0.1015
VR	2.00	2.00	2.00	2.00	2.25	2.00	2.67	2.00	2.67	2.67	2.00	1.00	1.60	1.40	1.20	1.40	1.860	0.1107
MP	0.63	0.63	0.63	0.63	0.57	0.63	2.00	0.63	2.00	2.00	0.63	0.63	1.00	1.67	1.33	1.67	0.943	0.0561
TD	0.71	0.71	0.71	0.71	0.67	0.71	0.60	0.71	0.60	0.60	0.71	0.71	0.60	1.00	1.50	0.50	0.712	0.0424
LI	0.83	0.83	0.83	0.83	0.80	0.83	0.75	0.83	0.75	0.75	0.83	0.83	0.75	0.67	1.00	0.33	0.763	0.0454
TC	0.71	0.71	0.71	0.71	0.67	0.71	0.60	0.71	0.60	0.60	0.71	0.71	0.60	2.00	3.00	1.00	0.811	0.0483
(sum)																	16.808	1.000

Note: The priority vector denotes W^R , the Regional Weights

The aforementioned calculation is repeated for all the sub-criteria for each region, with Table 1-4 showing a summary of the calculated regional weights. Since not all sub-criteria have the same priority in all states/regions, the calculated weights are different for the sub-criteria in each state/region. It is also clear that the sum of each row is 1.

Table 1-4. Summary of Regional Weights: W^R

State/Region	Urban				Land				Real Estate				Infra				sum
	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC	
Kachin	0.0624	0.0252	0.0275	0.0300	0.0327	0.1079	0.0750	0.0411	0.0449	0.1212	0.0534	0.0582	0.0635	0.1061	0.0723	0.0788	1.00
Sagaing	0.0597	0.0374	0.0578	0.0692	0.0437	0.0820	0.0283	0.0308	0.0550	0.1158	0.1262	0.0672	0.0733	0.0468	0.0511	0.0557	1.00
Mandalay	0.0386	0.0488	0.0532	0.0654	0.0588	0.0723	0.0789	0.0308	0.0336	0.0965	0.1052	0.1147	0.0435	0.0581	0.0486	0.0530	1.00
Chin	0.0203	0.0221	0.0660	0.0258	0.0282	0.1061	0.0340	0.0370	0.0404	0.0678	0.0739	0.0806	0.1307	0.1425	0.0596	0.0650	1.00
Magwe	0.0468	0.0269	0.0523	0.0571	0.0308	0.0892	0.0806	0.0987	0.0393	0.0711	0.0440	0.1246	0.0508	0.0554	0.0399	0.0925	1.00
Shan	0.0448	0.0168	0.0641	0.0533	0.0312	0.0596	0.0757	0.0825	0.0380	0.1100	0.1199	0.0465	0.1009	0.0529	0.0433	0.0603	1.00
Rakhine	0.0607	0.0200	0.0709	0.0773	0.0250	0.0403	0.0439	0.1066	0.0328	0.0529	0.1361	0.0414	0.0638	0.0696	0.0759	0.0828	1.00
Naypyitaw	0.0421	0.0212	0.0678	0.0536	0.0536	0.0270	0.0295	0.0322	0.0351	0.0383	0.1096	0.0745	0.1226	0.1564	0.0798	0.0569	1.00
Kayah	0.0332	0.0362	0.0476	0.0405	0.0208	0.1039	0.0589	0.0268	0.0292	0.1203	0.0975	0.0774	0.0844	0.0441	0.0481	0.1311	1.00
Bago	0.0181	0.0552	0.0602	0.0400	0.0236	0.0257	0.1021	0.0310	0.0526	0.0353	0.1131	0.1463	0.0662	0.1012	0.0520	0.0773	1.00
Yangon	0.0541	0.0590	0.0643	0.0701	0.0515	0.0775	0.0393	0.0873	0.0443	0.0483	0.1015	0.1107	0.0561	0.0424	0.0454	0.0483	1.00
Ayeyarwaddy	0.0771	0.0703	0.0767	0.0874	0.0463	0.0302	0.0329	0.0359	0.0575	0.0409	0.0655	0.0714	0.0779	0.0850	0.0865	0.0585	1.00
Mon	0.0440	0.0173	0.0514	0.0737	0.0804	0.0348	0.0596	0.0269	0.0294	0.1193	0.1301	0.0794	0.0489	0.0533	0.0581	0.0935	1.00
Kayin	0.0451	0.0491	0.0536	0.0657	0.0254	0.0277	0.0302	0.0329	0.0359	0.0392	0.1570	0.1117	0.1218	0.0866	0.0566	0.0617	1.00
Tanintharyi	0.0736	0.0600	0.0443	0.0666	0.0492	0.0879	0.0549	0.0279	0.0374	0.0777	0.0720	0.0467	0.0476	0.0405	0.0542	0.1594	1.00

Stage 3: Based on Stage 2, the EERs of the 16 sub-criteria are computed for the states/regions, individually. These EERs are termed “Regional EER,” and denoted as

EER^R . Thus, based on the base EER in Table 1-1 and the weights of the sub-criteria, the next step is to adjust the base EER to the weights. Therefore:

$$EER^R = EER^B \times W^R$$

Table 1-5 shows the summary of EER^R for all the states/regions.

Table 1-5. Summary of Regional EER: EER^R (%)

State/Region	Urban	Land	Real Estate	Infra	Sum
Kachin	6.65	15.26	12.83	8.53	43.27
Sagaing	15.28	11.13	29.09	6.01	61.50
Mandalay	17.02	21.06	32.98	9.29	80.35
Chin	5.32	12.59	9.70	24.35	51.96
Magwe	10.45	26.47	20.05	10.60	67.57
Shan	11.35	17.48	26.37	13.47	68.68
Rakhine	12.93	14.52	17.21	11.69	56.35
Naypyitaw	8.32	3.92	11.02	24.19	47.45
Kayah	7.25	14.88	25.06	17.40	64.59
Bago	8.89	11.82	26.48	12.86	60.05
Yangon	24.75	22.96	26.77	7.90	82.38
Ayeyarwaddy	23.73	3.83	8.60	11.14	47.30
Mon	11.96	11.93	30.30	12.02	66.21
Kayin	9.85	2.32	23.90	13.14	49.21
Tanintharyi	20.15	15.60	13.90	20.82	70.47

Stage 4: This is the second pairwise comparison of the 15 states/regions for the four markets of urban, land, real estate, and infrastructure. Therefore, there are four matrix tables, each consists of 15x15 rows and columns as shown by equation 6-1. The relative importance is measured according to a numerical scale from 1 to 5 as shown in Table 1-2. Accordingly, the relative weights of the sub-criteria are calculated by equation 6-2. These relative weights are readjusted to the maximum weight in a market. Consequently, the readjusted weights are termed "Weight," and calculated by WM and computed as $WM = w_i / \max(w)$, where w_i denotes the relative weight of the i th state/region, and $\max(w)$ is the maximum weight among the states/regions in the market.

Table 1-6. Market Weight (W^M) by Pair-wise Comparison

(Infra)

State/Region	Kachin	Sagaing	Mandalay	Chin	Magwe	Shan	Rakhine	Naypyitaw	Kayah	Bago	Yangon	Ayeyarwaddy	Mon	Kayin	Tanintharyi	Geometric Average	Priority Vector	Relative Weight
Kachin	1.00	0.50	0.36	0.33	0.38	0.36	0.38	0.33	0.36	0.38	0.38	0.42	0.36	0.42	0.33	0.4017	0.0241	0.386
Sagaing	2.00	1.00	0.36	0.33	0.38	0.36	0.38	0.33	0.36	0.38	0.38	0.42	0.36	0.42	0.33	0.4406	0.0265	0.423
Mandalay	2.80	2.80	1.00	0.47	1.89	0.50	1.89	0.47	0.50	1.89	1.89	1.78	0.50	1.78	0.47	1.1002	0.0661	1.057
Chin	3.00	3.00	2.11	1.00	1.80	1.90	1.80	0.50	1.90	1.80	1.80	1.70	1.90	1.70	0.50	1.5837	0.0951	1.522
Magwe	2.60	2.60	0.53	0.56	1.00	0.47	0.50	0.44	0.47	0.50	0.50	1.88	0.47	1.88	0.44	0.7650	0.0459	0.735
Shan	2.80	2.80	2.00	0.53	2.13	1.00	1.89	0.47	0.50	1.89	1.89	1.78	0.50	1.78	0.47	1.2248	0.0736	1.177
Rakhine	2.60	2.60	0.53	0.56	2.00	0.53	1.00	0.44	0.47	0.50	0.50	1.88	0.47	1.88	0.44	0.8457	0.0508	0.813
Naypyitaw	3.00	3.00	2.11	2.00	2.25	2.11	2.25	1.00	1.90	1.80	1.80	1.70	1.90	1.70	0.50	1.8021	0.1082	1.731
Kayah	2.80	2.80	2.00	0.53	2.13	2.00	2.13	0.53	1.00	1.89	1.89	1.78	0.50	1.78	0.47	1.3636	0.0819	1.310
Bago	2.60	2.60	0.53	0.56	2.00	0.53	2.00	0.56	0.53	1.00	0.50	1.88	0.47	1.88	0.44	0.9489	0.0570	0.912
Yangon	2.60	2.60	0.53	0.56	2.00	0.53	2.00	0.56	0.53	2.00	1.00	1.88	0.47	1.88	0.44	1.0408	0.0625	1.000
Ayeyarwaddy	2.40	2.40	0.56	0.59	0.53	0.56	0.53	0.59	0.56	0.53	0.53	1.00	0.44	0.50	0.41	0.6722	0.0404	0.646
Mon	2.80	2.80	2.00	0.53	2.13	2.00	2.13	0.53	2.00	2.13	2.13	2.29	1.00	1.78	0.47	1.5450	0.0928	1.484
Kayin	2.40	2.40	0.56	0.59	0.53	0.56	0.53	0.59	0.56	0.53	0.53	2.00	0.56	1.00	0.41	0.7497	0.0450	0.720
Tanintharyi	3.00	3.00	2.11	2.00	2.25	2.11	2.25	2.00	2.11	2.25	2.25	2.43	2.11	2.43	1.00	2.1656	0.1301	2.081
(sum)																16.6496	1	

Note: The Relative Weights denotes W^M , the Market Weights

Table 1-7. Summary of Market Weights: W^M

State/Region	Urban	Land	Real Estate	Infra
Kachin	0.1814	0.3252	0.5137	0.3056
Sagaing	0.4921	0.3566	0.8060	0.1919
Mandalay	0.5854	0.6564	0.8840	0.5532
Chin	0.1723	0.2790	0.4014	0.7256
Magwe	0.3689	0.7540	0.4830	0.3538
Shan	0.4046	0.6316	1.0000	0.3880
Rakhine	0.4438	0.5809	0.4504	0.4256
Naypyitaw	0.2511	0.2645	0.3160	0.8321
Kayah	0.2836	0.4776	0.6004	0.6300
Bago	0.3111	0.3633	0.3518	0.4775
Yangon	1.0000	1.0000	0.6771	0.5238
Ayeyarwaddy	0.6808	0.3349	0.3110	0.2840
Mon	0.5401	0.5700	0.7663	0.7138
Kayin	0.3756	0.3169	0.4058	0.3168
Tanintharyi	0.9722	0.6961	0.8568	1.0000

Stage 5: Finally, based on the Stage 2, the EERs of the 15 states/regions are computed for each of the four markets, with adjustments being made on the EERR. These EERs are termed “Market EER,” and denoted as $EERM$. Thus:

$$EER^M = EER^R \times W^M$$

Finally, the EERs in the tables can be used to compare the attractiveness of each market among states/regions.

Table 1-8. Summary of Market Expected Economic Return: EER^M

State/Region	Urban	Land	Real	Infra	Total
Kachin	1.20	4.96	2.69	3.29	12.14
Sagain	7.51	3.96	18.16	2.54	32.17
Mandalay	9.93	13.38	28.87	9.82	62.00
Chin	0.92	3.51	2.48	37.05	43.95
Magwe	4.21	19.32	10.17	7.79	41.49
Shan	5.02	10.87	19.36	15.85	51.10
Rakhine	4.79	6.40	6.60	9.50	27.29
Naypyitaw	2.08	1.02	3.41	41.89	48.40
Kayah	2.05	7.53	16.45	22.79	48.82
Bago	2.76	4.16	15.80	11.72	34.44
Yangon	24.75	22.96	26.77	7.90	82.38
Ayeyarwaddy	16.48	1.28	3.33	7.20	28.28
Mon	6.51	7.30	28.23	17.84	59.87
Kayin	3.71	0.72	11.68	9.46	25.56
Tanintharyi	18.60	11.79	7.47	43.33	81.19

1.6 The Outputs

1.6.1 Comparisons of EER^B, EER^R, and EER^M

Graphical demonstrations, which are useful tools to visualize the relationships between calculated values, prove that the formula of road infrastructure investment and economic development is meaningful in practice. In the following, some of the example outputs are shown, and more detailed outputs and the discussion will be in Chapter 6.

EER^B is not an inter-relative value, as it only shows the attractiveness of the economic return for states and regions. In others words, it demonstrates the initial economic condition of a region so that policy makers can understand its general economic condition. On the other hand, EER^R is obtained by adjusting the weights of pairwise comparisons between states and regions. Hence, it shows the economic

return for each state and region in accordance with their economic and demographic conditions. The EER^R calculation is based on regional conditions; it does not consider the comparisons among other states and regions.

Figures 1-5 presents the correlation between EER^B and EER^R overall. EER^B and EER^R are proportional to each other, or highly correlated. For example, both the EER^B and EER^R of Yangon (YGN) are almost the same, approximately 80%. Similarly, those of Kachin (KCHIN) are around 40%. The above figure shows the plots between the total base EER^B and the total regional EER^R , showing the underlying potential of investment, with YGN having the largest attractiveness potential and KCHIN being the least attractive according to the regional analysis.

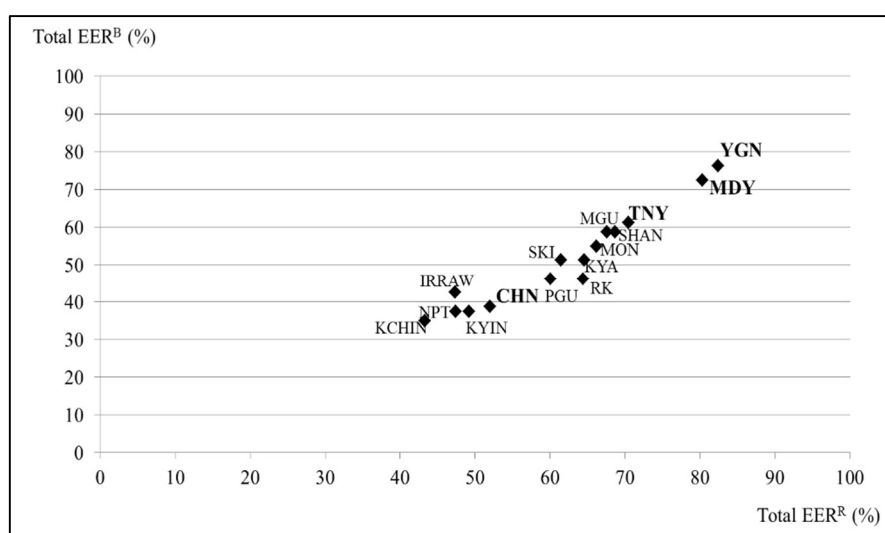


Figure 1-5. Total EER^B and EER^R

Where,

YGN = Yangon Region
MDY = Mandalay Region
TNY = Tanintharyi Region
MGU = Magwe Region
SKI = Sagaing Region
PGU = Bago Region
IRRAW = Ayeyarwaddy Region
NPT = Naypyitaw Region
SHAN = Shan State
MON = Mon State
KYA = Kayah State
RK = Rakhine State
CHN = Chin State
KYIN = Kayin State
KCHIN = Kachin State

On the other hand, EER^M_s are the values of national economic return among states and regions in Myanmar, which are calculated from the market-weighted values among these states and regions so that it represents national values. Therefore, policy makers shall use these EER^M_s values as criteria when determining priority if the investment projects are situated in all states and regions.

Figure 1-6 represents the relations between the total value attractiveness EER^B and the national values EER^M of all states and regions. It shows that the two EERs are directly related to each other, namely, the values of attractiveness of EER^B reflect the national values of EER^M_s of each state and region. As seen in the figure, with regard to attractiveness, KCHIN is the smallest from the central government perspective, whereas YGN and TNY are the most significant in the whole country.

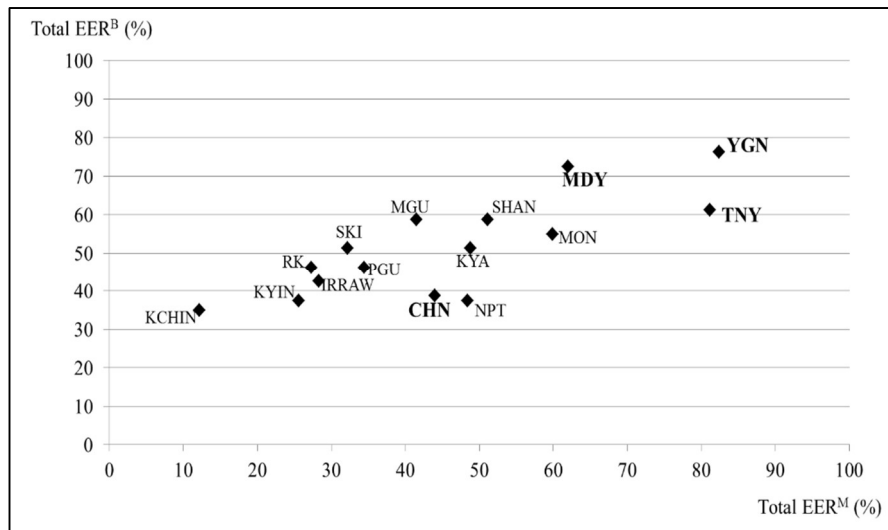


Figure 1-6. Total EER^B and EER^M

1.6.2 Comparisons of EER^R and EER^M

Regional EER^R is the economic return of each region within itself, while the national EER^M is the economic return of each region among all states and regions. Figure 1-7 shows the comparison of regional economic return EER^R and national economic return EER^M among all states and regions. From this figure, the author notes that most regions have high EER^R values in their regions, but with lower national values of EER^M when compared to all states and regions, with the

exception of the YGN region that has the same values of EER regionally and nationally. Therefore, the YGN region has the highest potential return on investment both regionally and nationally, with other potential regions being MDY and TNY because they have the same values regionally and nationally.

Generally, the regional EER^R values for all states and regions are higher than the national EER^M values, indicating the existence of more opportunities within regions, but lesser opportunities among the states and regions because of the related and weighted values of socioeconomic and demographic data of all states and regions. This figure shows the regions with both high EER^R and EER^M .

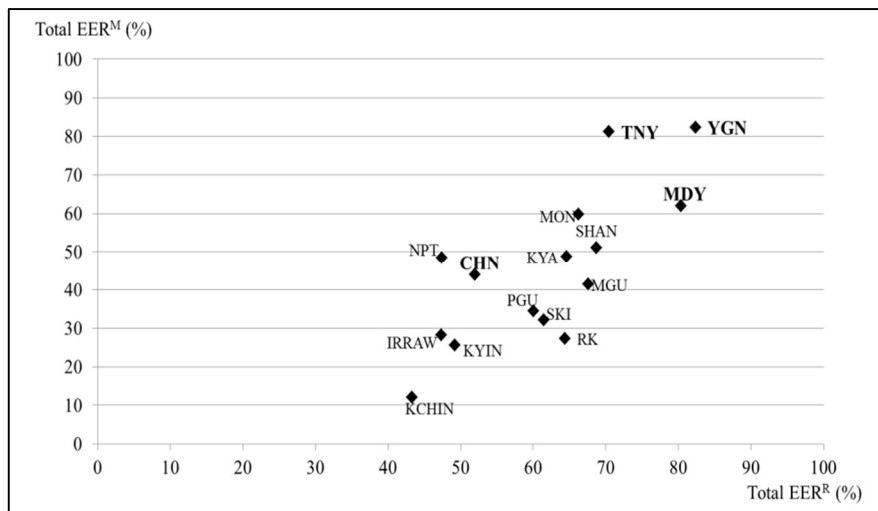


Figure 1-7. Total EER^R and EER^M

1.7 An Application Example of Output

1.7.1 EER^M and Budget

Figure 1-8 presents the relation between 10 years road infrastructure investment and EER^M , with YGN, TNY, MDY, and MON being able to achieve high EER^M with less investment in road infrastructure, indicating that they are first potential regions for investment. Additionally, KYA, KYIN, and NPT are second potential regions for investment because they can get low EER^M with less investment; therefore, policy makers need to maximize the EER^M by leveraging the market. For example, MON and MDY regions have values of 28.23 and 28.87 values

in the real estate market, respectively; thus, the investment in real estate will trigger other markets development. Moreover, the other states and regions are third potential regions that can get low EER with high investment; therefore, the planner needs to use the potential market as a trigger for development of these regions. For example, the MGU region can use the land development market as the trigger because of the market value of 19.32, while the CHN state also uses the infrastructure market as the development trigger with a market value of 37.05.

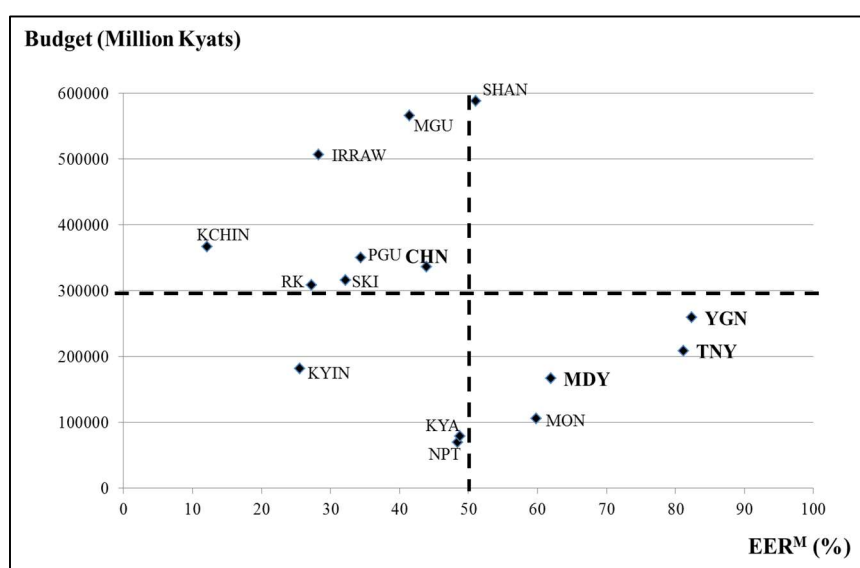


Figure 1-8. EER Achievement in terms of Budget

1.7.2 Comparison of the EER^M and GRDP Growth Rate

The calculated EER^M results can be used only by the policy makers or the government for investments. For example, the CHN state has a high value of EER^M in the infrastructure market, while the MON state has a higher value than the YGN region in the real estate market. Therefore, private investors could not get robust EER, if they were to invest in these regions. If private investors want to invest in individual states or regions, the following comparisons should be used.

In Figure 1-9, the upper-right group shows a continuous investment potential; while the lower-right regions indicate a bright future, although their past performance was not significant. However, the lower-left states/regions might be a concern from a harmonious development perspective.

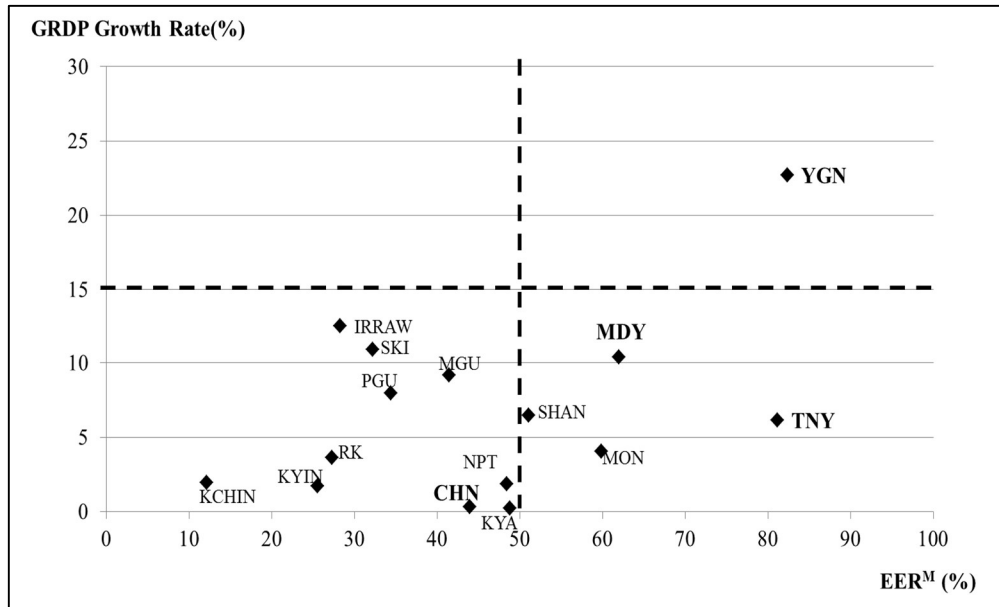


Figure 1-9. EER^M and GRDP Growth Rate

According to the figure, YGN has the highest value in terms of both GRDP and EER^M, thus being the best region to invest in among the 15 states/regions for private investors. MDY should be chosen as the second region for private investors, with TNY region, MON state, and SHAN state being in the third place because of their great potential for the future, since they have good EER^M and despite their low GRDP. More consideration would be required, if private investors were to invest in the KCHIN, KYIN, RK, and CHN states, as they have low value in terms of GRDP and EER^M.

The growth rate has been very small in CHN. Similarly, KCHIN, KYIN, and RK also have little impact on Myanmar's GDP. In the case of KCHIN, it is located near to China, so Chinese investors come into it and invest in calibration, banana planting, sugar cane planting, and so on, while the KYIN state is near to Thailand. However, RK is slightly different from the aforementioned two regions. At present, RK has the biggest problem in Myanmar, which is the Bengali problem. Approximately 700,000 people run away to Bangladesh; thus, both the Rakhine's GDP growth rate and EER^M value are low. Although the IRRRAW, SKI, and PGU regions are good for investment, since their GRDPs are high, the best one among the four markets should be chosen, since their EER^M values are low.

1.7.3 Comparison of EER^M and Unemployment Rate

Figure 1-10 shows comparisons of the unemployment rates in respective states/regions and their EER^M values, with the unemployment rate being almost the same between about 2%-6 %; however, YGN, MDY, TNY, and MON have bigger EER^M values. For KCHIN, KYIN, IRRRAW, and SKI, these regions have smaller EER^M values. RK has the highest unemployment rate in addition to the KYIN state. However, the unemployment rate is almost the same in KCHIN, IRRRAW, SKI region, MGU, NPT, MDY, and YGN, accounting for about 2%-4%.

As seen in YGN, its unemployment rate is low, whereas its expected market EER^M is the highest indicating that the unemployment may be alleviated in the future because of the high expectation. However, it also necessitates suitable investment in the four markets by the central government.

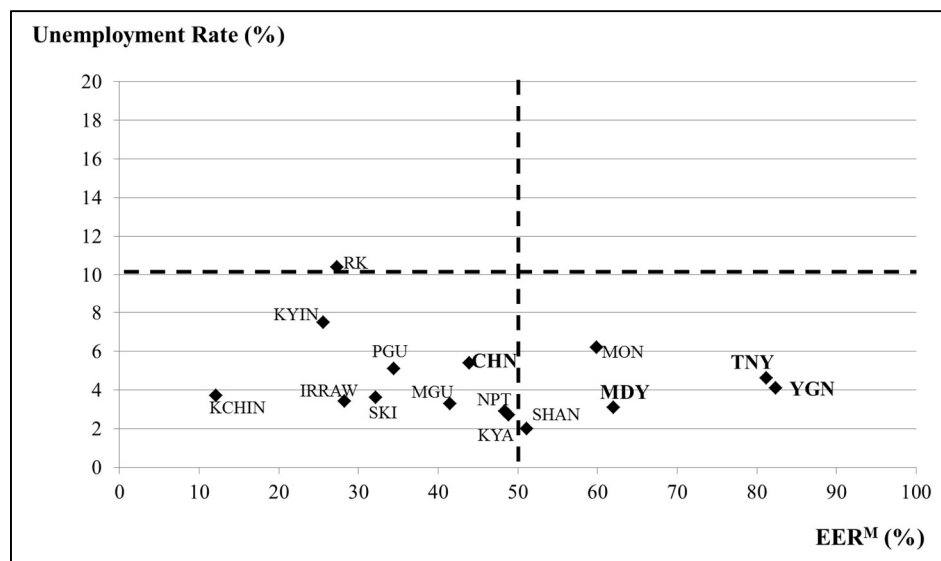


Figure 1-10. EER^M and Unemployment Rate

1.8 Conclusion

This chapter develops an appropriate formula for evaluating road investment that is applicable as an early and cost-effective method to prioritize road infrastructure projects in terms of their economic potential. Additionally, different road infrastructure projects can be depicted graphically to assist with the comparisons and ranking processes.

This thesis starts with the motivation of harmonious development in Myanmar and concludes with measurable, visible, and practical outputs. The analytical framework can be also be shared with other ministries such as the Ministry of Electricity and Energy and other decision makers. Therefore, this research makes a significant contribution to government investment decision-making.

It was shown that the demand for development as well as the potential for maximum expected returns could be evaluated using the formula of road infrastructure investment and economic development introduced in this chapter. This formula is an excellent tool for evaluating road infrastructure investment decisions at an early stage of the process. The provision of road infrastructure should be based on actual demand; hence, there must be an actual market for such infrastructure. This will ensure a higher probability of meaningful economic activities and stimulation.

Chapter 2

Research Background

This chapter discusses the three major background motivations and needs for implementation of public-private partnership (PPP) in Myanmar. The first background condition is the insufficiency of a country's budget, which is essentially the budget shortage for use in government investment. Myanmar is a developing country and with the government's limited budget, it is difficult to meet the capital demands for social and infrastructure development. A huge investment is required for the large-scale development of infrastructure in Myanmar in various sectors, such as transportation, power generation special economic zones, resource development, and other supporting infrastructures, to realize its long-term growth and development. Privatization is one of the measures for increasing funding and meeting all demands within a short period of time. Further, it has been highlighted that the government has been suffering from budget deficit, and the gross domestic product (GDP) growth has not been sufficient to lower the ratio of deficit in comparison to GDP growth.

As the second background motivation, this chapter discusses the PPP needs caused by the national infrastructure development plan. This section presents the master plan of infrastructure development. By just considering road/highway and bridges, the MOC assumes a total of 26784 billion kyat (22.32 billion USD) equivalent worth of infrastructure investment by the government itself for 2016–2030, which consists of 3804 billion kyats for bridge and 22980 billion kyat for road/highways. Consequently, the efficient implementation of PPP may be inevitable because of national budget constraints. Furthermore, the government wants to avoid having excessive burdens of loans from international lenders, such as the World Bank, ADB, and JICA.

The third background motivation for the implement of PPP in Myanmar arises from its unique social conditions. Myanmar is a county of unions, consisting of 135 ethnic groups, with eight major groups having different social values. This signifies the diversity of socio-economic values and it also denotes that only economic values are not enough for social development. PPP is a model based on the financial feasibility of the

private sector; however, the socio-economic impact of infrastructure implementation should be considered when applying PPP. This, in turn, means that the government requires its own evaluation model to decide the project that should be under PPP considering its socio-economic values.

Currently, in Myanmar, there are ministries that implement the work in the form of PPP. However, there are no specific rules and regulations to implement PPP in projects, and the decision to discuss and develop PPP is taken within a ministerial level meeting. Therefore, there are no specific rules and regulations that the investors can trust and rely on concerning public sector participation. Therefore, this study focuses on the analytical framework to share some of the evaluations among public and private sectors. As a result, the above motivations are based on the analytical framework of this study, which is discussed in detail in Chapter 6 as a major contribution.

2.1 Union Budget

2.1.1 Expenditure of Union and Region/State

Figure 2.1 shows the yearly budget earning, expenditure, and deficiency data from Myanmar Statistical Yearbook. The figure shows an increase in the deficiency of budget in each year.

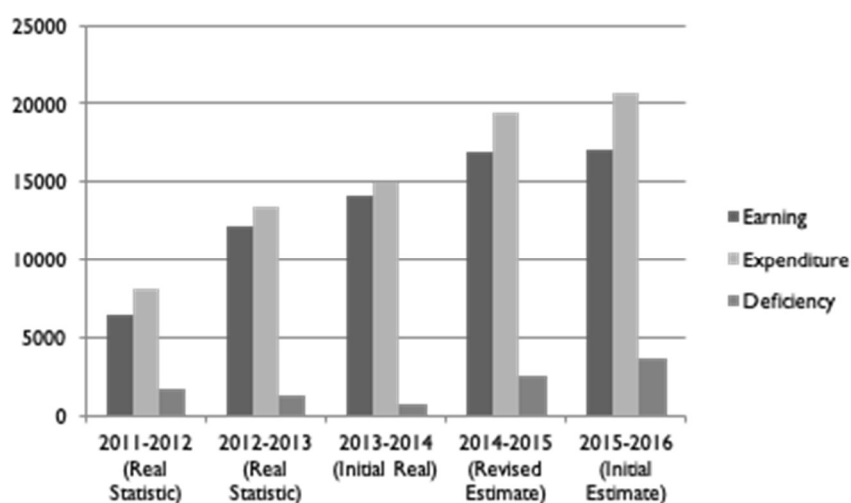


Figure 2-1. Fiscal Year Ratio of Deficiency and GDP Budget of Union

(Source: [MNPED(2015)])

Table 2-1 presents the details of the historical earnings/expenditures in Myanmar between 2011–2016. The earning has been increasing consistently each year in the past at both union and region state levels. Comparing fiscal years 2011 and 2015, the overall earning increased approximately three times, i.e., from 5781 to 19403 billion kyat (16.17 billion USD). Accordingly, the expenditure also increased at almost the same rate. At the same time, while the expenditures were more than the earnings between 2011–2014, the earnings became larger than the expenditures after 2014. This seems to be a good trend; however, the ratios of deficiency against the GDP growth have stayed almost the same between 4 to 5% as in the past. This concludes that the GDP growth has not been enough to lower the amount of deficiencies in comparison to the economic growth.

Table 2-1. Historical Earnings/ Expenditures and Deficiencies

		2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Earning	Union	5421.00	10052.00	13214.00	16538.00	17000.00
	Region/State	360.00	832.00	1172.00	2623.00	2403.00
	Total	5781.00	10884.00	14386.00	19161.00	19403.00
	(USD)	4.82	9.07	11.99	15.97	16.17
Expenditure	Union	7476.00	12006.00	16141.00	19291.00	20614.00
	Region/State	507.00	832.00	1172.00	2263.00	2403.00
	Total	7983.00	12838.00	17313.00	21914.00	23017.00
	(USD)	6.65	10.70	14.43	18.26	19.18
Deficiency	Union	▲2055.00	▲1954.00	▲2927.00	2753.00	3614.00
	Region/State	▲147.00	0.00	0.00	0.00	0.00
	Total	▲2202.00	▲1954.00	▲2917.00	2753.00	3614.00
	(USD)	▲1.84	▲1.63	▲2.43	2.29	3.01
GDP		45928.00	51383.00	59249.00	66187.00	73314.00
(USD)		38.27	42.82	49.37	55.16	61.10
Deficiency/GDP		4.79%	3.80%	4.94%	4.16%	4.93%

Unit: Billion Kyats
(Billion USD; 1\$ = 1,200 kyats)

Source [IMF(2013)]

According to IMF's report [IMF(2013)]¹, Myanmar's national deficit is set at 5% of GDP. The report suggests that half of this deficit, which is expected to be 1.3 trillion kyat (1.6 billion USD) in 2014, will be financed by foreign sources, including loans and

grants from international co-operators. These loans are a viable option for the government to secure some of the required financing for transport sector projects. To achieve these required levels of investment, it will be necessary to encourage investment from foreign and domestic private sources. One method of achieving this is to permit private investors to hold 100% investment in certain projects or to assemble new investments through PPP/BOT agreements. Domestic and foreign private financial resources are additional option for financing. There is evidence that suggests that both private investments and PPPs are progressing in Myanmar's transport sector at present. However, incomplete legislation or regulations to govern PPP arrangements can hinder implementing new PPP projects, especially large-scale transport projects.

Some concessional loans are allocated for the development of infrastructure because of the insufficiency of government budget for all sectors. Apart from the government budget, there are two types of budget financing for the development of infrastructure. One is external borrowing, which means getting concessional loan from development partners; and the other is internal borrowing from the banks. As per the records, the total borrowing of about 3900 billion kyat was provided in the year 2015–16's Union Budget Law.

Many concessional loans from ADB, JICA, and other such agencies, under the debt sustainability framework are available in Myanmar. Line ministries and internal organizations acquire international practice of infrastructure finance and implementation through concessional loan projects financed by AMDBs, JICA, and other agencies. Fiscal risk management lacks rules, institutions, and capacity to make decisions on the mode of financing on public, PPP, or private; and assess and manage fiscal impact, risks, and liabilities.

The coverage and quality of infrastructure in Myanmar is lower than other developing countries, including Southeast Asia. Myanmar is ranked 134 among 140 countries in terms of infrastructure quality [GCI(2015)]. The required infrastructure investment to sustain an average 8% annual economic growth till year 2030 was estimated as 320 billion USD [Chhor et al. (2013)]. About 60% of this investment was required for residential and commercial real estates. Moreover, the power generation,

transmission, and distribution sectors require about 66.6 billion USD, and National Network transport infrastructure requires about 40 billion USD till year 2030

It is difficult to estimate the current financing structure for infrastructure development in Myanmar because of the limitations in data availability and transparency, especially for off-budget activities. There are many non-financial requirements stated to modernize and streamline implementation of infrastructure development in Myanmar [JICA et al. (2015)]. Capital expenditure is currently at 5.6% of the GDP, which is significantly lower than the required infrastructure investment needs.

2.1.2 Transport Sector Investment in Myanmar

Table 2-2 presents the recent changes in a various economic indicators, such as GFCF in the Transport Sector (Column 5) and total national GFCF (Column 6) in Myanmar. Column (6) presents the ratio of Transport GFCF to Total GFCF, which indicates a steady decline in transport investment. For example, in FY2004-05 and FY2005-06, while Nay Pyi Taw was under construction, the Transport GFCF to Total GFCF ratio reached 12.8% and 14.4%, respectively. As presented in the table, the ratio of transport sector GFCF to total GFCF decreases in Column (6). The government expenditure is increasing every year; however, GFCF related to the transport sector is decreasing.

Table 2-2. Proportion of GFCF in the Transport Sector to GDP and Total GFCF (%)

Fiscal Year	Nominal GDP	Total Fixed Capital Formation	Government Expenditure	Government Capital Expenditure	Fixed Capital Formation in Transport Sector	Transport to Total GFCF (5)/(2) (%)
0	(1)	(2)	(3)	(4)	(5)	(6)
May-04	9,078.90	1,207.50	1,693.00	733.5	154.3	12.8
Jun-05	12,286.80	1,867.60	2,353.90	906.5	269.3	14.4
Jul-06	16,852.80	2,359.40	3,693.50	1,274.00	177.7	7.5
Aug-07	23,336.10	3,710.40	4,901.50	1,890.00	255.9	6.9
Sep-08	29,233.30	5,057.40	5,314.90	2,033.60	244.3	4.8
Oct-09	33,894.00	7,151.60	6,260.60	2,840.80	381.7	5.3
Nov-10	39,846.70	10,081.20	7,506.90	3,575.30	352.3	3.5

Figure 2.2 illustrates three possible transport sector investment scenarios based on the three peer country groups between 2014 and 2030. The first scenario assumes that the ratio of Transport Sector GFCF (investment) will be 5% of total national GFCF under the GDP growth in line with the Low Investment country group.. The second scenario assumes that this ratio will be 10% of the national GFCF, in line with the Medium Investment country group. The third scenario assumes a ratio of 15%, in line with the High Investment countries, such as Thailand and Vietnam.

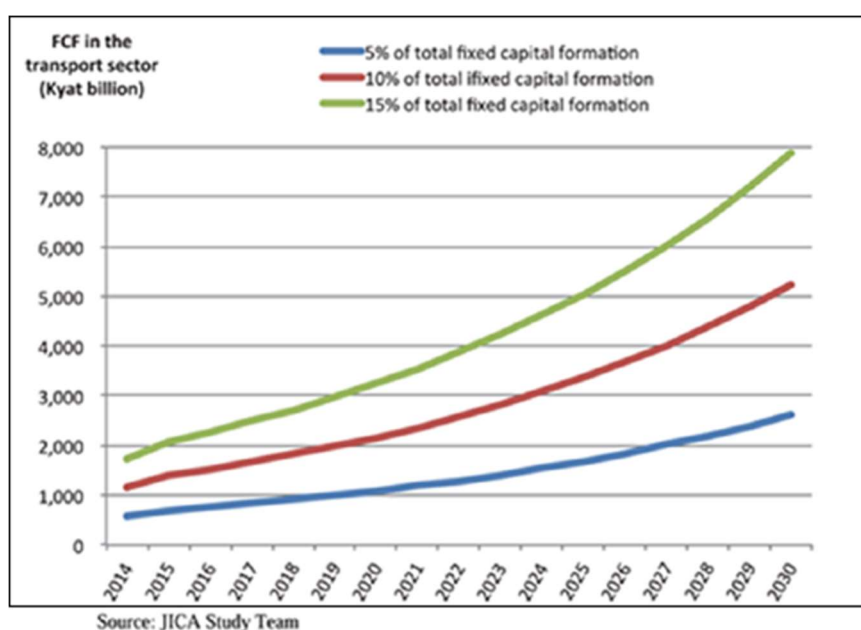


Figure 2-2. Alternative Transport Sector Investment (GFCF) Scenarios
(Source: [JICA(2014)])

To maintain a 5% share of Transport GFCF in the total GFCF in Myanmar, the amount of investment required in 2014 was 576 billion Kyat, which will rise to approximately 2.6 trillion kyat by 2030. In the Medium investment scenario (10% ratio), the levels of required investment increased to 1.2 trillion kyat in year 2014 and will rise to 5.3 trillion kyat in 2030. If Myanmar targets the High investment scenario (15% ratio), the investment requirement that was 1.7 trillion kyat in 2014 will increase to 7.9 trillion kyat in 2030.

Table 2-3 presents the required ratio of GFCF to GDP. The first three columns of the table are the percentages for 2010-2030, whereas the fourth column indicates the accumulated amount of the required GFCF. According to the forecast, the required

GFCF may be doubled in Scenarios 1 and 2 from year 2010 to 2030, approximately. This required rapid GFCF increment will be a major challenge for Myanmar because of other Asian countries that have experienced rapid economic growth and have recorded such high percentages.

Table 2-3. Required Ratio of GFCF to GDP and Accumulated GFCF Amounts

Scenarios	2010	2020	2030	Accumulated amount
				2014-2030 (trillion Kyat)
Scenario 1	16.80%	28.9	35.00%	536
Scenario 2	16.80%	27.00%	32.70%	481
Scenario 3	16.80%	22.50%	27.30%	359

Figure 2-3 shows the required amount of gross fixed capital formation to achieve the GDP growth targets. One method of achieving this scenario is to permit private investors to hold 100% investment in certain projects or to arrange new investments through PPP/BOT agreements. Another option for financing is through domestic and foreign private financial resources. There is evidence that suggests that both private investments and PPP's are currently progressing in Myanmar's transport sector. However, implementing new PPP projects, especially large-scale transport projects, could be hindered by incomplete legislation or regulations to govern PPP arrangements.

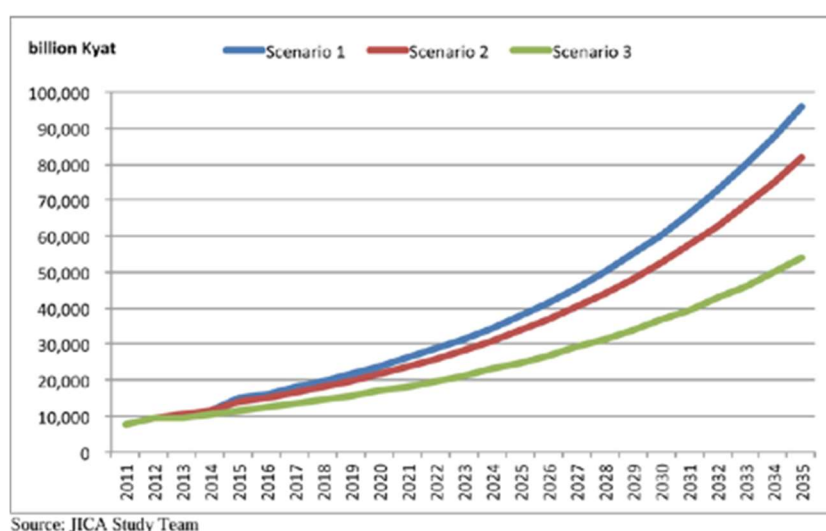


Figure 2-3. Required Amount of Gross Fixed Capital Formation to Achieve GDP Growth Targets in Myanmar
(Source: [JICA(2014)])

2.2 Master Plan and PPP Needs in Transportation Sector

Currently, the departments are distressed with insufficient budget in every fiscal year. According to the MOC forecast, a total amount of approximately 28 billion USD is assumed to be necessary. Whereas approximately 19 billion USD for DOH, 3 billion USD for DOB, and 6 billion USD are required for Rural Road and Development over the next 15 years (Table 2-4). The required budget exceeds more than 30 billion USD because the MOC includes Department of Urban Development and Housing [MOC(2016)].

Table 2-4. Total Costs for Main Projects (2016-2030) of Ministry of Construction

(3) Times for (5) Years Short-term Project Plan (Billion USD)									
No	Department	Total		Phase (1) (2016-2020)		Phase (2) (2021-2025)		Phase (3) (2026-2030)	
		Amount	Project Cost	Amount	Project Cost	Amount	Project Cost	Amount	Project Cost
1	Department of Highway	17519 km	19.145	6612 km	5.247	5023 km	5.7	6364 km	8.199
2	Department of Bridge	26249 No	3.173	10677 No	1.223	4481 No	0.643	11301 No	1.307
3	Department of Rural Road Development	62880 km	5.99	15771 km	1.506	24243 km	2.288	22866 km	2.196
Total		80399 km	28.309	22383 km	7.976	29266 km	8.631	29230 km	11.702
		26249 No		10677 No		4481 No		11301 No	

As summarized in Table 2-5, some projects have already been implemented under foreign aids. For example, considering only bridge-related projects, many major projects have been undertaken [DOB(2018)].

Table 2-5. Foreign Aids

	Location	Bridges	Type	Amount	Fund
1	Tamu-Kyigone-Kalewa Road	69 bridges	small and medium bridges	54.21 million USD	India Grant
2	Zinchaung-KingMyauk-LayTaun Road	KinChaung Bridge	383 m long	Euro 5.0 million	Austria Soft Loan
3	Htantalan town, Chin State	Bwenu River Bridge	500 feet long and reinforced concrete bridge	USD 2.5 million	India Grant
4	RhidKhawdar Town, Chin State	India-Myanmar Border Friendship Bridge	200 feet with reinforced concrete	USD 1.0 million	India Grant
5	Kunlon district, North Shan State	Kunlong Bridge	Feasibility Study	Yuan 137.73 million.	China
6	Kayin State, Mon State, Rakhine State and Tanintharyee Region	14 projects with small and medium bridges		120.87 million USD and MMK 40541 million MMK.	PPP
7	KyaukPhyu Township, Rakhine State	Ohn Taw Bridge	60 feet and reinforced concrete	0.158 million	India Grant
8	Kentung Township, Eastern Part of Shan State	Tarkaw Bridge	250 m long	7.0 million EURO	
9	Bago	Bago River Bridge (Thanlyin Bridge No-3)	Consultant Contract	31,051) Million JPY 1.06 million JPY and USD 3.65 million USD	JICA ODA
10	East-West Economic Corridor	Gyaing (Kawkeyeik) Bridge, Gyaing (Zarthapyin) Bridge and Attrun Bridge	Consultant Contract	33,869) million JPY 16.58 million JPY, & USD 11.62 million USD, and 998.99 thousand MMK	JICA ODA
11	Dala	Korea-Myanmar Friendship Bridge	Consultant Contract	137.833 million USD 11.42million KRW	Korea EDCF Loan

The Arterial Road Network Master Plan was drawn by Ministry of Construction based on National Transport Master Plan coordinated by MOC & JICA [JICA(2014)]. There are seven Expressways in the East-West direction and five Expressways in South-North direction based on the Arterial Road Network Master Plan.

The Ministry of Construction decided to give first priority to East-West and South-North expressways as implementation project throughout the country (Table 2-6), which includes new bridges longer than 180 ft on the expressway network along with new bridges and existing bridge upgrading on arterial road network, and essential bridges longer than 180 ft for local development and security excluding network road projects [KOICA(2015)].

Table 2-6. Long-term Plan

(East-West Expressway)

	Name	Length
1	Pathein-Einme-Hlaingtharya-Hlegu-Bago-Bilin Road	Expressway-10 (269.6 km)
2	Gwa-Lemyethna-Thayarwady-DaikU-Hpapun Road	Expressway-20 (343.9 km)
3	Toungup-Padaung-Thegon-Oktwin-Hpasawng Road	Expressway-30 (367.1 km)
4	Maei-Mindon-Sinbaungwe-Oattara Thiri-Tatkon-Loikaw Road	Expressway-40 (363.6 km)
5	Minbya-Sidoktaya-Kyaukpadaung-Meiktila-Hopong-Loilen-Kengtung-Mongla Road	Expressway-50 (830.2 km)
6	Tilin-Salingyi-Sagaing-Amarapura-Hsipaw Road	Expressway-60 (394.2 km)
7	Tamu-Pinlebu-Intaw-Mansi Road	Expressway-70 (347.8 km)

(SouthNorth Expressway)

1	Labutta-Pathein-Gwa- Toungup-Maei-Minbya-Taungpyalatwal Road	Expressway-15 (728.8 km)
2	Einme- Lemyethna-Padaung-Mindon- Sidoktaya-Tilin-Kale-Tamu Road	Expressway-25 (860.1 km)
3	Hmawbi- Thayarwady- Thegon-PaukKaung(Pyay)-Sinbaungwe-Kyaukpadaung-Salingyi-Taze-Pinlebu Road	Expressway-35 (809.4 km)
4	Yangon-Mandalay-Mogaung(Myitkyina)-Pangsang Road	Expressway-45 (1230.6 k)
5	Kawthoung-Myeik-Dawei-Mawlamyine-Bilin-Hpapun-Hpasawng-Loikaw-Hopong-Hsipaw-Mansi-Waingmaw-Putao Road	Expressway-55 (2165.5 km)

For instance, the requested fund for the DOH construction work is 188.96 billion kyats; however, the available fund is 88.46 billion kyats in 2018-2019 fiscal years. The total number of proposed bridges are 255 bridges. Among these, 46 bridges under construction and 209 new bridges to be constructed. According to the available budget, the construction of 46 bridges will be initialized to prioritize the needs of the citizens and only 58 out of 209 new bridges can be constructed according to the proposal. In fiscal years 2019-2020, the required budget for construction work is 186.85 billion kyats. As per the proposal, 68 bridges are under construction, whereas 77 bridges are to be built newly, summing up to a total of 145 bridges. Similar to the former fiscal year, the allowable funds are 81 billion kyats in the later fiscal year because of budget deficit. Among 145 bridges, 68 bridges and 19 new proposed bridges can be built, adding to a total of 87 bridges, because of the limited allowable funds.

The DOB plans to construct 92 (above 180 ft in Length) in the Phase II and 54 Bridges (above 180 ft in Length) in the Phase III of Integrated Master Plan. The

proposed amount of Budget for Phase II is about 786568 Million MMK and Phase III is approximately 397105 million MMK.

Among the 92 Phase II Bridges, 11 of 4 lanes bridges are on the East-West Expressway, 16 of 2 lanes bridges and 15 of 4 Lanes bridges are on the East-West main arterial road whereas 13 of 2 lanes bridges and 24 of 4 lanes bridges are on the South-North main arterial road, 11 of 4 lanes bridges are the international loan and grant projects, and 2 of 2 Lanes bridges on the other roads.

Among the 54 of Phase III Bridges, 4 of 4 lanes bridges are on the South-North Expressway, 6 of 2 lanes bridges are on the East-West main arterial road, 43 of 2 lanes bridges are on the South-North main arterial road and 1 No of 2 lanes bridge is the international loan and grant project.

Table 2-7. Priority Implementation Project on Expressway (4-lane)

	Name	Numbers*
(East-West Expressway-10)		
Phase I	Yangon-Kyaikto Road Bridges	10
Phase II	Pathein-Yangon Road Bridges	9
	Kyaikto-Bilin Road Bridges	2
(South-North Expressway-35)		
Phase III	Yangon-Pyay _Pauckkaung Bridges	4
(South-North Expressway-45)		
Phase I	Yangon-Mandalay-Myitkyina Bridges	51

* number of bridges longer than 180 ft

The planned arterial road network will consist of 12 in East-West and 6 roads in South- North direction. There need be constructed 34 (2 lane) and 33 (4 lane) bridges on 12 East-West direction roads. The estimated cost for these bridges will be 228519 Million MMK. For South-North Arterial road, 81 (2 lane) and 33 (4 lane) bridges needs to be constructed and the estimated cost for these bridges will be 293526 Million MMK.

The Ministry has lot of challenges to fulfill the required budget and needs to be in line with the Master plan, to receive the ODA loans from international partner like JICA, ADB, World Bank etc. At the same time, however, these measures are

insufficient to fulfill the master plan. Therefore, PPP is essential to be in line with the master plan as shown in the following sections.

2.3 Socio-Economic Considerations

Myanmar requires large-scale infrastructure investments in main sectors such as transportation, power generation, special economic zones and resource development as well as other supporting infrastructure, to realize its long-term growth and development. However, it is challenging to meet the capital demands for social and infrastructure development with government's limited budget. Privatization is one of the measures for increasing funding to fulfill all the demands within a short period of time. It can contribute toward users and taxpayers in terms of tariffs and tax for implementation of small projects. In fact, involvement of private sectors is important and can account for a large portion of financial flow making the developing countries to developed countries. The private sectors are expanding their trading and investment activities with certain advantage and are focusing on new field including PPP.

Currently, Myanmar lacks cross-sector, cross-ministry plan that consolidates and prioritizes infrastructure projects, decision-making regarding the mode of financing for projects at the national level. Line ministries appear to be deciding which projects are to be financed by private sector funds, but calculations of the scope of the availability of budget, sovereign loan resources, and the fiscal impact of the selection of the mode of financing, by the line ministries remains unclear.

Myanmar is a culturally and ethnically diverse country, comprising of more than 135 ethnic groups across countries and regions. It is one of the poorest countries in East Asia and Pacific Region, with an estimated GDP per capita of between US \$1000–1100. While reliable poverty data are scarce in Myanmar, all indicators point toward poverty being concentrated in rural areas: two rounds of household surveys (in year 2005 and 2009) supported by the United Nations Development Program highlights the significant differences in poverty across geographical areas, and the bulk of the poor are reported to be concentrated in rural areas. Furthermore, the available figures suggest that social indicators are poor; for example, 32% of the children under five years of age suffer from malnutrition, which is the highest rate in the region. Agriculture is the strength of the national economy,

generating approximately 43% of gross domestic product, providing 54% of employment and livelihoods to more than 70% of the population.

Myanmar’s final goal would be unification of the country. However, political unification may still be a long-term goal because of the diversity and some other cultural conditions. Therefore, the country may seek economic unification. However, financial or budget consideration may not be enough to implement the plan. Infrastructure is a means to provide convenience to people, but it is also a medium to bring about huge socio-economic values for the society.

Therefore, socio-economic value should be evaluated appropriately in government’s cost/benefit analysis. Furthermore, infrastructure contributes in accelerating various social projects, such as land development, real estate development, and improvement of economic conditions. Therefore, it is important to evaluate the overall socio-economic values associated with the related developments.

Technically, in the cost/benefit analysis, PPP is analyzed from private sector’s point of view for the financial feasibility. Government can expect huge socio-economic values (Figure 2.4) from the private sector’s cost/benefit. However, if private sector’s cost/benefit is negative, they could transfer some of the risks to the government (Figure 2.5). Resulting in government’s cost/benefit to become negative. In such a case, the government requires rational to have the positive cost benefit. This is also one of the socio-economic benefits that should be considered in PPP from government’s point of view [Minato(2018)].

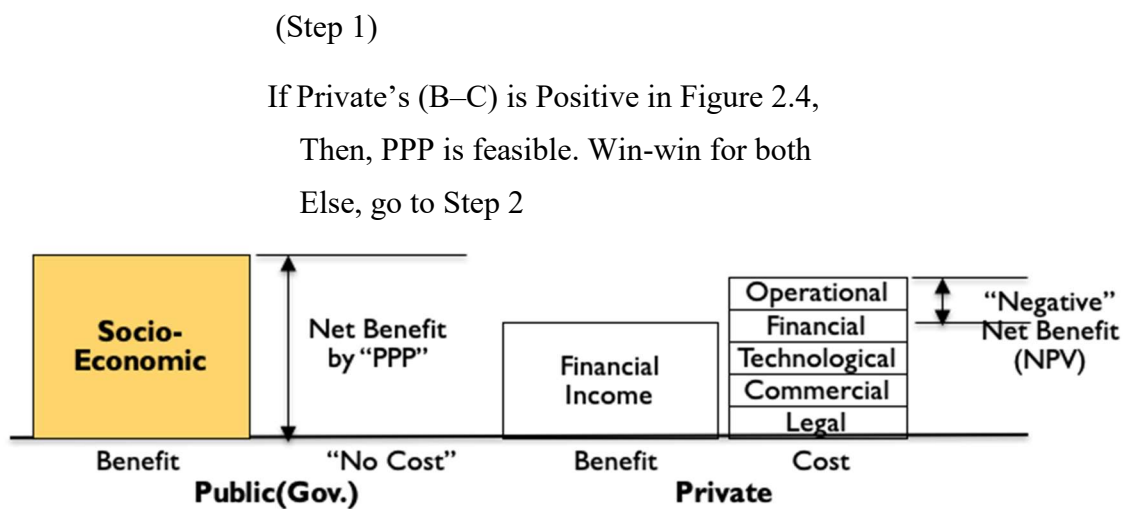


Figure 2-4. Cost/Benefit before Risk Transfer

(Step 2)

If Private's (B-C) becomes positive,

Then, PPP is feasible for Private

Else, If Gov's (B-LCC) is positive,

Then, PPP is feasible

Else, If Gov's Guarantee/Support is possible

Then, PPP may be possible,

Else, if other options are available,

Then, PPP is feasible

Else, PPP may not be applicable

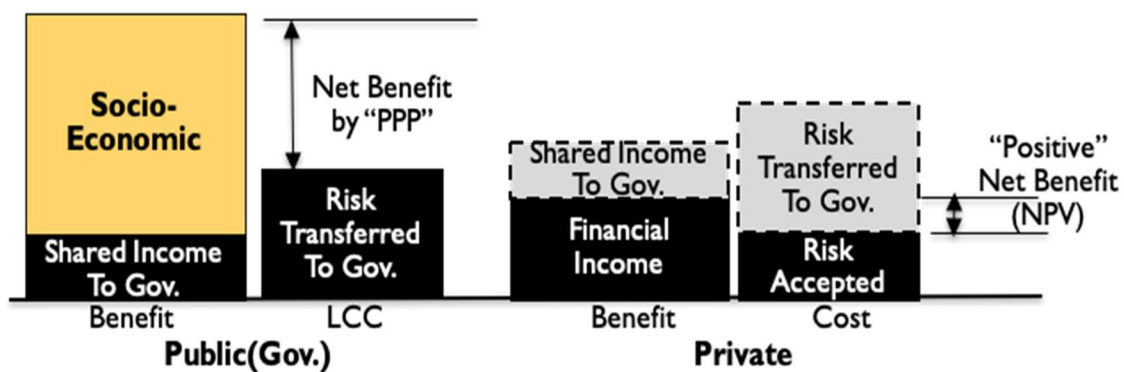


Figure 2-5. Cost/Benefit after Risk Transfer

Other than the technical requirements, it is more important to consider the social transition brought in the development projects. This is the inherent motivation of this study. This study hypothesizes that the proportionate urban utilities through infrastructure development are achieved by the simultaneous considerations of socio-economic values from Urban Economy Development (U), Land Development (L), and Real Estates Development (R), or the “government markets.”

There are 15 states and regions in Myanmar, and the level of development differs from one region to another. For example, in some of the regions, the infrastructure investment is growing advanced, or the improvement of urban economic conditions. Moreover, some regions are still requires initial infrastructure investment and similarly the conditions can be other way round for different regions. Therefore, the objective of this thesis is to explore the socio-economic values along with the other associated projects (Figure 1-1).

Myanmar also needs to deal with the interests of countries such as India, China, Japan, Korea, Thailand, and other western countries. In this situation, one can be more interested in land and some others in real estate. For example, the Japanese government can be more interested in road/bridge construction to connect the Thilawa industrial zone (land development) with Thailand by the East-West Economic Corridor. Similarly, some foreign private firms can be interested in real estate development around Yangon City. Therefore, these four markets are currently essential for Myanmar.

2.4 Summary

Myanmar requires a multi-year, consolidated, and prioritized infrastructure investment plan (a cross-sector and cross-ministry project list), which is consistent with the national development strategies and medium-term fiscal framework, to develop a credible pipeline of PPP projects effective for the private sector and manageable for the government. Infrastructure investment projects, including those by PPP, should be linked to the development goals and funding plans. A broader and longer application of the fiscal framework is required in correspondence to the reform on the development planning.. Based on the efforts to improve development planning and fiscal management, an integrated screening and management of sector investment projects for both public investment and private sector-led initiatives can be established.

Myanmar consists of 15 states and regions, and the level of development is different from one region to another. Under the conditions, the country seeks economically harmonious unification. The projects are also executed with donation from foreign aids expressing different interests in infrastructure, land, and real estate projects. Therefore, when applying PPP, it becomes very important to evaluate the socio-economic values by considering the interactions of individual projects not only in infrastructure, but also those related to land, real estate, and improvement of economic conditions, which are termed “government markets” in this study.

The long-term vision of the government is to establish PPP as a significant approach, through which infrastructure and services are delivered to develop a strong economy and society in the country. The medium-term vision of the government is to further develop an enabling environment for PPP while implementing pioneer PPP projects.

Chapter 3

PPP Definitions, Scheme, and Practices

3.1 Introduction

Infrastructure is considered as a “life supporting service” and has been under government control for a long period. Insufficient infrastructure has been a problem for most countries, which is exacerbated by the lack of funds in the public sectors. Further, the monopoly of government over infrastructure has made the development and operation of infrastructure facilities less efficient. Public-Private Partnership (PPP), as an innovation of project delivery alternatives, has been widely applied in many countries in the last two decades for resolving issues, especially the worldwide trend in the public sector. Furthermore, good governance is an important factor for the success of PPP projects in terms of developing sound economic policy and administrating projects.

The use of the private sector involvement and financing is an old traditional experience than a new revival. The beginning of the relationship between the Private and Public sectors is recorded as the Roman Empire two thousand years ago in Europe.

Today, PPP differs in form from project to project in different countries. In this chapter, Myanmar standing for PPP has been presented first followed by general definitions of PPP by different international organizations. The definitions are also associated with some practical organizational diagrams such as BOT, BTO, and so on. Accordingly, this chapter includes some of the PPP practices from Engineering News Records (ENR) review.

3.2 Myanmar's Standing

The government of Myanmar became a representative democracy in late 2010, when several international sanctions were lifted, and outstanding sovereign debts were

restructured, repaid, or forgiven. These developments removed the limitations in international investment, indicating a new era of growth and development. After insufficient investment for decades in the infrastructure and public services, the Myanmar government has moved swiftly to advance national development by (i) implementing PPPs in core infrastructure investment areas, wherein the private sector has expressed interest; and (ii) by capitalizing on strong development partners and bilateral government offers of support for develop areas unfavorable to private sector participation, or where it is best to maintain government ownership. From the government's perspective, this strategy makes optimal use of available financial and human resources, with the potential of achieving significant progress in national development.

The government, of its own volition, has begun various forms of PPPs in multiple sectors of the economy, such as telecommunications, electricity, natural resources, housing, civil aviation, roads, and public transport. Private sector counterparts have been rapidly appointed irrespective of the absence of sector or national policy frameworks, attendant processes, or institutional management functions dedicated to PPPs. However, these developments are yet to yield sustainable economic benefits for the government.

The advantages of significant, underdeveloped natural resources, combined with large-scale investment opportunities, has attracted foreign investors toward Myanmar. Investors have lodged numerous unsolicited proposals with the government, which vary widely in quality and intent. These proposals can appear attractive while they address core development requirements; however, the government has fewer basis to evaluate if the proposals and their proponents are of good quality; offer fair terms and conditions; and will deliver sustainable commercial, financial, and economic value. However, the government was bound to consider these proposals because of Myanmar's development hurdles and the absence of sufficient technical capacity and funding within government to develop projects themselves. This has resulted in an ad hoc approach toward project selection and negotiations, making it difficult for the government to determine its monetary gains. The government immediately requires asserting control over the development process and needs to become more proactive in directing

investment outcomes, while capitalizing on the current investor interest in the country. This will require development of appropriate policies and processes, identification of prioritized sector development projects, and use of improved tendering processes and documentation, supported by an enhanced institutional planning and management structure. In this process, the government can benefit from the large body of international PPP experiences.

3.3 PPP Definitions

The definition of PPP provides new assets and services, and also for existing assets and services. It can include PPPs in which the private party is paid entirely by service users, and those in which a government agency makes some or all of the payments. The project functions transferred to the private party such as design, construction, financing, operations, and maintenance, which can vary for each contract, but in all cases the private party is accountable for project performance, bearing significant risk, and management responsibility [WB(2014)].

PPPs presents a framework for the private sector to acknowledge and structure the role for government in ensuring that the social obligations are met, and successful sector reforms and public investments are achieved [ADB(2008)].

Table 3-1 presents some definitions by several international organizations. The definition consists of contracts in various sectors and for various services, assuming that there is a public interest in the provision of the service, and the project involves long-life assets concomitant with the long term of the PPP contract.

Table 3-1. PPP Definitions by International Organizations

Organization	Definition
World Bank	a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration, is linked to performance.
ADB	a range of possible relationships among public and private entities in the context of infrastructure and other services. Other terms used for this type of activity include private sector participation (PSP) and privatization.
European Investment Bank	relationships formed between the private sector and public bodies often with the aim of introducing private sector resources and/or expertise in order to help provide and deliver public sector assets and services.
OECD	Private sector provides service and shares risk on a project in which goals of government (providing service) and private (profit) are met.
IMF	Private sector finances infrastructure of a project while government delegates risk to private sector.

In PPP, it is assumed that “through partnership with private sector, the public sector reduces the risk faced by Japanese firms in partner countries and encourages employment, technology, trade, and investment with public funds, such as ODA, in Japan.” [ODA(2008)] Similarly, United Kingdom apprehends that public sector finances a project while private sector shares its risk.” [OECD(2015)]

3.4 Traditional, PFI, PPP, and the Other Form of Procurement

Generally, the difference between traditional procurement and PPP approach is funding. In traditional procurement, the government provides funds while it becomes a responsibility of the private sector in PPP. The other key difference between PPPs and traditional procurement models is related to duration. In traditional procurement, the association between the government agency and the private contractor ends once the construction phase is over. In PPPs, the association continues post the completion of construction as the private partner is responsible for building the infrastructure as well as operating it for a set number of years: typically more than 20. At the end of the PPP contract, asset rights usually revert back to the public authority proving it to be a major distinction between PPPs and outright privatization of public assets. Other comparisons are presented in Table 3-2 [COA (2008)].

Table 3-2. Comparison of Traditional Procurement and PPP Procurement

	Traditional Procurement	PPP Procurement
Government purchase	Government purchase an infrastructure asset	Government purchase infrastructure services
Contract	Short-term design and construction contracts	One long-term contract integrating design, build, finance and maintenance
Specifications	Input-based specifications	Output-based specifications
Asset risk	Government retains whole-of-life asset risk	Private sector retains whole-of-life asset risk
Mode of payment	Payment profile has a spike at the start to pay for capital costs, with low ongoing costs	Payments begin once the asset is commissioned. The payment profile is relatively even, reflecting the level of service provision over the longer term of the contract
Construction time and cost overruns	Government is usually liable for construction time and cost overruns	Private contractor is responsible for construction time and cost overruns
Operation	Government operates the facility	Government may or may not operate the facility
Management of contract	Government manages multiple contracts over the life of the facility	Government manages one contract over the life of the facility
Performance standards	Often no ongoing performance standards	Performance standards are in place. Payments may be abated if services are not delivered to contractual requirement
Handover quality	Handover quality less defined	End-of-term handover quality defined

There are a number of characteristics that differentiate PPPs from others traditional, PFI, and state enterprise. The most important is the funding source, and the

schemes can be also classified in terms of service provided. Figure 3-1 presents a way to classify the four schemes.

		Capital	
		Tax/Borrowing	Toll/Fees
Service	Public	Traditional	State Enterprise
	Private	Service Purchase (PFI)	Concession (PPP)

Figure 3-1. Traditional, PFI, PPP, and the Other Form
(Source: [Donahue(1989): with modification by [Minato(2018)])

Distinctions of project procurement can be made in terms of funding and the services provided either by government or private partners. The first row indicates, if the public body provides service, the project procurement is either in the form of traditional or state enterprise approach. In this form, the government selects a contractor and pays them on the basis of the services required. Moreover, the services brought by private sectors, can be called either private finance initiative (PFI) or PPP. The distinction between PFI and PPP depends on the difference of capital recovery. In the PPP project, private investors are financing the infrastructure whereas private sectors are financing upfront at certain cost in the PFI project, the capital is repaid later, and the fund then has to be remunerated by the government eventually (Fig. 3-2).

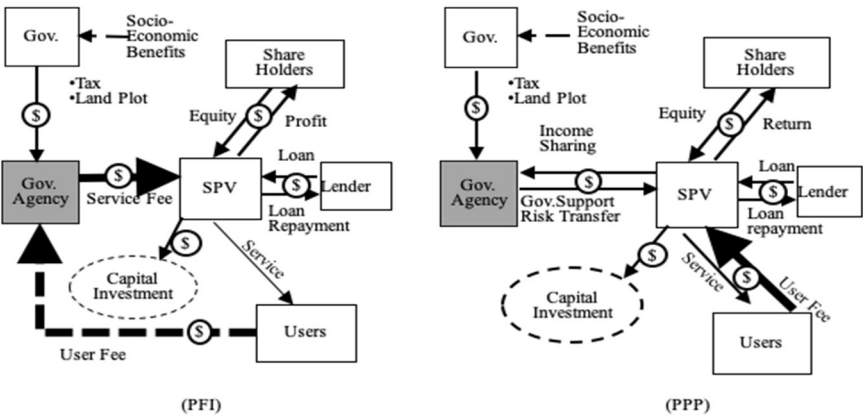


Figure 3-2. PFI and PPP (Source: [Minato(2018)])

Generally, the key features of most PPP projects can be understood in the following manner:

- A private sector partner invests in public infrastructure facilities, and provides related non-core services to the public sector client or the community
- The public sector client retains ultimate responsibility/accountability for delivering the underlying core services to the public

The structure of the partnership should be designed to allocate risks to the partners, who are best able to manage those risks, thereby, minimizing costs while improving performance. Effective PPPs recognize that the public and private sectors each have certain advantages related to the other, in performing specific tasks (Fig. 3-3).

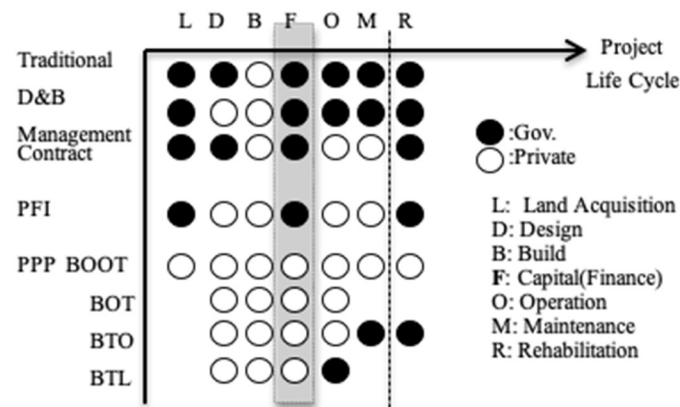


Figure 3-3. Private and Gov's Roles (Source: [Minato(2018)])

It should be noted that PFI and PPP are sometimes used interchangeably in the concept of PPP. In Korea, eligible PPP procurement methods are divided into BTO and BTL; BTO for revenue generating facilities such as road, railroad, harbor, and BTL only for public goods such as school, military resident, sewage, through government payment [KDI(2017), Jay-Hyung et al.(2011)]. In case of BOT, the concessionaire assumes the ownership of the infrastructure facilities for a specific time after completion of the construction, and the ownership is transferred to the government upon termination of the concession period. Moreover, for BTL, ownership of the facilities is transferred to the government upon completion of construction, and the concessionaire takes the right to operate the infrastructure facilities for a specific time, in this case the concessionaire profits from the project, by leasing the facilities to the government to use for a period of time as per the concession agreement.

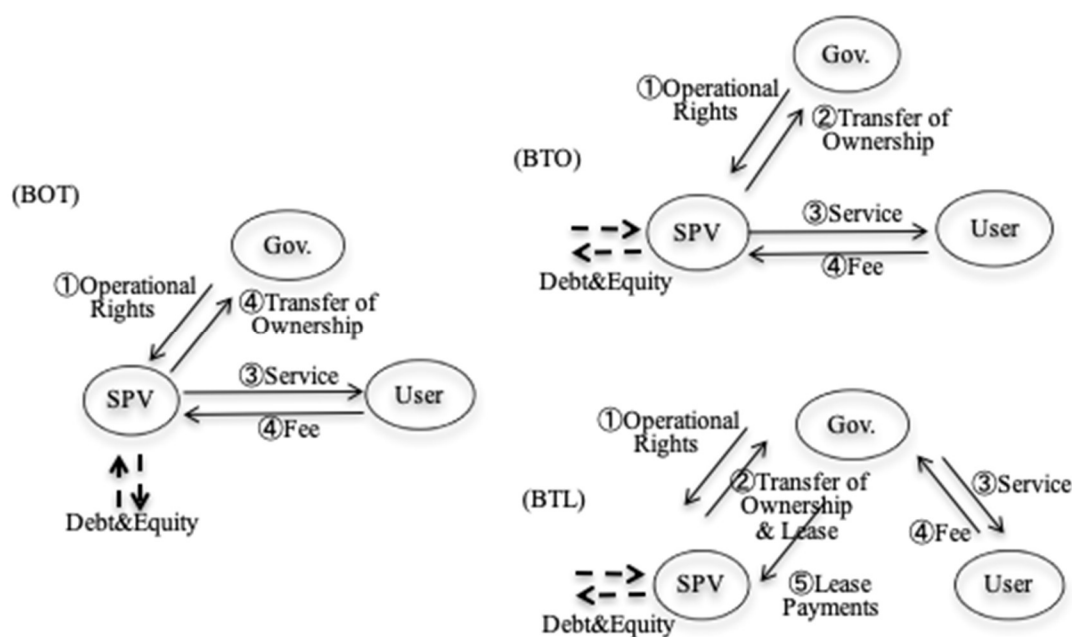


Figure 3-4. BOT, BTO, and BTL

(Source: [KDI(2017)], [Jay-Hyung et al.(2011)], modified by [Minato(2018)])

Here are also some distinctions between management contract, lease contract, and PPP (BOT). Some of their key features are as follows.

Management Contracts: In management contract, public entity engages a private partner to manage the activities within a short period (3–5 years). The ownership of assets and investment typically remain with the public entity.

Lease Contracts: In a lease contract, the asset is leased, by the public entity to the private partner. Lease contracts are usually of medium-term length, and can involve capital investment by the private partner. BLT, BOLT, and BTL are types of lease contract. In case of a lease, a share of the fixed fees for his service goes to the public entity as the owner of the assets in form of lease fee.

BOT: BOT generally involves large investments requiring substantial outside finance, for both equity and debt. A number of BOT variants are possible depending on the allocation of roles and risk. These include DBO, DBFOT, BOOT, DBOOT, BOO, and so on. The difference between a BOT-type arrangement and a concession is that a concession generally involves extensions to and operation of existing systems, whereas BOTs sometimes involve the expansion of existing facilities.

3.5 ENR Review

PPP is a long-term contract normally over 20 years between the government entity and private party, for the provision of public services and/or development of public infrastructure with shared responsibility and rewards. PPP can be a wide range of sector such as road, energy, rail, education, water, health, and so on. Sectors in which PPPs have been completed worldwide includes the following:

- power generation and distribution
- water and sanitation
- disposal
- pipelines
- hospitals
- school buildings and teaching facilities
- stadiums
- air traffic control
- prisons
- railways
- roads
- billing and other information technology systems
- housing

Engineering News-Record (ENR) an American weekly magazine, is the one that provides news, analysis, data, and opinions for the construction industry globally. It is the bible of the construction industry, providing new and features about projects, products and people in construction, architecture, and engineering.

Reviews are based on ninety six articles from Engineering News Record concerning with PPP projects in different countries, such as United States, United Kingdom, North Carolina, Belgium, Ireland, Portuguese, China, Latin America, Africa, India, Europe, Italy, Denver, and Belgium, with different views, aspects, and opinion of PPP. The articles are recorded since 2005 till present about the difficulties on investing in infrastructures, increasing growth rate, insufficient funding, reducing staffing, lack of community support, higher cost, increasing traffic congestion and pollution, tolling concerns, declining revenue, impacting of the economic downturn, land acquisition, and

so on [ENR]. For more details, refer to [Appendix A].

Contributions in the articles are based on the development of good infrastructure by attracting private investment in transparency, financial institutions, technology and innovation, creativity, competition, taxation, education on PPPs, and transferring risk.

PPP legislation is required to launch for more efficiency and to achieve faster delivery while transferring risk to the private sector and reducing overall project costs. However, when PPP is applied, flexibility is as important as the amount of money. Creative financing, creative delivery methods and making concrete decisions are necessary in PPP. Below mentioned are some of the challenges for development of successful PPP.

- Allow investment as a bond.
- Best value PPP contractor should be selected.
- Toll price should vary according to time of the day, segment used and direction.
- Use of toll revenue to invest in transit and carpool lanes.
- Development of SPVs is required to assist the government raise funds from the market.
- Future greenfield PPP should include environmental performance specifications.
- Projects that apply PPP should be more innovative and competitive.
- PPP is applied more efficiently and achieves faster delivery while transferring risk to the private sector and reducing overall project costs.
- Each PPP is unique; however, successful PPP often begins with a commitment from state and local leaders who are willing to seek innovative solutions to solve the issues.
- Land acquisition and environmental problems should be settled and environmental performance specifications should be considered before starting the project.
- Education on behalf of PPPs could go a long way toward converting the large number of ambivalent officials as a useful development tool.

Overall, the ENR is all about lease, interest rate, public debt, investment, support,

road user tax, toll fees, and most of the issues are financial matters, and sometimes the socio economic discussion, such as land acquisition and environmental problems. From the key learning points, no contributions or discussion are observed in ENR about how a socio-economic value is evaluated and important.

3.6 Summary

3.6.1 Advantages of PPP

PPPs, operating at the boundary between the public and private sectors, are neither nationalized nor privatized services, but represent an alternative approach in which the government can deliver some public services. International experience suggests that the use of PPP approaches can deliver a number of advantages such as acceleration of providing the necessary services, faster implementation, reduced whole life costs, better risk allocation, better incentives to perform, generation of additional revenues, and enhanced public management.

PPP allows the public sectors to translate upfront capital expenditure into a flow of ongoing service payments. This enables projects to proceed when the availability of public capital is constrained; thus, bringing forward core public services. The private sectors are allocated with designing and construction responsibility combined with payments linked to the availability of a service. This provides significant incentives for the private sector to deliver the project within a shorter construction period. PPP projects that includes operational and maintenance services provide a strong incentive for the private sector to minimize the overall cost of the project that is difficult to achieve within the traditional public sector procurement.

A core principle of PPP approaches is the allocation of risks to the party best able to manage with least cost. The approach of optimizing rather than maximizing risk transfer can ensure that best value is achieved. The allocation of project risk can provide incentives to the private sector to improve its management and performance on any given project. This is because the private sector is fully paid only if the required service standards are met on an ongoing basis. International experience suggests that the quality of service achieved under a PPP approach is often better compared to traditional procurement. This can reflect the better integration of services, improved economies of

scale, innovation in service delivery, or performance incentives, and penalties typically included within a PPP contract.

The private sector can generate additional revenues from the third parties, thereby reducing the cost of any public sector where subvention is required. Additional revenue can be generated through the use of spare capacity or the disposal of surplus assets. By transferring responsibility to the private sector, the public sector will act as regulators and will focus upon service planning and performance monitoring instead of the management of the day-to-day delivery of public services. In addition, by exposing public services to competition, PPPs enables the cost of public services to be benchmarked against market standards to ensure maximum monetary gains.

Private sectors are exposed to competitive pressures that are difficult to replicate for public agencies. This provides a private partner an advantage in carrying out the capital and operating phases of the project efficiently. The private sector can also consist of recent experience and leading technical skills for operating infrequent or new projects. The private sector is also well placed to access quality and skilled manpower and technology and hold its employees, suppliers, and vendors more accountable for performance; whereas for a public entity it is difficult to perform in a similar manner. A well-designed and managed PPP should take advantage of the potential for efficient gains from using the private sector. The reason for increased efficiency is to allocate risk and the associated performance rewards and penalties. It creates incentives in the PPP contract that encourage the private partner to achieve efficiency at each stage of the project and to introduce improvements in productivity where possible.

PPPs focus on overall cost of the project in which the private partner designs the project to consider the relation between construction and operation so that the cost will be minimized over the project's life cycle. A private partner, in addition to designing and building the project, will also provide the ongoing operations and maintenance management and so has an incentive to ensure that the design and construction facilitate efficient Operation & Maintenance (O&M). To compare, if one set of contractors is employed for design and construction and other unrelated contractors for O&M, they will each take a narrow perspective, considering only the efficient points in their component and not will not be accountable of the interactions between the two.

In PPPs, there are clear allocation of risks and responsibilities wherein the role

of the public entity is to monitor service provision and the private partner is responsible for actual delivery of services. This increases the scope for accountability of the private partner, as conflicting to the conventional procurement where the public entity is both the monitoring agency as well as the service provider, and therefore, can be reluctant to question itself. Furthermore, completion of construction is a contractual end in conventional projects whereas in PPPs, there is generally no exit after construction,(for a specific time) and therefore, the private partner is bound to ensure service delivery in a transparent manner. Thus, PPPs lead to increased transparency and accountability in both utilization of funds and delivering quality service.

PPPs allow the public entity to leverage private finances in development of public infrastructure projects. This enables public entity to focus more on social and other sectors that require additional funding and support in comparison with the core infrastructure projects. Development of projects under PPP framework also frees the public entity from the need to meet financing requirements from its own revenues (taxes) or through borrowing.

3.6.2 Limitations of PPP

Despite of the benefits associated with the development of projects under the PPP framework, there are certain limitations to PPP arrangements that are discussed in this section. Most of the limitations can be minimized under certain circumstances and through careful management of the PPP design by the public entity that is sponsoring the project. This requires the public entity to possess the capacity (experience and expertise) to manage the PPP process.

The PPP project must clearly specify the allocation of risk and a clear statement of the service output requirements. The long-term nature of the PPP contracts requires greater consideration and specification of possibilities in advance. Transaction advisors and other consultants would need to be appointed to assist the public entity to handle the challenges involved in project structuring and procurement process. Moreover, a well-established procedure has been in place for a long time which helps the public entity to conduct conventional procurement accustomed to the arrangement.

Once it enters the construction and operation phases, the success of the PPP project, from the public perspective, will depend on the ability of the public entity to

monitor performance of the private partner against standards, and to enforce the terms of the contract. When a PPP project performs below its expectations, it is often because of the lack of capabilities in the public entities to perform enforcement and monitoring activities, which is partly because of inadequately established procedures for this task.

In addition to these limitations, there are other factors that deter the development of projects through a PPP framework. For instance, most of the legislation and rules were formulated at a time when PPPs were not yet conceptualized. Thus, the law is usually undeclared on the possibility of PPPs in the sector. Furthermore, the government budgeting systems are usually unaligned with the needs of PPP financing and support, because they do not make any provisions for committed and/or contingent liabilities arising out of PPP arrangements. Furthermore, the time interval for structuring and procurement for PPPs is extensive, which impacts the ability to see through a PPP project without leadership changes. This challenges the commitment of the public entity toward project development activities.

CHAPTER 4

PPP Case Studies

Many countries apply a public-private partnership (PPP) scheme to develop their infrastructure. There is no doubt that without real effort, it is difficult for projects with PPP to be successfully implemented. This chapter shows case studies of PPP projects from various countries, including China, the Philippines, India, Indonesia, Hong Kong, Malaysia, Thailand and others. Then, it aims to help government officials and other interested parties answer the following questions: 1) PPP Needs: What are PPPs, and why would governments want to use them? 2) Experiences: What insights can be gleaned from previous PPP project experiences? This chapter then touches on some additional issues.

The information contained in the PPP cycle primarily draws upon the PPP Reference Guide, which was jointly produced by the Asian Development Bank (ADB), European Bank for Reconstruction and Development (EBRD), Global Infrastructure Hub, Inter-American Development Bank (IDB), Islamic Development Bank (IsDB), Organisation for Economic Co-operation and Development (OECD), United Nations Economic Commission for Europe (UNECE), United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), and the World Bank Group [WB (2019)].

4.1 Myanmar PPP Implementation

In Myanmar, the Mandalay-Muse road is the first Build-Operate-Transfer (BOT) project to give the private sector the opportunity for investment. Asia World Company Limited implemented the project in 1996. At that time, the region was situated in an insurgent area and could not trade with China. The economic and political situation was also not stable. However, the Ministry of Construction chose Asia World Company Ltd. as the very first BOT investor. They faced many difficulties while implementing the project but took risks and accepted the investment. Fortunately, the company saw

success in that project; however, for some BOT projects, private-sector investors do not see success. The main reason is that they cannot obtain the government's support and guarantee.

Another possibility for PPP is a joint venture with the private sector. The ministries made joint ventures with international companies and established businesses. Concerning the Ministry of Construction, J&M Steel Solutions Company was established by JFE Company, from Japan, as a joint venture with the Ministry of Construction (MOC) of Myanmar. The factory produces materials for steel structures. At first, the factory was established to produce 10000 tons of steel per year. After two years, due to the demand, the production was increased to 20000 tons per year. Also, labor increased from 250 to 400 people. This example demonstrates that a joint venture sees success in Myanmar. Chiyoda Corporation from Japan also made a joint venture with the Ministry of Construction and established the Chiyoda-Public Works company in 1997 for consultancy services. IHI Corporation from Japan also made a joint venture with the MOC and established I&H Company for precast concrete production. The government already approved and is preparing to submit to the Myanmar Investment Commission (MIC) for permission regarding this joint venture.

Leasing land to private partners is also one of the models of PPP. The government leases land to local and international investors to develop businesses. In the case of Myanmar, while there were less profits with local partners, the model saw success with international investors. Most of the local partners invested only to make a profit and are not trusted by the government. International partners, by contrast, want to develop successful businesses in Myanmar. Kajima Cooperation in Japan leased seven areas of land owned by the Ministry of Construction for the development of hotels and offices, and this is also an excellent benefit for the MOC.

Another example of a successful PPP system in Myanmar is the aviation system, particularly the public-sector airlines under the Ministry of Transport. Previously, the pilots of these airlines were government employees, and their jobs were considered undesirable due to their low salaries. Then the aviation system invited private

investment as a result of the PPP system. The private airlines are seeing more success, and the transportation network is developing rapidly because of higher demand, both locally and internationally.

However, not all sectors saw success with PPPs; among the unsuccessful PPP systems in Myanmar is the movie theaters moving to the private sector. Myanmar movie production standards are still low, and many people enjoy movies produced in other countries, including Korean dramas, English movies, and Indian films.

The Government of Myanmar already has significant experiences with PPP projects. In particular, projects have occurred in the energy sector (pipelines and power plants) and the transport sector. In the transport sector, for example, a concession agreement was signed in 2014 for the operation, rehabilitation, and maintenance of airport facilities at the Mandalay International airport. Also, a 30-year PPP contract was awarded the same year to construct a new airport approximately 70 kilometers (km) northeast of Yangon. Roads have also been developed under a BOT scheme for many years. The following are some of the Myanmar PPP experiences.

Myingyan Power Generation Project (MPGP): The Ministry of Electric Power (MOEP) of the Government of Myanmar (GOM) has selected a private sector Independent Power Producer (IPP) to develop the project on a build, operate and transfer basis in Myingyan Township, in the Mandalay region in Myanmar.

Key Facts:

- The project cost is expected to cost around USD 250 million and comprise a 250-megawatt combined cycle gas turbine (CCGT) pPower Plant.
- The project combines financial advisory support from the International Finance Corporation (IFC) and an International Development Association (IDA) guarantee to mitigate select risks facing private-sector lenders and investors in Myanmar.
- This project will utilize high-efficiency CCGT technology, which is the least costly approach to rapidly increase electricity production from natural gas while minimizing CO2 emissions.

Mandalay and Hanthawaddy Airport Projects: In Myanmar, PPP schemes are used for the operation, rehabilitation, and maintenance of airport facilities at the Mandalay International airport and the construction of a new airport, the Hanthawaddy International Airport, approximately 70 km northeast of Yangon.

Key facts:

- JALUX Inc. (JALUX), Mitsubishi Corporation (MC), and Myanmar's SPA affiliated group, Yoma Development Group Limited, signed a concession agreement with Myanmar's Department of Civil Aviation (DCA) in November 2014 for the concession to operate Mandalay International Airport for 30 years. Operations were scheduled to commence around March 2015, based on the concession agreement with the DCA.
- The consortium comprising JGC Corporation, Yongnam Holdings Limited, and Changi Airports International reached a milestone in the Hanthawaddy International Airport project with the signing of the framework agreement with Myanmar's Department of Civil Aviation in January 2016. This agreement was an essential step toward the finalization of the concession agreement. The consortium won the contract for this airport in October 2014. The project is planned for completion by 2022, and the airport is expected to have an initial capacity of 12 million passengers a year.

Telecommunications: With the regulatory framework and capacity-building initiatives in place, a competitive, transparent license-issuance process was launched by the Government of Myanmar for selected bidders. Telenor, from Norway, and Ooredoo, from Qatar, obtained their licenses in January 2014 and launched commercial services later that year.

Key facts:

- At USD one billion, Telenor Myanmar was the most significant new deal in 2014. The 15-year paid spectrum license was granted by Myanmar's federal government to Norway's Telenor Group, which committed USD 500 million toward the project. The payment was scheduled to be 50% in 2014, 25% in 2015,

and 25% in 2016.

- The second-largest new project was also in Myanmar—the USD 500 million Ooredoo Myanmar project. Ooredoo paid USD 500 million to the government for the license and has pledged a total of USD 15 billion to help develop Myanmar’s telecom sector. Ooredoo is targeting a rapid roll-out of its network and expects to cover the vast majority of the population with LTE-ready infrastructure within five years.

In the case of Myanmar, as shown in Table 4-1, while there is some strength, the weaknesses are the need to improve the capacity of dedicated staff, the need to create a sound BOT contract, and the required regulations and viability gap funding. The most exciting finding from the Myanmar case was about detail evaluations. This finding led to the interest in this research that the analysis of socio-economic values is essential.

Table 4-1. Myanmar PPP Projects; Strength and Weakness

Project	Strength	Weakness
Myingyan Power	•Independent power producer	•Need to improve capacity of dedicated staff
Western Highway	•Only direct main route between western ranges and central low lands.	•Need to have sound BOT contract and regulations. •Need to clarify detailed evaluations
Mandalay – Muse	•Main trade route with China •Value-for-money	•Need to have sound BOT contract and regulations •Need to clarify detailed evaluations •Need to have viability gap funding

4.2 PPP’s in Different Countries

With PPP, in general, financial issues can be solved, risk transfers from the public to the private sector may be done, risk-sharing facilitates a win-win solution among the stakeholders, and technology transfer may be possible. So far, this research found the financial aspects of PPP; however, there were no significant findings regarding the socio-economic issues as intended in this paper. Still, it is worth exploring the discussions about PPP by looking at the case studies in different countries. Table 4-2 shows the summary.

Table 4-2. PPP Case Studies in 10 Countries

Country	PPP	Strength	Weakness
Australia	PPP	•Discount Rates Availability-payment model with key performance indicators, monitored with public sector comparator (shadow toll)	•No financing by Gov.
Canada	DBFOM	•More effective than traditional methods	
China (Taipei)	BOT	•Close supervision by organizer •Agree to use assets to seek financing from bank	•Financially independent basis. •No Viability Gap Funding
Japan	BTO	•TOD system •Amortization repayment by legal entity, •Availability based type PFI –called BTO system	•Demand risk
Korea	BTO, BTL	•Public and Private Sectors working in cooperation and partnership	•No min. Revenue Guarantee since 2006
Philippines	BOT	•Risk sharing, Best PPP in Asia.	
Singapore	DBOO	•Share demand risk, SPC	
Thailand	BTO	•Foreign equity and Debt financing	•Toll rate based on investment value
UK	PPP	•Improved public sector capability.	•Allocation of risk and reward
USA	DBFO	•Federal Gov. funding, availability payment	

4.2.1 AUSTRALIA

Australia has a federal government system consisting of a central government, the governments of eight states and territories, and 560 local governments. [APEC (2014)]. More than 130 PPP projects have been contracted in Australia by the national and state/territory governments with a mix of social and economic organizations [COA (2018)]. In Australia, the first PPP project commenced in 1987 [Whitfield (2012)].

In 2008, the Council of Australian Government (COAG) endorsed the National Public-Private Partnership Policy and Guidelines. The National Guidelines are applied by all governments and target PPP projects greater than \$50 million.

In the same year, the Australian government also created Infrastructure Australia as a statutory body to advise governments, investors, and infrastructure owners. Infrastructure Australia provides information on the impact of these issues on investments and the efficiency of the delivery, operation, and use of national infrastructure networks.

Since the mid-1990s, Australia received a significant amount of private sector investments through demand-risk economic PPPs by collecting every \$1 of government

funding for toll road infrastructure, attracting around \$16 of private investment. However, since 2008, there has been a marked decrease in the number of toll road PPP deals contracted and the amount of private-sector capital attracted per dollar of government funding. [APEC (2014)]

Concerning the social infrastructure of PPP projects such as health care, education, and justice sectors, the low-risk and long-term nature of the projects attracted institutional investors with an availability-payment based PPP contract system. In the construction sector, investors generally provide most of the equity for PPPs with financing provided by a bank. [APEC (2014)]

Peninsula Link: The Peninsula Link is a 27 km un-tolled freeway in the South-East of Melbourne, Victoria, Australia.

Key Facts:

- The objective of the project is to reduce and improve travel time reliability by integrating the project with the existing surrounding transport network.
- The project is an availability-payment based PPP, meaning the project is funded using periodic payments from the government on the condition that the road is available for use and key performance indicators are satisfied. The government provided no financing.
- Under the project agreement, the private sector operates and maintains the project for over 25 years.
- The primary risks in land acquisition are the risks of costs and delays associated with acquiring land as identified at the contractual close. Traffic flow risks include traffic flow, vehicle mix, and volume on the freeway that is different from what is forecasted in the government fitness report.

4.2.2 CANADA

In Canada, several studies were undertaken to determine the most appropriate procurement method. The results of these studies enabled the Ministère des transports du Québec (the provincial transport department) to conclude that completing the highway link through a PPP would offer more benefits than a traditional procurement

[Paul Boothe et al. (2015)].

Autoroute 25 (A-25) Highway Project: The completion of a 7.2 km stretch of highway between Henri-Bourassa Boulevard in Montréal and the A-440/A-25 interchange in Laval.

Key Facts:

- Planning for the A-25 dates back to the early 1970s, with the four-lane A-25 major highway including interchanges, overpasses, and a 1.2 km bridge to serve the Montréal Metropolitan Area.
- Furthermore, demographic growth projections forecasted strong economic and demographic growth in Laval, the Laurentides and Lanaudière regions (the areas north of Montréal and Laval), and in the Anjou/Mercier economic hub.
- The completion of the A-25 Highway Project enabled commuters, and transit and truck traffic to travel across the northeastern section of the metropolitan region and avoid detours. Completing the highway link also has the added benefit of fostering economic development in the eastern section of the Montréal Metropolitan Area.
- In the PPP contract, the private sector is responsible for designing, building, financing, operating, and maintaining (DBFOM) the project over the next 35 years, with four years for construction and 31 years for the operation, maintenance, and rehabilitation activities. Payments depend on performance and service quality.
- For toll revenue risk, the contractor guaranteed a minimum revenue, with approximately 60% of the revenue estimated by the Province. The concession keeps up to 120% of the revenue exceeding the guarantee. If the revenue is beyond this threshold, the government and the investor will share the revenue equally.
- Toll revenues using the bridge are collected by the contractor daily, and the contractor is guaranteed a minimum of approximately 60% of the revenue. The project was scheduled to start in 2005 and the concession period will end in 2042.

4.2.3 China

4.2.3.1 China

At the initial stages of China's reform and opening-up, basic infrastructure such as roads, ports, and power generation facilities were urgently required, and accounted for a large proportion of government expenditure. From 1982 to 1989, the Chinese government invested RMB 292.7 billion in about 261 infrastructure projects, including energy and public transportation [NBSC (2008)].

Since 1990, private capital has been encouraged to participate in infrastructure development, with most projects being implemented as BOT. With the development of private participation, there was a rapid growth of China's infrastructure. It is worth noting that the Chinese government has issued treasury bonds worth RMB 660 billion and invested these in infrastructure construction (NBSC, 2008) when the Asian Financial Crisis occurred in 1997.

Since 2000, market mechanisms have become mature in most cities in China. PPPs have also become one of the government's strategies for the provision of public facilities and services. According to the World Bank [WB(2013)], the total number of infrastructure projects with private participation from 1990 to 2012 reached 1064 in China, ranking first worldwide, with the total investment commitment reaching USD 119,330 million, ranking fourth worldwide, after Brazil, India, and Russia.

In 2002, the total investment in public facilities was RMB 315 billion, 80% of which was from the government and the remaining 20% from the private sector. Preserving its role in enterprises only gave rise to a government monopoly on the provision of public facilities and services. With the rapid growth of urbanization, it is insufficient to rely only on government expenditure. The government should widen its funding sources, particularly focusing on investments from the private sector.

PPP is not a new model in China. The first PPP was in the power industry in 1988, and it operated as a BOT project. BOT is the most popular model for toll roads, where private investors directly collect tariffs from users. This 'user pays' mechanism means that operators of toll roads in China carry the risk of traffic volume and toll revenue [Wan et al. in Winch et al. (2012)]. The government and commercial banks

took many risks due to the lack of BOT experience. Later, many BOT projects were introduced in the energy, water, and transportation sectors as the involvement of private sectors in infrastructure development of public utilities grew. In 2000, the central government invested a considerable amount of treasury bonds in infrastructure and was determined to clean up the unregulated or illegal projects, which lead to a termination of private investment.

According to the recorded data of the Chinese government in early 2016, there have been 7,110 PPP projects recorded on the PPP Comprehensive Information Platform in China, with a total investment value of RMB 8.3 trillion (USD 1.3 trillion). Around 91% of these funds – a total value of RMB 7.6 trillion (USD 1.1 trillion) – has been invested into newly built PPP projects, while only RMB 730 billion (USD 112 billion), or 9%, was invested in existing PPP projects. 78% of ventures (5,542 projects) are in the recognition stage, while only 5% (351 projects) are at the execution stage.

Nowadays, to alleviate the negative impact, the Chinese government has always shown its active attitude to support the investment and development of infrastructure. Some large private companies have even started to expand their business to overseas countries. The Chinese government supports massive efforts to encourage and support private investors to participate in infrastructure development, especially in private service sectors such as infrastructure construction and public service supply.

In April 2018, in Myanmar, the Chinese-owned China Communication Construction Company (CCCC) signed a framework agreement with the Yangon regional government incorporated company, the New Yangon Development Company Limited (NYDC), for the New Yangon City at west of central Yangon across from Kyeemyindaing [Nan Lwin (2019)].

NYC (New Yangon City at Mingakar): The investment for the first phase of the project, mostly infrastructure projects, is USD 1.5 billion with six infrastructure projects in the works, including the development of five townships villages, two bridges accessing new cities, 26 km of main roads, a 10 square-kilometer industrial park, power plants, transmission and distribution facilities, and water and wastewater treatment plants [MMTimes (2018)]

Key Facts:

- The 20,000-acre-wide New Yangon City is one of the projects of China's ambitious Belt and Road Initiative (BRI) as well as the China-Myanmar Economic Corridor (CMEC) projects, and can easily access the sea, which is one of the essential routes for BRI.
- CCCC and its subsidiaries have been leaving a trail of controversy in the Philippines, Sri Lanka, Malaysia, Bangladesh, Thailand, Canada, Australia, and Kenya.
- The vision of the project is to be a safe, smart, and clean city that will serve as an example of efficiency, integrity, and accountability [NYDC (2019)].
- CCCC will be controlling 134,400 acres out of 168,000 acres of land after compensating original landowners via a 20:80 ratio [Eleven Media (2019)]
- The project will be implemented with a PPP based on design, invest, build, and operate.
- Phase I will bring the area to an urban industrial district with two million jobs created.
- The project developed a Socio-Economic Master Plan (SEMP), and the purpose is to identify the value proposition, to undertake economic analysis, and to develop sector prioritization and strategies for the highest economic and job growth plans. The purpose is also to create job opportunities, develop skills human capital development plans, and to identify the best way to fast track and incentivize the development of NYC's industrial corridor. Furthermore, the project aims to develop an infrastructure phasing plan and urbanization guidelines to provide an environmental strategy and a delivery plan with recommendations on critical policies for the government, and to recommend governance and risk management processes to NYDC for long-term sustainability [NYDC (2019)].
- Most of the basic infrastructure of Phase I aims to be implemented in 2020.

4.2.3.2 Chinese Taipei

The Chinese Taipei Area Freeway Bureau of the Ministry of Transportation and Communications, (hereinafter referred to as “the Organizer”) plans to promote the

Private Participation in Construction and Operation of Freeway Electronic Toll Collection System project (hereinafter referred to as the ETC project). The Organizer aims to achieve the goals of increasing toll station capacity, shortening payment time, improving the convenience and safety of road users, conserving energy, reducing carbon emission, and reducing air pollution. At the same time, through the construction and operation of the electronic toll collection system, the Organizer aims to achieve the overall goal of implementing a fair toll collection scheme based on the “distance traveled” by the road user. Additionally, to support the development of the intelligent highway in the future, the electronic toll collection system must be able to integrate all its operations. The goal is to become an electronic toll collection and traffic management system, thereby laying down the foundations for the application of intelligent transportation systems.

The Organizer bases the implementation of the ETC on the Act for Promotion of Private Participation in Infrastructure Projects in which the BOT method was adopted. The ETC contract provides that the construction and operation company should compile its annual financial statements from Chinese Taipei’s GAAP and be audited by a certified public accountant. These financial statements will be submitted to the Organizer each year before May 1. Financial statements will be prepared quarterly and published on the company’s website as well as submitted to the Organizer within 30 days after the end of each quarter. Therefore, related financial risks will be controlled and monitored by both the Organizer and the construction and operation company.

ETC’s main challenge is financing. The construction and operation company is still operating at a loss, which makes it challenging to seek financing from banks. The construction and operation company has obtained consent from the Organizer to use its distance-based construction and operation assets to seek financing from banks. To guarantee that the construction and operation company will perform the obligations stipulated in the ETC contract, the construction and operation company agrees to provide a performance bond of NTD 288 million at the time of contract signing. Also, the construction and operation company should submit its insurance plan to the Organizer within three months of signing the ETC contract and obtain approval from the Organizer. Any changes to the plans should be submitted to the Organizer for approval within one month.

Chinese Taipei's PPP projects are implemented on a financially- independent basis. The authority does not provide viability gap financing. Chinese Taipei has over 1,100 PPP contracted projects worth more than NTD 890 billion dollars (equivalent to USD 30 billion, or CNY 178 billion) in capital investments from 2000 until 2013, including hospitals, cultural creativity parks, bus terminals, and port container terminal facilities. Currently, the private investment through PPP is around NTD 50 billion dollars (equivalent to USD 1.6 billion, or CNY 10 billion) per year. The authority does not provide individual loans or guarantee business revenue. Chinese Taipei has relevant professional expertise in the legal, financial, and technological aspects of PPP, and has set up a list of PPP experts.

4.2.4 JAPAN

In 1965, the Ministry of Construction of Japan conducted an initial feasibility study, and Japan Highway Public Corporation obtained the study in 1975. Based on the study by the government, Japan Highway Public Corporation led the training and planning of construction and the foundation of the project company named the Trans Tokyo Bay Highway Corporation. The company commenced the design and construction of the highway in 1989 and opened in 1997. The Japanese government primarily conducted the Tokyo Bay Aqualine project, and through this, the government considered a foundation of PPP for this project.

Tokyo Bay Aqualine: The Tokyo Bay Aqualine is the longest marine highway, passing over Tokyo Bay. It consists of a shield tunnel (9.6 km) and a bridge (4.4 km) with a total length of 15.1 km that connects the Keihin area (Tokyo and Kanagawa).

Key Facts:

- The project is not offered a direct debt guarantee, and the debts used for construction in this project are eventually structured to be covered from amortization repayment by Japan Expressway Holding and Debt Repayment Agency.
- Trans Tokyo Bay Highway Corporation undertook the design and construction works, and, after the completion of the construction, it transferred all assets belonging to the project to Japan Expressway Holding and Debt Repayment Agency.

- Concerning credit risk, the debt repayment of this project depended on the credit of Japan Expressway Holding and Debt Repayment Agency.
- A significant source of revenue for the Trans Tokyo Bay Highway Corporation, is its management of a service area located in the middle of the highway. Apart from the service area, the source of debt redemption is an amortized repayment by Japan Expressway Holding and Debt Repayment Agency.
- The toll has been reduced by one-fifth of the initial fare (under a case to use ETC system, public sectors (such as Chiba Pref.) owe part of toll fare), following criticism over the expensive initial fare.
- In the initial estimate, the total project cost was calculated as JPY one trillion (USD 10 billion). However, due to the delay in construction work, the project cost eventually reached 1.4 trillion JPY (14 billion USD). The funds for construction are procured as below.

Table 4-3. Finance of Tokyo Bay Highway

Fund	Amount
Government-guaranteed bonds	5.8
Government budget to develop roads	3.7
Loan from private financial institutions	1.8
Bond (Government Underwriting)	2.1
Equity 0.99	0.99

(unit: billion USA)

- Initially, it was estimated that the project should generate a positive economic return of JPY 200 million (USD two million) per day from its shorter access; however, such an effect might have decreased in today's standards because actual traffic volume is less than initially planned.

4.2.5 Korea

Since the 1990s, the use of a Public-Private Partnership is an essential treatment to solve financial constraints faced by the Korean government. The scope of PPP projects in South Korea is also expanding from road and transportation facilities to

social infrastructure facilities such as schools, hospitals, and residential accommodations. The concept of PPP in South Korea is the involvement of public and private sectors working in cooperation and partnership to provide infrastructure and public services.

Public investments have been continuously increasing since the introduction of the PPP act in 1994. The proportion of private investment to public investment in social overhead capital increased from 4% in 1998 to 18% in 2008. As of September 2009, 461 PPP projects had been awarded, among them, 169 projects are Build-Transfer-Operate (BTO) projects, and the remaining 292 are Built-Transfer-Lease (BTL) projects [Jay-Hyung et al. (2011)].

The first BTO project was carried out at the Incheon International Airport Expressway under the 1994 PPP act. It originally started as a government-financed project but turned into a BTO project to assist with the fiscal burden on the government. At this expressway, there was a gap between the estimated traffic volume and observed volume. So, a service contract type (BTL) of PPP was introduced in addition to the existing user-fee type (BTO).

Incheon International Airport Expressway [MKIF (2019)]: The Incheon International Airport Expressway is a 40.2 km, dual-direction, three-to-four-lane expressway connecting Yeongjong Island, site of the Incheon International Airport, to Korea's capital, Seoul. The Incheon International Airport Expressway is Korea's first operational private infrastructure asset under the PPI act. Construction began in December 1995 and was completed in December 2000. The expressway includes two major bridges, the 4.4 km Yeongjong Grand Bridge and the 2.56 km Banghwa Grand Bridge, as well as the 630-meter Gaehwa tunnel.

Key Facts:

- MKIF has invested in New Airport Hiway Co., Ltd. ("NAHC"), the concessionaire of Incheon International Airport Expressway, in the form of equity and subordinated loan. As of the record date, MKIF is a 24.1% shareholder of NAHC, and MKIF's total investment amount is KRW 75.3 billion, which is comprised of equity of KRW 23.6 billion and subordinated loan of KRW 51.7 billion.

- The concession is for 30 years, starting in January 2001.
- The guarantee duration is 20 years, and the minimum guarantee is 80% of annual CA projected revenue.
- The revenue gap, which is partial revenue sharing over 80% to 110%, is 110% of annual CA projected revenue.

Incheon International Airport [Yeo (2004)][Soh Young In et al. (2015)]: The Incheon International Airport (IIA) is the central airport of South Korea, and it is owned and operated by Incheon International Airport Corporation (IIAC), which is 100% government-owned. Since the Gimpo International Airport in Seoul does not have enough capacity with increasing passengers and freight after the Seoul Olympics in 1988, IIA was planned, constructed, and designed as an Asian hub airport.

Key Facts:

- The development of the IIA was divided into two initial phases.
- Phase I was from 1992 to 2001 with 11,920 km² land preparation, including two 3750 x 60 meter (m) runways, one 504 km² passenger terminal, and one 1,686 km² ramp area with a construction cost of approximately \$6.5 billion. The government supported 40% of funding, and debt financed the remaining 60%.
- Phase II followed Phase I in 2003 with a total cost of \$4.2 billion and was completed in 2008 with 8,265 km² land preparation, including a 165 km² remote concourse, one runway, and one 1,223 km² ramp area. Government funding and debt funding equally funded the project.
- The main facilities of the airport operation were financed, built, and operated by the government and IIAC, which was established in January 1999 with 788 employees across four business groups.
- The government and IIAC prepared the land for air cargo terminals and airport access roads, and private investors were invited to finance, own, and operate the terminals and access roads for a limited time. The goal was to reduce the government's contribution and to raise the creativeness and efficiency for constructing and operating Special Overhead Capital (SOC).
- Non-governmental builders implemented airport access infrastructure such as the Incheon International Airport Expressway, Second Airport Bridge, and Incheon International Airport Railway by applying PPP with a 30-year operation

period.

- Risk allocation and selection of the right partner is essential in PPP implementation.
- The success of PPP depends on how the government can grasp private sector interests and stimulate the achievement of a mutual partnership interest.
- Challenges for IIA include lower revenue from the expressway traffic, a higher toll fee compared with other national roads, weak private sector interest owing to the long-term investment, incentives for financial investors, and land development.
- There should be a successful opening and operation, dynamic marketing and hubbing strategy, and social agreement on the Beneficiary Pay Principle (BPP) to obtain successful PPPs in IIA. Further, the government should effectively allocate its financial resources through the introduction of private capital in SOC and managerial efficiency in SOC.
- For the future success of PPP, the government and private investors have to share interests and cooperate in various economic entities to obtain maximum financial and managerial efficiency. A vivid exchange of updated information on SOC is essential for the productive allocation of resources for future development.

In Korea, the Minimum Revenue Guarantee (MRG) scheme was introduced after the onset of the Asian Financial Crisis in 1997. Table 4-4 shows that the amount the MRG burden is expected to increase is significant due to the movement of new projects into the operational phase [Do in Winch et al. (2012)].

After viewing Korea's PPP, it was determined that due to the aging population, welfare expenses are gradually increasing and causing a limited public infrastructure investment. Some factors prevent a PPP from having a smooth implementation in Korea. The government adopted a double-entry book-keeping system, which is difficult to understand with the limited preparatory period. Thus, the government is actively promoting private investment in areas where private entities prove more efficient and competitive in supplementing the government's budget. Therefore, PPP will continue to play an essential role in expanding and improving infrastructure facilities in South Korea.

Table 4-4. Minimum Revenue Guarantee

Road (9)	Incheon airport expressway	MLTM*	Solicited	20	Oct-95	80
	Kwangju 2nd bypass phase 1	Kwangju	Solicited	28	Feb-97	85
	Cheonan-Nonsan expressway	MLTM	Solicited	20	Apr-97	82
	Daegu-Busan expressway	MLTM	Solicited	20	Mar-98	77
	Woomyeonsan tunnel	Seoul	Solicited	30	May-98	79
	Seoul beltway	MLTM	Solicited	20	Dec-00	90
	Ilsan bridge	Gyeonggi province	Solicited	30	Jun-02	90
	Machang bridge	Gyeongnam province	Unsolicited	30	May-03	80
	Busan-Ulsan expressway	MLTM	Solicited	30	May-06	Expected rate of return (6%)
Port (4)	Mokpo new port phase 1-1	MLTM	Solicited	20	Jul-97	79,77
	Incheon N. port phase 1-1	MLTM	Solicited	20	Aug-01	80
	Mokpo new port phase 1-2	MLTM	Unsolicited	20	Dec-01	79,77
	Incheon N. port wharf	MLTM	Unsolicited	15	Feb-03	80
Environmental	Seoul landfill gas facility	MOE**	Solicited	11	Mar-03	90
Airport	Incheon airport oil facility	MLTM	Solicited	11	Feb-97	90

*MLTM: Ministry of Land, Transport and Maritime Affairs, **MOE: Ministry of Environment

Source: Ministry of Strategy and Finance (2010) and the Board of Audit and Inspection of Korea (2010).

4.2.6 Philippines

The Philippines has one of the best performing Public-Private Partnership programs in Asia. Since 1992, President Ramos campaigned on a platform of economic reform. He fights for the promotion of competition and a private enterprise economy, and a commitment to continue the economic liberalization program introduced two

years earlier by Corazon Aquino's market-oriented technocrats. The Philippines had completed an International Monetary Fund (IMF) standby program.

The Philippines' experience with PPP programs goes back almost 30 years. The country had the first BOT law in Asia in 1990, which served as a model for other countries. Even before the BOT law was passed, the first BOT contract in Asia was awarded to Hopewell's Pagbilao project for the 210 MW Navotas plant in 1988. The Philippines also used the PPP approach to solve the power crisis in the 1990s when 8 to 12-hour blackouts paralyzed industry and crippled exports. From 1991 to 1995, 4200 MW of new private power capacity was commissioned, with project costs totaling almost USD 5 billion. In 1997, the Philippines executed the most extensive water privatization in the world with the award of the Metropolitan Waterworks and Sewerage System (MWSS) franchise to two concessionaires at a total project cost of USD 7.5 billion.

The Philippines BOT program applied to power projects, and the government implemented the project at the height of the power crisis. The fast-track program met a fair degree of success. The power generation in the Philippines has been a state of control for the government since 1972. In 1987, the government allowed the private sector to participate in electricity generation. Executive Order 215 (EO215) of the government mentioned that unlike the transmission and distribution of electricity, power generation is not a natural monopoly, and more than one entity can participate in the undertaking. The government encouraged the private sector to participate in economic development and started to disengage in areas that could be adequately handled by the private sector. Finally, the private sector can contribute to an increase in power generation capacity without requiring financial assistance or guarantees for the government. Fuel supply provision was separated from the main BOT.

- The BOT operator receives a capacity fee that covers operating profit and fixed costs and an energy fee based on the availability of capacity upon the completion date.
- There is a clear delineation of risk allocation between the National Privacy Commission (NPC) and the BOT operator. The NPC carried country risk, and the BOT proponent covers construction delays and cost overruns.

- The agreement is performance-based and provides for bonuses and penalties related to the plant heat rate and actual power production.

The IFC, ADB, Commonwealth Development Corporate (CDC), Export-Import Bank of Japan (J Exim), Export-Import Bank of the United States (U.S. Exim) and commercial banks lend a total of USD 698 million in a 13-year debt financing deal for the implementation of Hopewell's Pagbilao project. All the agencies except the U.S. Exim provided financing before completion. There are 10 to 15 banks, which are prepared to finance with tenures of five to seven years. Fixed-rate financing is generally not available, and the typical floating rate is LIBOR plus 2.5% to 3%.

In the case of the Light Rail Transit 1 project in Manila, during consultations with bidders, an issue arose regarding real estate taxes being the responsibility of the winning bidder. Due to this issue, the first round of bidding failed. The terms had to be amended by the approving authorities. The second bidding was successful, but the back and forth with the approving authorities resulted in a year's delay.

However, there are promising opportunities ahead for the Philippine's successful PPP program. With improvements including a more streamlined approval process, more flexibility built into the terms of the approval, early resolution of immediate issues, and structural changes that would allow greater foreign ownership of public utilities, the Philippine's PPP program will go even further in reducing the infrastructure gap in the Philippines. This program will become a model for ASEAN infrastructure spending.

4.2.7 Singapore

PPPs are implemented for a wide range of social and economic infrastructure projects. They are, however, used mainly to build and operate hospitals, schools, prisons, roads, bridges and tunnels, light rail networks, and water and sanitation plants [Gunawansa in Winch et al. (2012)]. The development of successful PPP programs is complex and has various challenges [APEC (2019)].

Waste-to-Energy Infrastructure Development Project: In the 1960s and 1970s, Singapore disposed of solid waste by landfilling. In the late 1970s, an alternative method of solid waste treatment and disposal was needed because of the limitation of

land, the rapid increase in population, and economic growth. Therefore, the government wanted to adopt Waste-to-Energy (WTE) incineration to reduce waste volume by 90%. [APEC (2014)]

The first WTE plant was established in 1979 and grew to four plants by 2000. Non-recycle waste was collected and disposed of at WTE incineration plants or the offshore sanitary landfill. The heat released from the incineration process was converted into electricity, and ferrous metals in the ash residue were recovered for recycling.

Key Facts:

- The government had traditionally undertaken all financial, design, and operational risks in the preliminary development of the four WTE plants.
- The plants were managed and operated by the National Environmental Agency (NEA) on behalf of the government.
- The government loosened the WTE sector in phases with the private sector intending to increase efficiency by injecting competition and developing the environmental engineering industry by transferring expertise from government to the private sector.
- Since 2001, the government shifted the role of developing, owning, and operating WTE plants to purchasing incineration services directly from the private sector.
- A fifth WTE plant was privatized with a design-build-own-operate (DBOO) PPP model with a full take-or-pay approach through bidding; however, the private sector could not bear the demand risk and the quantity of waste in this project.
- In 2004, the bidding for WTE plant opened to pre-qualified bidders from the private sector to design, finance, construct, commission, own, operate, and maintain a WTE IP with a capacity of 800 tons per day.
- The successful developer needs to establish a Special Purpose Company (SPC) to provide waste incineration services for 25 years after the construction of the plant.
- The government would bear the demand risks associated with a non-guaranteed

waste stream, uncertain waste growth, waste quality, power generation, and electricity sale price.

- The SPC would bear planning and approvals, design and construction, installation, and commissioning risks, as well as financing, operations and maintenance, and service quality of the project.
- The SPC financed the fifth WTE plant through the combination of equity and bank loans. The plant was completed in 2009, and in 2010, the ownership transferred to a business trust, with the same majority shareholder and operator.
- Proper allocation of risk, supportive regulations and clear guidelines are required for the accomplishment of PPP.
- The PPP model allowed not only the value of money and certainty of price and budget to the public sector, but also financial discipline, cost-effective solutions, and optimal life-cycle costing for the private sector.

4.2.8 Thailand

In 1983, the JICA study team prepared the Feasibility Study in the Second Stage Toll Expressway System (SES) in the Greater Bangkok region and found that substantial economic benefits were estimated to increase both expressway usage and existing road usage as a result of time-saving and reduced of operating cost. Estimations indicated that the SES produced a positive value for economic and financial internal rate of return and travel demands of expressway users increased from 135,000 vehicles per day on the existing system, to more than 400,000 by the year 2001 on the combined systems.

The Cabinet approved the SES project in principle in March 1985. Funding the SES project through the regular annual government budget was limited during that time. For this reason, the Thai government became interested in having the private sector invest and participate in the development of the economy's transportation system and expected the expansion of the expressway network. To continue the implementation of the SES project, the Thai government allowed Expressway Authority of Thailand

(EXAT) to propose the alternative of the private sector investing in the SES project in order to reduce the government budget and enhance the efficiency of the project implementation.

The outputs of the SES project were linked with and extended the service area of the existing First Stage Expressway Toll System (FES). The total length of the SES is about 38.4 km and consists of four sectors.

Bangkok Expressway Company Limited (BECL) agreed to carry out the work to operate and maintain the SES as authorized by EXAT until the end of the contract period. This agreement was at BECL's own cost and risk without resourcing credits or guarantees to EXAT. Furthermore, BECL acknowledged and agreed that BECL has no title to the land on which the SES is or is to be constructed without prejudice to BECL's rights. This SES project was in a build-transfer-operate format.

EXAT ensured that all tolls paid by users at toll booths or other means concerning the Urban Network were collected from the toll booths on the Urban Network, and the necessary person, firm, or entity of Thailand was appointed by EXAT (with the prior written consent of BECL). EXAT paid the relative proportions to BECL. The relative proportions shall, in respect of the periods set out below, be that percentage set out hereunder:

BECL was granted the exclusive right during the contract period to receive tolls for the SES Suburban Network except during the period prior to the completion of the construction of Sector B, the toll revenues arising from apportioned between EXAT and BECL in their relative proportions, and until completion of BECL's obligations to carry out the works in relation to Sector B.

For the implementation of the SES project, EXAT and BECL established a Coordination Committee under the chairmanship of EXAT's representative and vice-chairmanship of BECL's representative. A senior representative from each of the relevant authorities and the project manager comprised the committee. Additionally, EXAT or BECL may invite other people and advisors occasionally to attend any committee meeting. The Coordination Committee shall meet at least once a month during the project period to assist in resolving any problems related to the

implementation of the project and shall meet after that as deemed appropriate.

BECL shall furnish EXAT's engineer with reports and other information related to the project as EXAT's engineer may reasonably request said reports to ensure that the construction of the SES by BECL is compliant with BECL's obligations. Moreover, upon construction completion, BECL shall supply EXAT's engineer with copies of all as-built drawings and such other technical and design information relating to the finished project as EXAT's engineer may reasonably request said documents. When BECL considers all or any part of the SES to be suitable for use as a public highway, BECL shall give notice thereof in writing to the Independent Certification Engineer and EXAT shall take all necessary measures to open the public highway for use, unless the Independent Certification Engineer, in consultation with EXAT's engineer states, in writing, that the highway is not ready for use as a public highway on the grounds of safety within 14 days from the date of receipt of said BECL notice.

Regarding the renegotiation during the SES agreement, it is the intention of the parties that the contract period may be extended for two further periods (10 years each) upon such terms as agreed between EXAT and BECL in the light of the continuing feasibility of the contract rights, the rate of return to both EXAT and BECL, and the interests of the public, BECL's shareholders, and the lenders. Before the expiry of the contract period, EXAT and BECL shall negotiate together in good faith to extend the contract period on mutually acceptable terms.

The interest rate to be assessed by the lenders on the aggregate utilized portion of the credit facilities was targeted to be no more than the minimum lending rate with a possible provision of a fixed interest rate during a portion of the construction period for the priority component. As a result of NECCO studies, the economic internal rate of return (EIRR) was 22.6 %, and Net Present Value (NPV) was 20,616 million baht.

For guarantee or insurance instruments, the SES project is backed by guarantees to enhance the financing structure as follows:

- Guarantees to be issued by foreign banks of up to the foreign currency equivalent of five billion baht for a period of up to ten years.
- Provisions under the credit facilities to issue guarantees concerning instruments to

be issued by BECL and placed with entities in Thailand and overseas.

- Export and multilateral credits.

Toll Expressway System (Stage2): JICA provided a Feasibility Study (FS) on the Second Stage Toll Expressway System (SES) in the Greater Bangkok region to the Expressway Authority of Thailand (EXAT) in 1983.

Key Facts:

- The FS estimated substantial economic benefits as a result of reducing time and operating costs.
- The FS also estimated that the SES produced a value for both economic and financial internal rates of return as well as increased travel demands of expressway users from 135,000 vehicles per day on the existing system, to more than 400,000 by the year 2001 on the combined systems.
- The government budget is limited for SES projects, so there is interest to invite private investors to reduce the government budget in the project and enhance the efficiency of the project implementation.
- The project had a total length of 38.4 km with four sections. The construction started in 1990 and finished in 1997, with a total cost of 22.4 billion Thai baht.
- The SES project was undertaken in a BTO fashion with BECL with a debt to equity ratio of 80:20.
- BECL operated and maintained the contract with its own cost and risk without resourcing to EXAT credits or guarantees, excluding the land provided by EXAT.
- According to the report of NECCO in May 1986, the ratio of the foreign component to the local component was 31:69, the Economic Internal Rate of Return was 22.6%, and the Net Present Value was 20,616 million baht.
- Revision on the toll system caused a misunderstanding in the rules and conditions of the agreement between both contract parties.
- The toll rate is based on investments of the private party, which had an impact on end-users and EXAT.
- The government agency should control the service rate to be fair to the private party.

4.2.9 United Kingdom

In the early 1990s, PPP projects were public and accrued benefits at different stages. Since PPP is considered sophisticated and controversial in the UK, its acceleration is vast in all sectors for adoption. One of the key objectives is the accessibility of PPP to small scale developments and participants.

Most of the PPP and Public Financing Initiative (PFI) projects in the UK saw high levels of satisfaction. In the public sector contract managers' report, 96% of the projects are performing at least satisfactorily, with 66% at a very good/good standard. For user satisfaction, 80% of the responses indicated that services are always or almost always delivered at an acceptable standard. Furthermore, 97% of managers rated the relation with their private-sector counterparts as satisfactory or better and a 72% rating of very good/good services [PUK (2016)].

PPP is required for fitting the projects, delivering the appropriate mechanism, supporting stakeholders, and obtaining quality products. By applying PPP, there is an optimal balance of cost, quality, risk allocation, and management between both parties. So far, PPP projects in the UK have been implemented effectively.

By applying PPP, beneficial achievements are allocated on the tangible improvement in public services, a more strategic approach to infrastructure investment. Achievements include the development of higher capacity and completion in the supply market, improvement of the public sector client capability, and quality of procurement.

Some of the common problems in UK PPP are:

- PPP does not put service delivery ahead of profit
- Insufficient training or support for contract management in the public sector
- Allocation of risk and reward
- The public sector is not transparent on what it wants
- Project complexity exceeds public and private sector capacity
- Poor market assessment and management
- Appointing/managing advisers
- Poor project governance
- Affordability issues

It is also stated that PPP in the UK may be characterized as follows [Farquharson (2008)]:

- PPPs do not suit every type of infrastructure investment
- Public sector skills are challenging to retain—need centralized support
- Programs from investments are better than those from deals
- Standardization needs enforcement
- Plan for contract management—change is the norm
- Quality control processes
- The private sector would invest long-term approaches with some innovation

4.2.10 United State

I-595 is the only east-west highway in Broward County, Florida. Travel demands in the corridor proliferated due to several factors, including regional population shifts after Hurricane Andrew in 1992, and a significant capacity improvement needed to keep pace with growing demand.

However, a 2004 modification to state legislation and an industry forum in 2007 encouraged the Florida Department of Transportation (FDOT) to implement the project on a PPP basis by delivering the 16 separate improvement projects in a single procurement for more timely and efficient completion.

I-595 Road Project: ACS Infrastructure Development and TIAA-CREF implemented the reconstruction, widening, and resurfacing of 10.5 miles of the I-595 corridor under a 35-year concession with a design, build, finance, operate, and maintain PPP contract with Florida for USD 1.674 million. The implementation period is five years, from March 2009 to 2014.

Key Facts:

- The objective of the project is to increase the number of vehicles in the corridor.
- The Transportation Infrastructure Finance and Innovation Act (TIFIA) Loan 36%, concessionaire equity 17%, and senior bank debt 47% comprised the funding source.
- I-595 was the first U.S. application of an availability payment-based PPP project.
- ACS consortium took responsibility for the requested service for both toll and

non-toll lanes, and FDOT took responsibility for revenue risk, control toll rates, and toll collection on the corridor.

- Once construction is completed, the ACS consortium will be awarded a lump-sum payment of US 685 million.
- ACS will receive a yearly inflation-adjusted availability payment of USD 65.9 million for the remainder of the concession's life.
- Availability payment caused FDOT to lower the credit risk of the project to the concessionaire.
- Long-term financing for the project was available at affordable interest rates, which enabled the ACS consortium to switch from the bond market to the bank market.

4.3 Summary

The cases studied in this chapter demonstrate that all the countries tried their best for the productive and successful development of their projects by applying PPP in different ways. PPP is required not only to solve the financial gap but also for the development of technology transfer of innovative ideas from the private sectors for the development of public infrastructure. A sound PPP system is required along with many other aspects, including regulations, clear guidelines, government support, risk sharing, transparency, and capacity building. Many cases primarily related to the transport sector, and international and local cases are studied together with pros and cons.

Furthermore, the discussions in the case studies are mostly on financial matters such as discount rate, share demand, foreign equity, debt financing, risk, funding, and payment. Only one of the projects in Myanmar's joint venture with a Chinese-based company was founded for setting up the Socio-Economic Master Plan. This project is the first step to Myanmar considering such socio-economic matters. For the development of infrastructure in a country, sufficient financial support is essential as well as the consideration of the socio-economic matters. Most of the cases are not considered on the socio-economic matters. It is critical to consider the development of future projects together with the socio-economic conditions.

Chapter 5

Socio-Economic Outcomes of Projects

As stated in Chapter 1, the objective of this research is not to seek the socio-economic effects as the outcomes. Instead, the study focuses on how investments should be made to achieve the potential socio-economic values right at the early stages of the project development phase. That is, this thesis aims at an investment allocation to achieve potential socio-economic values effectively.

This chapter is not intended to explore the above thesis objective directly. It, however, explores the potential socio-economic effects of infrastructure projects. In other words, it describes the possible socio-economic effects as possible outcomes arising from infrastructure projects. Such analysis may provide explicit prior recognition with the government to realize the real socio-economic values and the necessary investment criteria, or “market” as termed in Chapter 6, to be considered in the project development phase.

The Wisara Housing Project, and two Yangon Ring Road Projects: Yangon Inner Ring Road (YIRR) and Outer Ring Road (YORR) are example projects examined in this chapter. By considering the critical features of the sample projects, the results of the analysis show numerous changes, including technology transfer, public space transformation, population and employment growth, and economic growth. These are the outputs associated with infrastructure, land and real estate development, economic improvement. Thus, this chapter provides implicative knowledge for Chapter 6.

5.1 Housing Redevelopment Project

5.1.1 Key Features

Land and people are the foundation of every nation, while in urban areas, rapid economic and social development are exerting sustained pressure on land demand. The land has changed from a traditional resource to a capital, becoming the most significant asset of the local government. Buildings play an essential role in determining a city’s sustainability. However, the design and construction of new developments have

received much of the academic and policy attention [Zhou et al. 2003].

Also, the population tells us who we are and where we are going as a nation. It helps our communities determine where to build everything from schools to supermarkets and from homes to hospitals. It supports the decision of the government on how to distribute funds and assistance to states and localities. Since the worldwide population is continuously growing, the number of housing units is increasing at the same time. The population growth in Myanmar is steadily increasing each year. From 1983 to 2014, the average annual growth rate (AAGR) of the population in Myanmar and Yangon was 1.22% and 1.67%, respectively. This trend warrants a wide-ranging modernization of both municipal governance and legal frameworks for urban development. Population growth rouses the development of cities and will require an increase in the number of dwellings, as well as improving their quality [Kazamovskyil et al. 2018].

Table 5-1. Population Growth in Myanmar

The Whole Myanmar

	1983 Census	2014 Census	AAGR (%)	2040 estimate
Population	35.29	51.48	1.22	70.56
Housing Units	6.75	10.88		15.68
Person per HU	5.44	4.73		4.5

* Housing Needs at 2040 = 15.68 – 10.88 = 4.8 units (million)

Yangon

	1983 Census	2014 Census	AAGR (%)	2040 estimate
Population		5.16	1.67	7.94
Housing Units		1.58		2.65
Person per HU		3.27		3

* Housing Needs at 2040 = 2.65 – 1.58 = 1.07 units (million)

Through comprehensive planning, redevelopment improves the built environment and infrastructure in old urban districts while providing additional green open spaces and community facilities. Dilapidated buildings are redeveloped into new buildings of the modern standard of environmentally friendly with a smart design. Housing improvement or urban renewal is one of the many types of neighborhood quality adjustments because it aims to improve the environment in urban blackspots by eliminating slums or derelict buildings. It is, therefore, reasonable for one to envisage

that urban renewal can change the quality of a neighborhood. In particular, urban renewal can help reduce the negative externalities of urban decay. Housing development refers to the process of reconstruction of a residential premise by demolishing the existing structure and constructing a new one. Furthermore, the housing requirement is slowly changing from quantity to quality.

Table 5-2. Housing Requirements in Different Era

Era	Periods	Housing Requirement		
Parliament Democracy Era	Before 1960s	Built One's Own House	Plant Materials Wood Base	Traditional Housing
Socialist Era	1960s~1990s	Self-Housing Built to Order Contract System	2 – 6 storey RCC Building	Modern Housing
Military Era	1980s~1990s	Built to Order Unit Sharing/Contract System Housing Project	4 – 8 storey RCC Building	
Democracy	2010s~	Housing Project Mixed Use Development	High rise 16 – 30 storey Cast – in – situ Precast	Mass Housing

Hence, the Department of Urban and Housing Development (DUHD) of Myanmar has been trying to provide adequate housing for the people through several housing schemes and urban development programs. To fulfill the housing needs of the people for the next 15 years, DUHD focuses on supply projection to meet future demand (Table 5-3).

Table 5-3. DUHD Plan for Next 15 years

Periods	Housing Units	Remark
Frist 5years	180,000	DUHD planned to provide 20% of housing units and will enable the LGs and private sector to produce the rest 80%.
2016~2017 to 2020~2021		
Second 5 years	300,000	
2021~2022 to 2025~2026		
Third 5 years	420,000	
2026~2027 to 2030~2031		
From 2016 to 2031	900,000	

5.1.2 Wisara Project

Recently, two public housing redevelopment projects–(1) 51st Estate Redevelopment, 2013 – 2015 and (2) Shwe Gone Estate Redevelopment, 2014 – 2016

finished between 2013 to 2016. From the results of these projects, it is proposed to redevelop Wisara District Area. Wisara District is located at the main axis of Shwedagon Pagoda, between a residential area and downtown. Wisara and its surrounding areas are covered by rich green and have commercial features, public features, bus stops, and two railway stations: Lanmadaw station and Phaya Land station. The existing housing units are 684 units, and population density is 140 population/acre or 0.0346 population/m² and 23 units planned with sizes ranging from 398sft. to 775sft, or 36.975m² to 71.99m². (Avg. 592sft). The redevelopment is proposed to be an average of 600sft (55.74m²) for the new unit, including offices and service apartments. The project applies the “Chain Development Concept” consisting of four steps as follows.

Phase1: Chain half of the original residents to the appropriate place by providing the rental fees for apartment and shifting cost. The remaining residents can live in their households.

Phase2: Demolish the old building

Phase3: Redevelop

Phase4: Resettle the original residents to the redeveloped housing

In the PPP model, the government invests in the land area, and the developer invests in the infrastructure. The developer provides the cost for resettlement, demolishing the old building, and starting the redevelopment project. Therefore, the land cost does not burden the developer, and the government subsidy can reduce the whole project cost. During the construction period, the government assists with bank loans if the developer requires. After the project finishes, the users can buy the apartments with the housing bank loan at a low-interest rate in an extended payment. The developer only needs to pay for the area of the apartments for original residents.

In the project, the DUHD is expected to be responsible for resettling the existing residents, preparing the land agreement, approving the long-term loan, and monitoring and evaluating project progress. By contrast, the developer is responsible for the infrastructure design under the design-bid-build method, the coordination of the shareholders, negotiation with the co-developer, provision of assistance to the buyers, as well as management of financial, construction, operation and demand risks, and the rules and regulations that are enacted by the government. In general, the benefits of

housing redevelopment projects may be recognized in the following ways [Trop (2017)].

- Enhance new, larger, and more expensive dwellings
- Modify neighborhood image
- High-quality dwellings at relatively affordable prices
- Strengthening occupants' sense of home
- Decent accommodations for people
- High living standard
- Enhance neighborhood safety
- High-quality of the environment
- Transformation of public spaces (hospital, school, coffee shop, etc.)
- Increase usage of commonly-shared spaces
- Local economic activation
- Increase employment rates and reduce poverty
- Decrease socio-economic spatial segregation
- Increase socio-economic status of the city
- Increase urban density

The critical expectation of the Wisara Housing Project is the recovery from recession in future economic and sustainable communities. The redevelopment programs are intended to transform the neighborhood community for better living under non-holistic interrelationships between the project areas and its surrounding neighborhood. In general, the advantages are expected to include:

- Low-income housing and major infrastructure construction
- More space and monetary benefits without any money from their own pockets
- Extra amenities like a gymnasium and high-end security systems
- Effective Floor Area Ratio (FAR) and Building Coverage Ratio (BCR)
- A higher-quality living environment such as elevator for 5-story RCC Building
- Enhance economic advantages
- Increase the quality of public services, facilities, and neighborhood retail

5.1.3 Analysis of Socio-Economic Values from Wisara Project

This section tries to explore the relevance in a chain. In doing so, it is appropriate to use the suitable tools and, here, the knowledge map [Howard (1989)] is applied. The knowledge map is an intuitive visual display, depicting critical elements of the decision drawn as a rectangular and the uncertain variables drawn as ovals. The arrows show the relevance between the variables, or a flow, implying the causal relations.

Figure 5-1 shows the relevance diagram of the potential socio-economic effects of the Wisara project [Nandar et al. (2016)]. It represents the socio-economic effects in the chain. In the short-term, the effects may manifest in, for example, higher employment, poverty reduction, neighborhood safety, and a higher living standard. Then, the effects result in public space transformation, unique socio-economic segregation, and economic advantages as end outcomes.

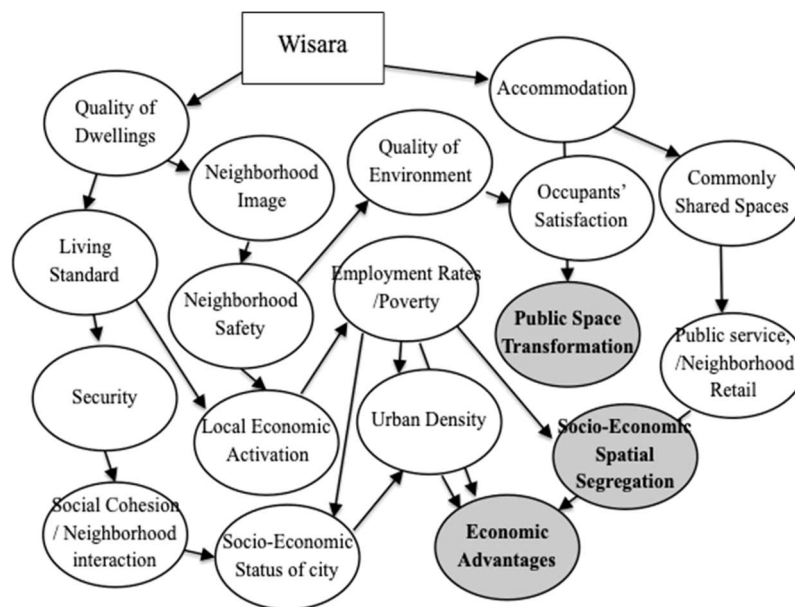


Figure 5-1. Chain Effects of Socio-Economic Effects, Wisara

Higher Employment Rates and Poverty Reduction: New job opportunities will be created after housing construction. Moreover, there will be new investments along with new job opportunities after redevelopment. This will lead to increased employment rates. Expenditure on household goods and services will support jobs in local businesses. Citizens will have more job opportunities than before with more income. It will help to reduce the poverty rate of the community and contribute to the long-term

sustainability of the city.

Neighborhood Safety and High Living Standard: Before redevelopment, family members lived in small dwellings. For a large household, the size of the dwelling was a dominant constraint. After redevelopment, the residents will be able to live in new, larger, and higher-quality dwellings, and it will also enhance neighborhood quality with fewer maintenance worries. The residents will enhance neighborhood safety and social interactions. The better the level of social cohesion and neighborhood interaction, the better is the level of neighborhood safety. It will increase the usage of common spaces by strengthening occupants' sense of place [Trop 2017]. Furthermore, it will also improve lighting in open areas for children to safely play.

Public Space Transformation: Residents will put pressure on services that have already been stretched thin owing to the constraints of public-sector expenditures, and they will additionally demand a range of services, including health and education. After the transformation of public spaces, public facilities such as coffee shops, shopping malls, bookstores, health centers, private schools, and other retailers will attract new residents. The transformation of public spaces will lead to time saved and other benefits for households.

Crime is a part of the social system. The crime rate is significantly different depending on social factors such as education levels, poverty rates, lack of social organization, and the construction of the community. The new residences and future developments can encourage residents in the community to take care of their properties and common areas, ultimately stabilizing an area socially and reducing crime rates [Freedman (2011)]. These facts may lead to a reduction in the crime rate.

Socio-economic Spatial Segregation: Urban segregation is a natural occurrence of excluding or hindering certain groups from accessing services, activities, and spaces. The segregation is not just about properties or individual spaces, but also about interrelations between the many spaces that make up the spatial layout [Maffini et al. (2018)]. Income inequality may be increasing in cities and neighborhoods, and higher and lower-income households live separately, causing the social instability of cities. These kinds of segregations are harmful. In the meantime, implementation of the redeveloping housing project may lead to a decrease in socio-economic spatial segregation.

Economic Advantages: The new environment will become an area for social contact,

and people can create more job opportunities from the projects to support their standard of living. The additional retail and other spending generated by residents and investors would support the local economy of the city. The services signal positive economic growth in local areas. They are viable only when there is a sufficient spending population. To this end, the development of new housing would be expected to contribute to the long-term economic sustainability of the city.

5.2 Metropolitan Highway Project

5.2.1 Key Features

Road infrastructure is a significant element of the broadly understood technical infrastructure by being responsible for the spatial transport of people and cargo, or “the blood circulatory system” in any economy. The development of road infrastructure accelerates cargo and passenger flows, and it also helps to create new companies and develop the infrastructure in the public sector.

The city of Yangon is one of the most important economic centers of the nation, and it sees rapid urbanization and motorization with the nation’s economic growth [JICA (2103)]. The current rapid urbanization and motorization depend on the existing urban transport infrastructure in the city of Yangon and its surrounding areas. The deterioration of the urban transport situation has become a severe concern socially, politically, and environmentally.

Unfortunately, the road network in Yangon is far from satisfactory. Since the existing solutions are not adequate to meet today’s needs, the current technical condition of roadway facilities is weak, and connections with other cities’ road networks are poor. All traffic flow in the Yangon area through the town’s streets becomes unsuitable for such heavy traffic in terms of geometric features, such as streets, junctions, and crossroads. The ring road implementation plan will include new construction, reconstruction, and widening of existing roads.

In recent years, the increasing motorization rate has led to a traffic congestion problem in the Yangon area, worsening with each passing day. Commuters face traffic congestion daily. Traffic congestion also leads to dangerous levels of pollution. The Yangon circular railway system began operating, and overpasses were built in the Yangon area to address the congestion, but the problem persists. Due to very low

accessibility and lack of a feeder service, only a few Yangon people use the circular railway system. Additionally, the public bus system is not adequate or organized, and runs a shoddy service.

More effective and well-planned road infrastructure projects are required to provide for future traffic growth. As a result, the Yangon city transport decided to construct a ring road project. Construction of the ring road can solve the traffic congestion problem and increase connectivity between the inner and outer areas of the city. High capital expenditure is necessary, and the government sector's support would not provide full assistance to these projects. Therefore, a public-private partnership (PPP) is required to accomplish ring road projects using private sector investments. A Build-Operate-Transfer (BOT) method is primarily used for investing in PPP projects throughout Yangon.

5.2.2 Yangon Ring Road Projects (YIRR and YORR)

Recently, the development of the eastern area of Yangon is in progress, specifically in the Thilawa Special Economic Zone. There are two Yangon Ring Roads: Yangon Inner Ring Road [JICA (2015)] and Yangon Outer Ring Road. These are expected to be the backbone of the city development, especially in the eastern area. Consequently, the proposed ring road network will make a connection with the Thilawa Special Economic Zone, Yangon-Mandalay Expressway, and National No.1 and No.2, which will be beneficial in the logistics sector of the country.



Figure 5-2. Location Map of Ring Roads

Yangon Inner Ring Road is proposed to have traffic flow at a speed of 60 km/h. Yangon is a highly urbanized, and thus, land acquisition is challenging. The project utilized PPP to minimize construction costs. According to the International Finance Corporation (IFC), the project applies “Chain Development Concept” consisting of four steps:

Phase1: Feasibility Assessment

Phase2: Due Diligence and Structuring

Phase3: Tender and Award

Phase4: Project Agreement

The feasibility study started in 2018, and Phase 4 is planned to be completed by 2019.

Table 5-4. YIRR Design Criteria

Metropolitan Expressway Design Criteria	
Design Speed	60 km/h
Classification	Expressway
Area	CBD in Urban
Min Horizontal Curve Radius	150 (120) m
Min Transition Curve Length	50 m
Max Superelevation	10%
Stopping Sight Distance	85 (75) m
Max Vertical Grade	4%

While YIRR is in Phase 2 at this moment, YORR is in the feasibility stage. Integrated Industrial Estate Project Plan intends to develop Yangon more and create national industrial zones. The project will consist of a two-way, four-lane highway with a speed limit of 100 km/h. The total length of the entire route is approximately 143.2 kilometers (km). The YORR is built to connect East Dagon, Hlegu, Mhawbi, Htantabin, Hlaingtharyar, Dala, and Thanlyin to each other. The proposed highway goes through these seven townships, and both PPP and ODA funding may be combined for the highway.

Table 5-5. YORR Plan

Name	Length
Road Project	143.2 km
Bridge:1	1500m
Bridge:2	2100m
Bridge:3	1000m

In general, the benefits from the ring road projects include:

- Improved mobility and accessibility
- Enhanced economic and social status
- Creation of job opportunities for local people
- Improved technical support
- More reliable commodities services
- Provision of market facilities for informal traders
- Improved access to social services
- Increased land price along with the ring road project

In the case of YORR, the benefits include:

- Improved profits of oil and gas firms as well as car manufacturers
- Increased profits of real estate agents and developers
- Improved profits of construction firms by building new infrastructure projects
- Enhanced convenience to people's living standards who live in the suburbs

5.2.3 Analysis of the Socio-Economic Effects from Ring Road Projects

Each ring road implementation project may generate direct and indirect effects. The effects may include a reduction in noise, vehicle operating costs, travel time, accidents, and pollution. It also may enhance market expansion, local community, and lead to a transformation of local industries [Kozłowski (2014)].

In a similar fashion to Figure 5-1, Figure 5-3 shows a more detailed study of the

industrial markets. Additionally, local and foreign investments will increase more than before.

Population Development: Ring road projects traverse a larger area and affect diverse and multiple groups in the community. They will improve the accessibility to schools, hospitals, shopping malls, business centers, and worship places. The local community will have a better image, and the people in the community will upgrade their quality of life. As a result, the population around the project area will be increased significantly. Additionally, the areas near the ring road will be more attractive places to settle down [Kozłowski (2014)]. For example, the Dala and Twantay areas are close to each other with a CBD area (a crowded area), and housing projects and an economic zone may develop in those areas.

Employment Creation: The ring roads will transform communities from an agrarian society to an industrial society. Skilled and unskilled workers will find new job opportunities. As the service industry is expected to grow, there will be jobs creation in the transport, commerce, and trade industries. These will also lead to an increased household income by reducing the unemployment problem at the same time.

While not explicitly shown in Figure 5-4, there are some people affected negatively in their businesses or residences [Mane et al. (2013)]. The existing industrial areas and markets could see relocation and informal businesses, especially street vendors along the ring road corridors, could be removed. It will be necessary to estimate the cost for compensation, resettlement, and land acquisition of all affected people. People should see asset replacement, and they should receive compensation. The ring roads cross the main rivers in the Yangon area resulting in the water sources seeing a pollution problem from construction.

5.3 Summary

This chapter scrutinized the potential socio-economic benefits out of the projects by examining on-going PPP projects around Yangon City, including the Wisara Housing Project, and the Yangon Inner and Outer Ring Roads. This chapter illustrated some of the socio-economic benefits as a result of the projects. Significant findings from the housing projects included higher employment, poverty reduction, neighborhood safety, and a higher standard of living. Similarly, ring road projects were associated with travel

time and cost savings, neighborhood security, poverty reduction, as well as public space transformation, unique socio-economic segregation, and economic advantages as end outcomes.

These socio-economic factors resulted not only from the infrastructure project itself, but also from other developments such as land development, real estate development, and improvement in economic conditions. Therefore, the discussions in this chapter could give rise to the rationale for the decision making in asset allocation. In other words, it is essential to consider the simultaneous effects of socio-economic values. This premise leads to the proposal in Chapter 6, that is, the simultaneous evaluation of infrastructure, land, real estate, and economic conditions may need to be considered in project decision-making at the stage of asset allocation.

CHAPTER 6

AN ANALYTICAL FRAMEWORK

6.1. Introduction

This chapter develops an analytical framework for socioeconomic valuation. It evaluates the attractiveness of four investment areas in terms of infrastructure, land, real estate, and economic conditions using the socioeconomic benefit index, which is referred to as the “Expected Economic Return (EER)”. Accordingly, the four investment targets are also referred to as the “government market,” or simply the market, in this thesis.

This chapter starts by discussing the sub-criteria for each market. Each of the four government markets is assessed using four sub-criteria components, thus leading to 16 (4x4) sub-criteria overall. The base EERs for these 16 sub-criteria are shown first; their estimation is subjective and uses the background data recorded by the government. Next, in the analytical framework, based on the pairwise comparisons of the 16 components, the adjusted EERs for the sub-criteria are calculated for each region, independently. Since this adjustment does not consider the interrelations or the differences among states/regions, a second adjustment is made based on pairwise comparisons among states/regions for each of the four markets individually. The results show the attractiveness of investments in the four markets based on the interrelations among all the states/regions.

6.2. The Model Concept

The analytical model concept depends on the sequence of four developments or markets, as shown in Figure 1-2. The figure shows that the development of urban economy, land, real estate, and infrastructure depends on the preceding developments. In other words, the four developments are interrelated with each other, directly and indirectly. Therefore, it is necessary to find a method to measure the socioeconomic values arising from the development of each market in the cycle. While the underlying linkage may not always be cyclical as shown in the figure, the interrelations may need to be

incorporated in the analytical framework. In this thesis, two considerations are made these are the cross dependencies among the four markets and among the states/regions and analyze them using pairwise comparisons, as expressed in the Analytical Hierarchy Process (AHP) and explained later in detail.

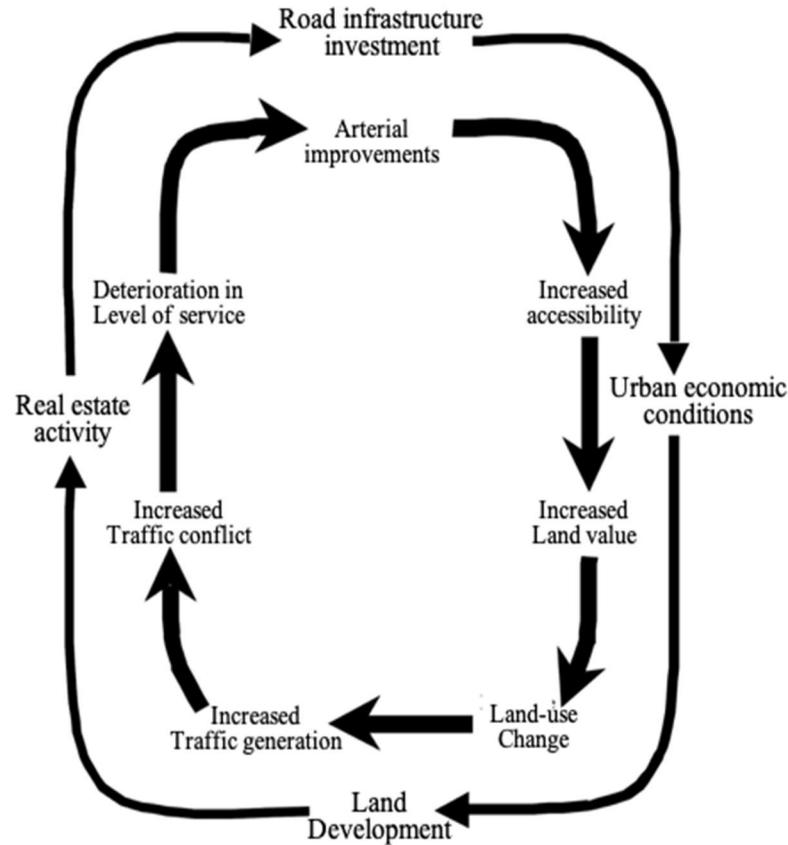


Figure 1-2. Road Network and Land-use Cycle (Source: [Hubert (2014)])

The four stages of development (i.e., the necessary conditions for the market) in this thesis are the Urban Economy Market (U), Land Market (L), Real Estate Market (R) and Infrastructure Market (I).

In the analytical framework, each market is further categorized by its sub-criteria as indexes that can be quantified in terms of EERs (Figure 6-1). As shown, each market is characterized using four sub-criteria, thus having 16 sub-criteria in total.

Market	Sub Criteria
Urban Economy	<ol style="list-style-type: none"> 1. Attraction (BA) 2. Agglo. Econ (AE) 3. Maturity (MM) 4. Exposure (ME)
Land	<ol style="list-style-type: none"> 1. Stimulus (DS) 2. Potential (DP) 3. Activities (DA) 4. Illegal Use (IL)
Real Estate	<ol style="list-style-type: none"> 1. Market Demand(MD) 2. Building Plans (BP) 3. Rental Rates (RR) 4. Vacancy Rates (VR)
Infrastructure	<ol style="list-style-type: none"> 1. Provision (MP) 2. Traffic Demand (TD) 3. Leakage/ Inflow (LI) 4. Transport Costs(TC)

Figure 6-1. Four Markets and 16 Sub-criteria

The urban economic market is characterized by four sub-criteria, namely, Business Attraction (BA), Agglomeration Economies (AE), Maturity of Market (MM), and Market Exposure (ME).

Urban economics is concerned with the activities that occur in urban areas, with the outputs of these activities being the economic effects. The economic development component addresses aspects of the economic conditions such as employment creation, business sales, contribution to the GDP, and urban competition [Wurtzebach et al. (1994)].

A well-established urban economic market is a major attraction [Gillis et al. (1996)], with private firms being pulled toward this area if the economic conditions are favorable. This characteristic of the urban economy is referred to as its natural BA.

Transport infrastructure improvements allow the integration of urban economic markets, hence inducing more competitions. The effectiveness and efficiency of the market location plays a key role in its competitiveness, with the competitiveness of urban locations being influenced by economies of scale and agglomeration economies (AE).

The economic conditions can also be characterized by the maturity of the market (MM). A city is dynamic, growing and shifting in great spurts during rapid expansion and

building booms. Growth is accompanied by the lateral expansion of the city as new districts are developed, evidencing another type of growth, namely, renewed construction activity in the vacant lots in areas that are already partially developed [Ratcliff (1979)]. Strong growth and development of the urban market takes place in such partially developed areas, whereas vacant areas or areas requiring redevelopment will not have a strong urban economy.

The characteristic of urban competition is also significant in urban economics. The competitiveness of an urban area describes its attractiveness for new businesses willing to relocate there. Wurtzebach and Miles state that businesses and households relocate where they can gain more benefits than elsewhere, which is referred to as the comparative advantage of one area over another, and often related to the accessibility of this area [Wurtzebach et al. (1994)].

The land market is characterized by four sub-criteria, namely, Development Stimulus (DS), Development Potential (DP), Development Activities (DA), and Illegal Land Use (IL).

Ratcliff (1979) showed that the construction of new roads might open areas for further land development. Since the slowly growing areas of a city may produce imperfections in the land market, an external development stimulus (DS), such as a specific city planning policy, is required to rectify these imperfections.

Land development goes through a successive process, which includes a period of uncertainty characterized by a stagnant market or even a decline in land use. However, competition occurs when different land users compete for sites within a given area, thus changing the land-use patterns [Wurtzebach et al. (1994)]. Therefore, stagnant areas will have almost no application for development despite the competition for land by different land users. If this pattern takes place, it indicates that more developers find higher development potential (DP), and consequently, more development activities (DA).

The zoning of land sets limitations on the use of land. Thus, if this zoning is inappropriate, then the land development needs may result in illegal land uses (IL). Additionally, the purpose of zoning is to direct the forces of growth into a desirable geographical pattern. Therefore, if zoning fails to conform to the basic forces of the market, it can do more harm than good [Ratcliff (1979)].

The real estate market is characterized by four sub-criteria: Market Demand (MD),

Building Plans (BP), Rental Rates (RR), and Vacancy Rates (VR).

The characteristics of the real estate market underline the importance of location, the role of supply and demand, and the impact of gestation time. However, one also needs to note the factors that influence the demand for property. Cloete (1994) identified the following factors:

- the size of the market
- the demographic and socioeconomic characteristics of the study area
- the preferences of consumers
- income and spending levels
- credit facilities
- the presence of competition
- the rentals asked
- vacancy rates
- expectations regarding price
- seasonal aspects of the property market

According to Greer et al. (1993), the following factors should be considered when conducting a demand analysis for real estate:

- location
- rental rate
- vacancy rates
- trade areas
- future trends
- competitive buildings

From the aforementioned discussions, one may infer that the following factors are important in characterizing the real estate market. First, the future trends and the demographic and socioeconomic characteristics of the study area, or the MD, which are vital because they impact the future demand for real estate in the area. Second, the BPs refer not only to existing buildings, but also to the planned construction of new buildings. It is thus advisable to obtain information on building plan approvals in the study area. Third, high RRs indicate a strong demand, whereas low rentals signify a poor one. Finally, the buildings' VR reflects the demand for real estate; for instance, high vacancy rates indicate low demand.

The infrastructure market is characterized by four sub-criteria, namely, Market Provision (MP), Traffic Demand (TD), Leakage/Inflow (LI), and Transport Costs (TC).

Since roads form networks and the high capital costs combined with their substantial sunk costs imply a scarcity factor, they are limited in supply. In addition to the roads' MP, other improvements should be implemented so that any study area (urban land) can be useful for development [Maritz (1993)]. The provision of roads may have a positive or negative impact on the urban location, which is the most variable characteristic of many properties and urban areas because movement and exposure networks are continuously subjected to change.

Road infrastructure alone cannot stimulate economic activity because of the need for other types of economic infrastructure. The scarcity factor of infrastructure also comes into play because it is essential to ensure a minimum level of traffic demand (TD) in order to support economic development in the study area. Moreover, the provision of roads should be based on the actual demand, and not theoretical demand. The demand for road infrastructure improvements is measured by the deterioration in Levels of Service (LOS) of the road network.

Given the limited supply of road infrastructure, it is necessary to ensure proper investment decision-making to reduce transport costs. The network performance addresses factors related to LI and TC, which are inter-modality and network efficiency. These factors must be analyzed to determine the improvements brought about by roads construction. It is evident that an appropriate investment based on the actual demand will optimize the road network performance because it ensures a reduction in transport costs.

6.3 The Analytical Framework

6.3.1 Background Information and Base EER

EER^B refers to natural attractiveness, or the initial investment potential of the market. The base EER of individual sub-criteria are subjectively estimated based on a rating from 1 to 5, with 1 denoting the lowest value (or noncompliance with the characteristics), and 5 denoting the highest value (or full compliance). A value of 5 thus indicates highly visible

or evident, while a value of 1 signifies the nonoccurrence or poor compliance. The values of 2, 3, and 4 indicate increased compliance with those sub-criteria. The scores for the base EER are shown in Table 6-1.

Table 6-1. Rating and Base EER

Scoring	Score	%
Very low	1	20
Low	2	40
Medium	3	60
High	4	80
Very High	5	100

To obtain the EER^B , the rating scores from 1 to 5 are automatically converted to the scale of 0 to 1 and represented by percentages as shown in the table. It should be noted again that the EER^B is defined as the potential attractiveness of the market in this thesis. It is not the efficiency of an investment, but a rudimentary gauge of investment opportunity. Therefore, while the EER^B is represented as a percentage, it is different from, for example, the return on investment (ROI) that refers to the amount of return on a particular investment, relative to the initial cost.

The Figure 6-2 is an example of the city of Yangon for Base EER^B rating. It is called spider graph. The figure, for example, shows investment in the hotel and tourism includes huge potential attractiveness, which is almost 100%. In the same way, it demonstrates that the rating for the Urban market may be large. This is because there are already important infrastructure such as International Airport, Harbor in Yangon therefore the Yangon is Finical Hub for Myanmar as precondition for Urban Development. On the other hand, the base EER for the infrastructure market in Yangon may not be necessary because some of the necessary infrastructures have been already implemented. Therefore, its rating may be 2. Other sample spider graphs for different states/regions are also available in Appendix B.

The majority of the ratings will be substantiated by evidence or supporting data. In estimating the base EER, governmental background data is available for the areas of industrial zones, types of land, numbers of permitted households, roads investment costs in the budget, basement rental rates, illegal land uses, cases of farmlands using other ways, electricity and water provision, sanitation supplement, socio-economic indicators, gross

regional domestic product (GRDP) growth rate of regions or states, traffic volumes, time savings, length of roads, and travel time from the respective departments like the Department of Highway (DOH), Department of Urban and Housing Development (DUHD), City Development Committee (CDC), and Department of Agricultural Land Management and Statistics (DOALMS) as shown in Appendix C. These types of data can be obtained from the government; thus they are the background of rating sub-criteria.

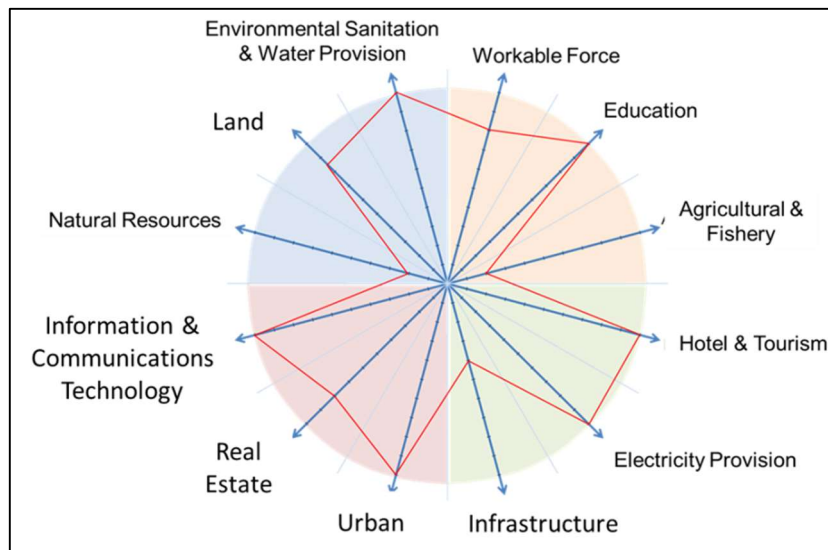


Figure 6-2. Background Information for Base EER (Yangon)

Subsequently, it is meaningful to classify the EER values based on the expectations using Figure 6-2 and other figures in Appendix B. It is contended that smaller progress is attractive, whereas high achievement is not. In terms of EERs, the rating score is associated as follows.

- $EER < 50\%$: poor base EER with possible high investment risks. Therefore, one has to carefully reconsider the investment and abandon if necessary. The rating is less than 2.
- $50\% < EER < 70\%$: average to good EER with moderate investment risks. Hence, one has to assess poor characteristics, especially those factors with low scores, before investing in this project. The rating may be 3.
- $EER > 70\%$: maximum EER is expected with lower investment risks. Thus, this project seems highly feasible. The ratings are 4 or 5.

Accordingly, the scoring system for each of the 16 sub-criteria is shown in Tables 6-2 to 6-5.

Table 6-2. The Scoring System for the Urban Economic Market

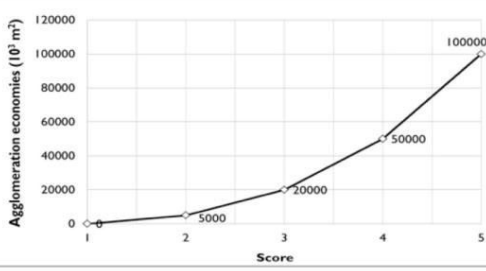
		Description	Scoring System												
Urban	BA	The attraction for business can be stimulated by assessing the type and strength of business activity in the area. Larger and more prominent businesses tend to locate in areas with a natural attraction for business. The scoring on this characteristic is based on the socio-economic data of each region or state. These socio-economic indicators depend on the presence of railway, airport, seaport, inland water way (IWT), border trade, and special economic zone (SEZ) of the study area.	No attraction for business:1 ~ High natural attraction: 5												
	AE	This relates to the occurrence of a relatively large activity such as a shopping centre or industrial plant that attracts other related or even nonrelated uses. These activities are also known as directly productive activities (DPA). Areas with no such activities have no agglomeration economies. A site inspection, as well as local knowledge of the study area, should provide sufficient information. The scoring system is based on the relative size of the agglomeration economies in terms of floor area.	 <table><caption>Data points from the Agglomeration Economies graph</caption><thead><tr><th>Score</th><th>Agglomeration economies (10⁶ m²)</th></tr></thead><tbody><tr><td>1</td><td>0</td></tr><tr><td>2</td><td>5000</td></tr><tr><td>3</td><td>20000</td></tr><tr><td>4</td><td>50000</td></tr><tr><td>5</td><td>100000</td></tr></tbody></table>	Score	Agglomeration economies (10 ⁶ m ²)	1	0	2	5000	3	20000	4	50000	5	100000
	Score	Agglomeration economies (10 ⁶ m ²)													
	1	0													
2	5000														
3	20000														
4	50000														
5	100000														
MM	An area with vacant farmland and no business activity is considered to be immature for economic activity, while a fully developed area may be fully mature, and any intervention to stimulate the economic activity may be meaningless. The maturity in the urban market may be characterised by changing economic patterns (mature for development) or stagnant areas with no economic new activity taking place (immature or fully mature). The urban market will be the product and the stages will include introduction, growth, maturity and decline (Churchill & Peter 1995:354). Both the stagnant or fully developed areas need the introduction of interventions in the urban market to stimulate new development or redevelopment.	No market activity, or market fully developed: 1 ~ Market 50% developed with high demand: 5													
ME	Market exposure fulfils a key role in the urban economic market. Remote, inaccessible areas have poor market exposure, while study areas in prominent locations characterised by the urban activity have favourable locations. According to Maritz (1993:64), the exposure network is a less tangible element of location, but poor exposure may have a profound impact on the productivity of a business enterprise. Exposure includes elements such as the land-use environment and exposure to the socioeconomic environment. The scoring of this characteristic is based on a descriptive assessment of the market exposure of the study area.	Comparative advantage of location ~ Positive market exposure													

Table 6-3. The Scoring System for the Land Development Market

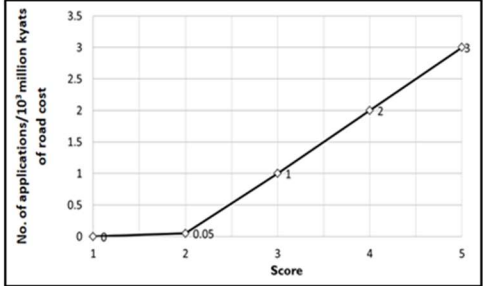
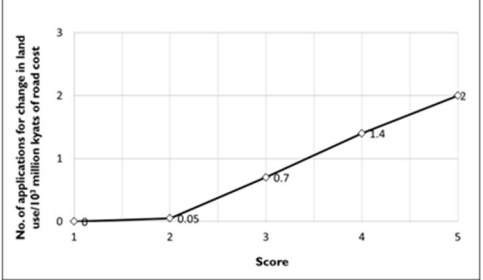
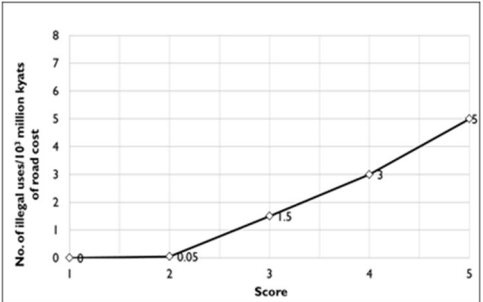
		Description	Scoring System
Land	DS	This characteristic focuses on the development potential of the area. It distinguishes between the natural occurrence of land development (free-market forces) on the one hand, and external intervention by government, on the other. Areas with natural development stimuli need no government interaction and are market driven. The scoring of this characteristic is based on the market forces or market control prevalent in the study area. If government policy is introduced to stimulate activity, then the score is 1 if no external market forces are evident. If the area has a natural stimulus for development with numerous private developers, then a scoring of 5 is appropriate.	Fast-growing area ~ Conditions of good market competition
	DP	The number of development applications reflects the potential of the land development market. Areas with no development applications have a poor land development market, while the converse is true of areas with a large number of applications. It is meaningful to obtain the number of applications for a specific time frame, say, a year, because this will make comparisons more meaningful. The scoring is based on the number of development applications per 103 million kyats invested in the roads.	
	DA	A site inspection of the area will indicate whether the area is stagnant or changes in land-use patterns are evident. These changes could be instances where agricultural holdings are being converted into businesses, or dwelling houses are being converted into home offices, etc. Stagnant areas are characterised by limited changes to the built environment such as old residential buildings or vacant farmland. The scoring of the development activity characteristic will be based on the number of applications for a change in land-use, measured against the investment cost of the roads.	
	IL	Experience has shown that areas under development pressure are usually characterised by the number of illegal use activities. This is because the market takes full advantage of good conditions, and cannot wait for the cumbersome and time-consuming procedures of local government to approve changes in land-use. Areas experiencing poor conditions have no need to conduct illegal practices. Site inspections together with information from local government will provide sufficient information. A comparison between the zoning of land and the actual land uses on site is generally made to assess the potential number of illegal uses. The scoring of illegal land-uses is also measured against the cost of the road.	

Table 6-4. The Scoring System for the Real Estate Market

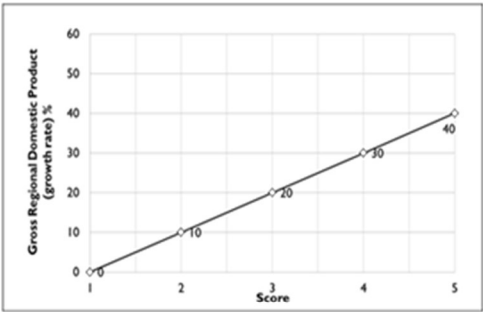
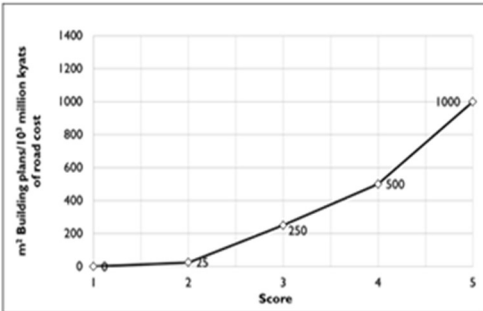
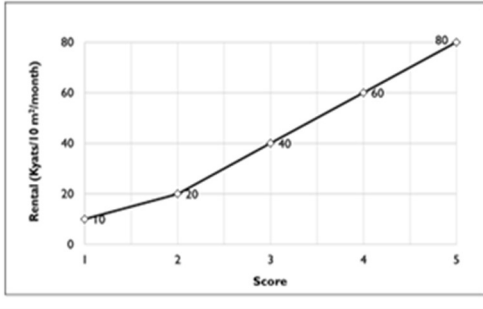
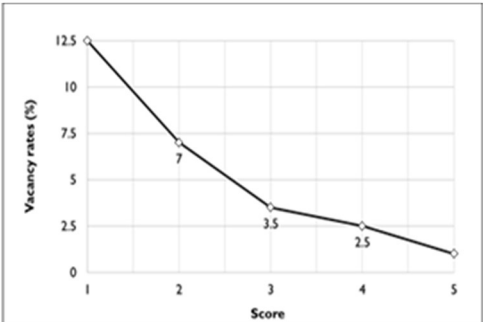
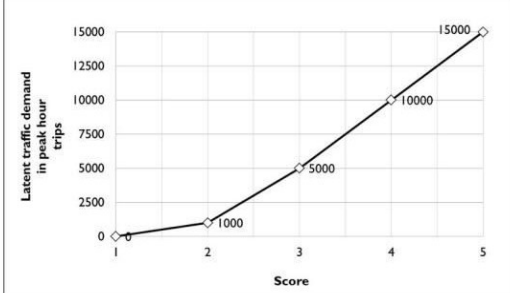
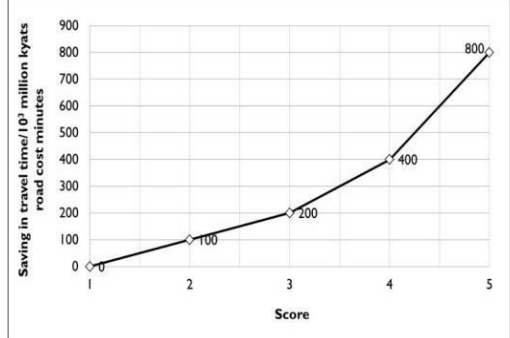
	Description	Scoring System												
Real Estate	MD The market could be calculated based on the data of gross regional domestic product (GRDP) growth rate (%) during the past 10 years of the study area. A poor real estate market will have extremely limited activity or demand. This information can be obtained from various sources, including socioeconomic projections based on future demand. Given the availability of information, for this study it was decided to use socioeconomic projections to indicate future demand.	 <table><caption>Data for MD Scoring System</caption><thead><tr><th>Score</th><th>Gross Regional Domestic Product (growth rate) %</th></tr></thead><tbody><tr><td>1</td><td>0</td></tr><tr><td>2</td><td>10</td></tr><tr><td>3</td><td>20</td></tr><tr><td>4</td><td>30</td></tr><tr><td>5</td><td>40</td></tr></tbody></table>	Score	Gross Regional Domestic Product (growth rate) %	1	0	2	10	3	20	4	30	5	40
	Score	Gross Regional Domestic Product (growth rate) %												
	1	0												
	2	10												
3	20													
4	30													
5	40													
BP Highly active real estate markets are also characterised by the number of new buildings erected or building plans submitted for approval. The local government can provide information on the number of building plans submitted for approval as well as the actual floor area proposed. The scoring of this characteristic is based on the relationship between the floor areas (m ²) of building plans submitted in one year and the cost of the road projects.	 <table><caption>Data for BP Scoring System</caption><thead><tr><th>Score</th><th>m³ Building plans/10⁷ million kyats of road cost</th></tr></thead><tbody><tr><td>1</td><td>0</td></tr><tr><td>2</td><td>25</td></tr><tr><td>3</td><td>250</td></tr><tr><td>4</td><td>500</td></tr><tr><td>5</td><td>1000</td></tr></tbody></table>	Score	m³ Building plans/10⁷ million kyats of road cost	1	0	2	25	3	250	4	500	5	1000	
Score	m³ Building plans/10⁷ million kyats of road cost													
1	0													
2	25													
3	250													
4	500													
5	1000													
RR This is another supply and demand issue. A high demand for building space usually manifests itself in high rental rates (rate/10 m ²). The converse is also true. These rates are usually compared with averages for the city per building type. There are a number of information sources available, the local department being the most useful.	 <table><caption>Data for RR Scoring System</caption><thead><tr><th>Score</th><th>Rental (Kyats/10 m²/month)</th></tr></thead><tbody><tr><td>1</td><td>10</td></tr><tr><td>2</td><td>20</td></tr><tr><td>3</td><td>40</td></tr><tr><td>4</td><td>60</td></tr><tr><td>5</td><td>80</td></tr></tbody></table>	Score	Rental (Kyats/10 m²/month)	1	10	2	20	3	40	4	60	5	80	
Score	Rental (Kyats/10 m²/month)													
1	10													
2	20													
3	40													
4	60													
5	80													
VR The demand for buildings (offices, industrial sites and commercial buildings) is reflected by the vacancy rates in the study area. A high demand for building space will usually occur in areas with extremely low vacancy rates for these commercial buildings, and vice versa. A site inspection will provide supportive information, while estate agents in the area can also provide useful information. The actual scoring of the vacancy rate of building may be difficult if no formal statistics are available. Surveys and visual observations will then be required.	 <table><caption>Data for VR Scoring System</caption><thead><tr><th>Score</th><th>Vacancy rates (%)</th></tr></thead><tbody><tr><td>1</td><td>12.5</td></tr><tr><td>2</td><td>7.5</td></tr><tr><td>3</td><td>3.5</td></tr><tr><td>4</td><td>2.5</td></tr><tr><td>5</td><td>1.25</td></tr></tbody></table>	Score	Vacancy rates (%)	1	12.5	2	7.5	3	3.5	4	2.5	5	1.25	
Score	Vacancy rates (%)													
1	12.5													
2	7.5													
3	3.5													
4	2.5													
5	1.25													

Table 6-5. The Scoring System for the Infrastructure Market

		Description	Scoring System																																								
Infra	MP	This section deals with the availability of economic infrastructure in the area. This includes roads. Total Road Length (km), area (km ²), and population of each state and region are needed to score this market. If the area has poor road conditions, then the provision of road infrastructure will do little to stimulate development in the area. This information can be obtained from local government, although a site investigation can also give one a good idea of the availability of infrastructure. The provision of road infrastructure is thus highly relevant to this characteristic.	No supporting infrastructure: 1 ~ Well-developed infrastructure: 5																																								
	TD	The traffic demand gives an indication of the need for road infrastructure in the area. Traffic demand could be calculated by using a highway that has exact data information among others of regions and states. The needed data are the length (km) and the travel time of the road. Defining LOS is done by calculating the speed of vehicles using on that road. Traffic models of the study area can provide reliable information. Transport studies may also provide invaluable information.	<p>Level of Service A: 1 ~ E&F: 5</p> <table><tr><th>Arterial Class</th><th>I</th><th>II</th><th>III</th></tr><tr><td>Range of Free-Flow Speeds (mph)</td><td>45 to 35</td><td>35 to 30</td><td>35 to 25</td></tr><tr><td>Typical Free-Flow Speed (mph)</td><td>40</td><td>33</td><td>27</td></tr></table> <table><tr><th>Level of Service</th><th colspan="3">Average Travel Speed (mph)</th></tr><tr><td>A</td><td>≥35</td><td>≥30</td><td>≥25</td></tr><tr><td>B</td><td>≥28</td><td>≥24</td><td>≥19</td></tr><tr><td>C</td><td>≥22</td><td>≥18</td><td>≥13</td></tr><tr><td>D</td><td>≥17</td><td>≥14</td><td>≥9</td></tr><tr><td>E</td><td>≥13</td><td>≥10</td><td>≥7</td></tr><tr><td>F</td><td><13</td><td><10</td><td><9</td></tr></table>	Arterial Class	I	II	III	Range of Free-Flow Speeds (mph)	45 to 35	35 to 30	35 to 25	Typical Free-Flow Speed (mph)	40	33	27	Level of Service	Average Travel Speed (mph)			A	≥35	≥30	≥25	B	≥28	≥24	≥19	C	≥22	≥18	≥13	D	≥17	≥14	≥9	E	≥13	≥10	≥7	F	<13	<10	<9
	Arterial Class	I	II	III																																							
	Range of Free-Flow Speeds (mph)	45 to 35	35 to 30	35 to 25																																							
Typical Free-Flow Speed (mph)	40	33	27																																								
Level of Service	Average Travel Speed (mph)																																										
A	≥35	≥30	≥25																																								
B	≥28	≥24	≥19																																								
C	≥22	≥18	≥13																																								
D	≥17	≥14	≥9																																								
E	≥13	≥10	≥7																																								
F	<13	<10	<9																																								
LI	Firstly, a highway that has exact data could be taken as an example and the traffic volume (AADT) was collected. And then, the number of vehicles using in peak hour were picked up from that traffic volume. After that, Highway Capacity Manual (HCM) is used to identify the highway that has collected data is one lane or two lane highway. The scoring will be based on the latent traffic demand which is directly linked to economic activity. A poor or negative traffic demand is indicative of economic leakage, while that of high latent traffic volumes of potential economic inflow.	 <table><tr><th>Score</th><th>Latent traffic demand in peak hour trips</th></tr><tr><td>1</td><td>0</td></tr><tr><td>2</td><td>1000</td></tr><tr><td>3</td><td>5000</td></tr><tr><td>4</td><td>10000</td></tr><tr><td>5</td><td>15000</td></tr></table>	Score	Latent traffic demand in peak hour trips	1	0	2	1000	3	5000	4	10000	5	15000																													
Score	Latent traffic demand in peak hour trips																																										
1	0																																										
2	1000																																										
3	5000																																										
4	10000																																										
5	15000																																										
TC	This characteristic will provide a rough estimate of whether or not the road will reduce transport costs. The scoring system is expressed in expected savings in travel time in relation to each million kyats invested in the road projects. This information is available from transport studies. Reduction in transport cost is directly proportional to time savings and inversely proportional to investment costs for the highways.	 <table><tr><th>Score</th><th>Saving in travel time/10⁶ million kyats road cost minutes</th></tr><tr><td>1</td><td>0</td></tr><tr><td>2</td><td>100</td></tr><tr><td>3</td><td>200</td></tr><tr><td>4</td><td>400</td></tr><tr><td>5</td><td>800</td></tr></table>	Score	Saving in travel time/10 ⁶ million kyats road cost minutes	1	0	2	100	3	200	4	400	5	800																													
Score	Saving in travel time/10 ⁶ million kyats road cost minutes																																										
1	0																																										
2	100																																										
3	200																																										
4	400																																										
5	800																																										

6.3.2 Pair-wise Comparisons between the Sub-criteria, for each Region

To incorporate the interrelations between the sub-criteria, the framework of AHP may be a potential method [Saaty (1980)]. It is a very flexible and powerful tool because the scores, and therefore the final ranking, are obtained based on the pairwise relative evaluations of both the criteria and the options provided by the users. The computations made by the AHP are always guided by the decision maker's experience, and thus can be considered a tool to translate the evaluations (both qualitative and quantitative) carried out by the decision maker into a multi-criteria ranking. In addition, the AHP is simple because there is no need for building a complex expert system with the decision maker's knowledge embedded in it.

The weights are calculated using pairwise comparisons between the sub-criteria. In addition, AHP is an effective tool for dealing with complex decision-making, as it may aid the decision maker in determining priorities and make the best decisions. It incorporates a useful technique for checking the consistency of the decision maker's evaluations, thus reducing the bias in the decision-making process. Using pairwise comparisons, AHP helps to capture both subjective and objective aspects of the decision maker's inputs. The analytical case studies will be shown in the following.

To compute the weights for the different criteria, the AHP starts creating a pairwise comparison matrix **A**. The matrix **A** is an $m \times m$ real matrix, where m is the number of evaluation criteria considered. Each entry a_{jk} of the matrix **A** represents the importance of the j th criterion relative to the k th criterion. If $a_{jk} > 1$, then the j th criterion is more important than the k th criterion; while if $a_{jk} < 1$, then the j th criterion is less important than the k th criterion. If two criteria have the same importance, then the entry a_{jk} is 1. The entries a_{jk} and a_{kj} satisfy the following constraint:

$$a_{jk} \cdot a_{kj} = 1. \quad (\text{Equation 6.1})$$

In this paper, the value of a_{jk} could be any number between 1 and 5. Evidently, $a_{jj} = 1$ for all j . The relative importance between two criteria is measured according to a numerical scale from, for example, 1 to 5, as shown in Table 6-6, where it is assumed that the j th criterion is equal to or more important than the k th criterion. The

phrases in the “Interpretation” column of Table 6-9 are only suggestive, and may be used to translate the decision maker’s qualitative evaluations of the relative importance between two criteria into numbers. It is also possible to assign intermediate values that do not correspond to a precise interpretation, with the values in the matrix **A** being by construction pairwise consistent. Nevertheless, the ratings may in general show slight inconsistencies. However, these do not cause serious difficulties for the AHP.

Table 6-6. Relative Scores

Value of a_{jk}	Interpretation
1	j and k are equally important
2	j is slightly more important than k
3	j is more important than k
4	j is strongly more important than k
5	j is absolutely more important than k

Once the matrix **A** is built, it is possible to derive from it the normalized pairwise comparison matrix **A**_{norm} by making the sum of the entries on each column equal to 1, that is, each entry \bar{a}_{jk} of the matrix **A**_{norm} is computed as:

$$\bar{a}_{jk} = \frac{a_{jk}}{\sum_{l=1}^m a_{lk}}. \quad (\text{Equation 6.2})$$

When many pairwise comparisons are performed, some inconsistencies may typically arise. For example, assuming that three criteria are considered, and the decision maker evaluates that the first criterion is slightly more important than the second criterion, while the second criterion is slightly more important than the third criterion.

An evident inconsistency arises if the decision maker mistakenly evaluates the third criterion as being equal to or more important than the first criterion. However, a slight inconsistency arises if the decision maker assesses that the first criterion is also slightly more important than the third criterion. A consistent evaluation would be, for instance, that the first criterion is more important than the third criterion.

The AHP incorporates an effective technique for checking the consistency of the evaluations made by the decision maker when building each of the pairwise comparison matrices involved in the process, namely, the matrix **A** and the matrices **B**^(j).

The technique depends on the computation of a suitable consistency index, which will be described only for the matrix A. It is straightforward to apply it in the case of the matrices $B^{(j)}$ by replacing A with $B^{(j)}$, w with $s^{(j)}$, and m with n. The consistency index (CI) is obtained by initially computing the scalar x as the average of the elements of the vector whose jth element is the ratio of the jth element of the vector A.w to the corresponding element of the vector w. Thus:

$$CI = \frac{x-m}{m-1}. \quad (\text{Equation 6.3})$$

The analysis must check the CI and the Consistency Ratio (CR), which must be less than 10%. If so, the inconsistencies are tolerable, and a reliable A (perfectly consistent decision maker) should always obtain $CI=0$. Small inconsistency values may be tolerated.

$$\frac{CI}{RI} < 0.1. \quad (\text{Equation 6.4})$$

In equation 6.4, RI is the Random Index, that is, the consistency index when the entries of A are completely random. The values of RI for small problems ($m \leq 10$) are shown in Table 6-7.

Table 6-7. Values of the Random Index (RI) for Small Problems

m	2	3	4	5	6	7	8	9	10
RI	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.51

6.4 Example Analysis

Within the analytical framework in this thesis, there are five stages of calculating EERs. In the analytical process, there are two pairwise comparisons. The first includes comparing the sub-criteria for states/regions, individually, while the second considers the states/regions comparisons for each market.

Stage 1: At the beginning, the base EERs are estimated for all the sub-criteria for each region based on Tables 6-2 to 6-5. These EERs are denoted as EER^B .

Stage 2: This is the first pairwise comparison between the 16 sub-criteria for the 15 states/regions, individually. Therefore, there are 15 matrix tables; each consists of 16x16 rows and columns as shown by equation 6-1. The relative importance is measured on a numerical scale from 1 to 5 as shown in Table 6-6. Accordingly, the relative weights of the sub-criteria are calculated using Equation 6-2, and are termed “Regional Weights,” hereafter. These weights are denoted as W^R .

Stage 3: Based on Stage 2, the EERs of the 16 sub-criteria are computed for the states/regions, individually. These EERs are termed “Regional EER,” and denoted as EER^R . Thus, based on the base EER in Table 6-9 and the weights of the sub-criteria, the next step is to adjust the base EER to the weights. Therefore:

$$EER^R = EER^B \times W^R \quad (\text{Equation 6-5})$$

Stage 4: This is the second pairwise comparison of the 15 states/regions for the four markets of urban, land, real estate, and infrastructure. Therefore, there are four matrix tables, each consists of 15x15 rows and columns as shown by equation 6-1. The relative importance is measured according to a numerical scale from 1 to 5 as shown in Table 6-6. Accordingly, the relative weights of the sub-criteria are calculated by equation 6-2. These relative weights are readjusted to the maximum weight in a market. Consequently, the readjusted weights are termed “Market Weight,” and calculated by W^M and computed as $W^M = w_i / \max(w)$, where w_i denotes the relative weight of the i^{th} state/region, and $\max(w)$ is the maximum weight among the states/regions in the market.

Stage 5: Finally, based on the Stage 2, the EERs of the 15 states/regions are computed for each of the four markets, with adjustments being made on the EER^R . These EERs are termed “Market EER,” and denoted as EER^M . Thus:

$$EER^M = EER^R \times W^M \quad (\text{Equation 6-6})$$

6.4.1 Base EER:EER^B

The rating for the sub-criteria depends on the background information in Figure 6-2. The supporting information and data are given in Appendices B and C. For example, the rating for Mandalay is obtained as shown in Table 6-8. Similarly, the rating for the other states/regions is carried out.

Table 6-8. Rating Examples

(Mandalay)			
The Urban Economic Market (U)			
BA	AE	MM	ME
3	4	4	5
The Land Development Market (L)			
DS	DP	DA	IL
4	5	5	2
The Real Estate Market (R)			
MD	BP	RR	VR
2	5	5	5
The Infrastructure Market (I)			
MP	TD	LI	TC
2	3	2	2

Accordingly, all the EER^B can be obtained as shown in Table 6-9, with the analysis of EERs starting with a 16 by 15 matrix table as a base.

Table 6-9. EER^B for States/Regions (%)

State/Region	Urban Economy (U)				Land (L)				Real Estate (R)				Infrastructure (I)			
	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
Kachin	80	20	20	20	20	100	40	20	20	80	20	20	20	40	20	20
Sagaing	80	40	60	80	40	100	20	20	40	100	100	40	40	20	20	20
Mandalay	60	80	80	100	80	100	100	40	40	100	100	100	40	60	40	40
Chin	20	20	60	20	20	100	20	20	20	40	40	40	80	80	20	20
Magwe	60	40	60	60	40	100	80	100	40	60	40	100	40	40	20	60
Shan	60	20	80	60	40	60	80	80	40	100	100	40	80	40	20	40
Rakhine	60	20	60	60	20	40	40	100	20	40	100	20	40	40	40	40
Naypyitaw	40	20	60	40	40	20	20	20	20	20	60	40	60	80	40	20
Kayah	40	40	60	40	20	100	60	20	20	100	80	60	60	20	20	80
Bago	20	60	60	40	20	20	100	20	40	20	80	100	40	60	20	40
Yangon	100	100	100	100	80	100	60	100	60	60	100	100	60	40	20	40
Ayeyarwaddy	80	60	60	100	40	20	20	20	40	20	40	40	40	40	40	20
Mon	60	20	60	80	80	40	60	20	20	100	100	60	40	40	40	60
Kayin	40	40	40	60	20	20	20	20	20	20	100	60	60	40	20	20
Tanintharyi	100	80	60	80	60	100	60	20	40	80	60	40	40	20	40	100

6.4.2 Pair-wise Comparisons between Sub-criteria for States/Regions: W^R

The second stage consists of the pairwise comparisons to judge which sub-criterion has more importance or higher priority in an individual state/region using the AHP method. The final outputs of the comparisons are the regional weights that are used to adjust the Base EER^Bs.

Table 6-10 demonstrates the pairwise comparisons in Yangon. The higher the number, the more importance the criterion has compared to others. For example, when looking at BA and DA, It indicates that the decision maker evaluates BA to be relatively more important than DA. Similarly, when comparing MM and BA, MM is much more important than BA and DA. The priority vector in the table represents the regional weights, with their sum being adjusted to be 1. Similar tables are made for all the 15 states/regions and are shown in the appendices. The comparisons are made for each state and region; thus, there are 15 tables in total as shown in Appendix D.

Table 6-10. Calculation of Regional Weights: W^R

(Yangon)

Criteria	Urban				Land				Real Estate				Infra				Geometric Average	Priority Vector
	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC		
BA	1.00	0.50	0.50	0.50	1.80	0.50	1.60	0.50	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	0.909	0.0541
AE	2.00	1.00	0.50	0.50	1.80	0.50	1.60	0.50	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	0.991	0.0590
MM	2.00	2.00	1.00	0.50	1.80	0.50	1.60	0.50	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	1.081	0.0643
ME	2.00	2.00	2.00	1.00	1.80	0.50	1.60	0.50	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	1.179	0.0701
DS	0.56	0.56	0.56	0.56	1.00	0.44	1.75	0.44	1.75	1.75	0.44	0.44	1.75	1.50	1.25	1.50	0.865	0.0515
DP	2.00	2.00	2.00	2.00	2.25	1.00	1.60	0.50	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	1.303	0.0775
DA	0.63	0.63	0.63	0.63	0.57	0.63	1.00	0.38	0.50	0.50	0.38	0.38	0.50	1.67	1.33	1.67	0.661	0.0393
IL	2.00	2.00	2.00	2.00	2.25	2.00	2.67	1.00	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	1.467	0.0873
MD	0.63	0.63	0.63	0.63	0.57	0.63	2.00	0.63	1.00	0.50	0.38	0.38	0.50	1.67	1.33	1.67	0.744	0.0443
BP	0.63	0.63	0.63	0.63	0.57	0.63	2.00	0.63	2.00	1.00	0.38	0.38	0.50	1.67	1.33	1.67	0.812	0.0483
RR	2.00	2.00	2.00	2.00	2.25	2.00	2.67	2.00	2.67	2.67	1.00	0.50	1.60	1.40	1.20	1.40	1.706	0.1015
VR	2.00	2.00	2.00	2.00	2.25	2.00	2.67	2.00	2.67	2.67	2.00	1.00	1.60	1.40	1.20	1.40	1.860	0.1107
MP	0.63	0.63	0.63	0.63	0.57	0.63	2.00	0.63	2.00	2.00	0.63	0.63	1.00	1.67	1.33	1.67	0.943	0.0561
TD	0.71	0.71	0.71	0.71	0.67	0.71	0.60	0.71	0.60	0.60	0.71	0.71	0.60	1.00	1.50	0.50	0.712	0.0424
LI	0.83	0.83	0.83	0.83	0.80	0.83	0.75	0.83	0.75	0.75	0.83	0.83	0.75	0.67	1.00	0.33	0.763	0.0454
TC	0.71	0.71	0.71	0.71	0.67	0.71	0.60	0.71	0.60	0.60	0.71	0.71	0.60	2.00	3.00	1.00	0.811	0.0483
(sum)																	16.808	1.000

Note: The priority vector denotes W^R , the Regional Weights

In the above table, the geometric average is first calculated for each row. For example, for the first row of BA, the value is 0.909 ($= 1.00 \times 0.50 \times 0.50 \times 0.50 \times 1.80 \times 0.50 \times 1.60 \times 0.50 \times 1.60 \times 1.60 \times 0.50 \times 0.50 \times 1.60 \times 1.40 \times 1.20 \times 1.40$)^{1/16}), and the same calculations are repeated for the other 15 States/Regions.

Next, after calculating that the sum of the geometric average as 16.808, this number is used to adjust each geometric average for the priority vector. For example, the priority vector for BA is 0.0541(= 0.909 / 16.808).

The aforementioned calculation is repeated for all the sub-criteria for each region, with Table 6-11 showing a summary of the calculated regional weights. Since not all sub-criteria have the same priority in all states/regions, the calculated weights are different for the sub-criteria in each state/region. It is also clear that the sum of each row is 1.

Table 6-11. Summary of Regional Weights: W^R

State/Region	Urban				Land				Real Estate				Infra				sum
	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC	
Kachin	0.0624	0.0252	0.0275	0.0300	0.0327	0.1079	0.0750	0.0411	0.0449	0.1212	0.0534	0.0582	0.0635	0.1061	0.0723	0.0788	1.00
Sagaing	0.0597	0.0374	0.0578	0.0692	0.0437	0.0820	0.0283	0.0308	0.0550	0.1158	0.1262	0.0672	0.0733	0.0468	0.0511	0.0557	1.00
Mandalay	0.0386	0.0488	0.0532	0.0654	0.0588	0.0723	0.0789	0.0308	0.0336	0.0965	0.1052	0.1147	0.0435	0.0581	0.0486	0.0530	1.00
Chin	0.0203	0.0221	0.0660	0.0258	0.0282	0.1061	0.0340	0.0370	0.0404	0.0678	0.0739	0.0806	0.1307	0.1425	0.0596	0.0650	1.00
Magwe	0.0468	0.0269	0.0523	0.0571	0.0308	0.0892	0.0806	0.0987	0.0393	0.0711	0.0440	0.1246	0.0508	0.0554	0.0399	0.0925	1.00
Shan	0.0448	0.0168	0.0641	0.0533	0.0312	0.0596	0.0757	0.0825	0.0380	0.1100	0.1199	0.0465	0.1009	0.0529	0.0433	0.0603	1.00
Rakhine	0.0607	0.0200	0.0709	0.0773	0.0250	0.0403	0.0439	0.1066	0.0328	0.0529	0.1361	0.0414	0.0638	0.0696	0.0759	0.0828	1.00
Naypyitaw	0.0421	0.0212	0.0678	0.0536	0.0536	0.0270	0.0295	0.0322	0.0351	0.0383	0.1096	0.0745	0.1226	0.1564	0.0798	0.0569	1.00
Kayah	0.0332	0.0362	0.0476	0.0405	0.0208	0.1039	0.0589	0.0268	0.0292	0.1203	0.0975	0.0774	0.0844	0.0441	0.0481	0.1311	1.00
Bago	0.0181	0.0552	0.0602	0.0400	0.0236	0.0257	0.1021	0.0310	0.0526	0.0353	0.1131	0.1463	0.0662	0.1012	0.0520	0.0773	1.00
Yangon	0.0541	0.0590	0.0643	0.0701	0.0515	0.0775	0.0393	0.0873	0.0443	0.0483	0.1015	0.1107	0.0561	0.0424	0.0454	0.0483	1.00
Ayeyarwaddy	0.0771	0.0703	0.0767	0.0874	0.0463	0.0302	0.0329	0.0359	0.0575	0.0409	0.0655	0.0714	0.0779	0.0850	0.0865	0.0585	1.00
Mon	0.0440	0.0173	0.0514	0.0737	0.0804	0.0348	0.0596	0.0269	0.0294	0.1193	0.1301	0.0794	0.0489	0.0533	0.0581	0.0935	1.00
Kayin	0.0451	0.0491	0.0536	0.0657	0.0254	0.0277	0.0302	0.0329	0.0359	0.0392	0.1570	0.1117	0.1218	0.0866	0.0566	0.0617	1.00
Tanintharyi	0.0736	0.0600	0.0443	0.0666	0.0492	0.0879	0.0549	0.0279	0.0374	0.0777	0.0720	0.0467	0.0476	0.0405	0.0542	0.1594	1.00

6.4.3 Regional Expected Economic Return: EER^R

The third stage is the calculation of the regional EER^R , which is the sum of base EER^B and regional weights W^R . Note that the regional EER^R s do not consider the interactions among states/regions. Therefore, the numbers represent the independent and absolute attractiveness of the market in each region. Additionally, they may be used for market identification to prioritize which market has more potential for each state/regional decision maker independently. In this sense, the regional EER^R may be interpreted as a regional index for comparing the investment attractiveness or priority within a state/region. Table 6-12 shows the calculations for Yangon, with the same calculations being repeated for all the states/regions as shown in Appendix E. Accordingly, Table 6-13 summarizes the adjusted EER similar to Table 6-12.

Table 6-12. Calculations of Regional Expected Return: EER^R

(Yangon)

Region/State		Urban				Land				Real Estate				Infra			
Yangon		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
	(1)	0.0541	0.0590	0.0643	0.0701	0.0515	0.0775	0.0393	0.0873	0.0443	0.0483	0.1015	0.1107	0.0561	0.0424	0.0454	0.0483
	(2)	0.247				0.256				0.305				0.192			
	(3)	0.22	0.24	0.26	0.28	0.20	0.30	0.15	0.34	0.15	0.16	0.33	0.36	0.29	0.22	0.24	0.25
	(4)	100	100	100	100	80	100	60	100	60	60	100	100	60	40	20	40
	(5)	100.00				89.82				87.85				41.12			
	(6)	24.75				22.96				26.77				7.90			
	(7)	82.38															

(1) W^R of the sub-criteria as shown in Table 6-11.

(2) The sum of W^R for each market. For example, 0.247 of urban (= 0.0541+0.0590+0.0643+0.0701)

(3) The adjusted weight in the market. For example, 0.22 of urban (= 0.0541 / 0.247).

(4) EER^B of the sub-criteria from Table 6-9

(5) EER^B of markets on (4). For example, 89.82 of land (= 0.2*80 + 0.3*100 + 0.15*60 + 0.34*100).

(6) EER^R of each market adjusted by (2). For example, 26.77 of real estate (= 0.305*87.85). The number is also calculated as 26.77 (= 0.0443*60 + 0.0483*60 + 0.1015*100 + 0.1107*100).

(7) Total EER^R for Yangon, 82.38 (= 24.75 + 22.96 + 26.77 + 7.90)

Table 6-13. Summary of Regional Expected Economic Return: EER^R (%)

State/Region	Urban	Land	Real Estate	Infra	Sum
Kachin	6.65	15.26	12.83	8.53	43.27
Sagaing	15.28	11.13	29.09	6.01	61.50
Mandalay	17.02	21.06	32.98	9.29	80.35
Chin	5.32	12.59	9.70	24.35	51.96
Magwe	10.45	26.47	20.05	10.60	67.57
Shan	11.35	17.48	26.37	13.47	68.68
Rakhine	12.93	14.52	17.21	11.69	56.35
Naypyitaw	8.32	3.92	11.02	24.19	47.45
Kayah	7.25	14.88	25.06	17.40	64.59
Bago	8.89	11.82	26.48	12.86	60.05
Yangon	24.75	22.96	26.77	7.90	82.38
Ayeyarwaddy	23.73	3.83	8.60	11.14	47.30
Mon	11.96	11.93	30.30	12.02	66.21
Kayin	9.85	2.32	23.90	13.14	49.21
Tanintharyi	20.15	15.60	13.90	20.82	70.47

Table 6-13 shows the summary of the regional EER^R. Note again, the numbers do not include the interactions among states/regions. In other words, the EERs do not consider the interrelations between states/regions (i.e., the pairwise comparisons are made independent from individual states/regions). Therefore, although the total EER of 66.21 for Mon is almost the same as the 64.59 for Kayah, it does not necessarily mean the two states have the same level of attractiveness because their importance may be different. Thus, another pairwise comparison becomes necessary as shown in the following.

6.4.4 Pair-wise Comparisons among States/Regions for Markets: W^M

Since the regional EER^Rs are the index for local government, there is a need for a different index from the central government perspective. Using the Regional EER^Rs, each local government can determine which market is more important; however, for example, 50% of attractiveness in one region is not equal to 50% in another region. From the central government viewpoint, it is necessary to prioritize the order of states/regions; thus, another pairwise market-by-market comparison is necessary, namely, market weights W^M.

Table 6-14. Calculation of Market Weight: W^M

(Infra)

State/Region	Kachin	Sagaing	Mandalay	Chin	Magwe	Shan	Rakhine	Naypyitaw	Kayah	Bago	Yangon	Ayeyarwaddy	Mon	Kayin	Tanintharyi	Geometric Average	Priority Vector	Relative Weight
Kachin	1.00	0.50	0.36	0.33	0.38	0.36	0.38	0.33	0.36	0.38	0.38	0.42	0.36	0.42	0.33	0.4017	0.0241	0.386
Sagaing	2.00	1.00	0.36	0.33	0.38	0.36	0.38	0.33	0.36	0.38	0.38	0.42	0.36	0.42	0.33	0.4406	0.0265	0.423
Mandalay	2.80	2.80	1.00	0.47	1.89	0.50	1.89	0.47	0.50	1.89	1.89	1.78	0.50	1.78	0.47	1.1002	0.0661	1.057
Chin	3.00	3.00	2.11	1.00	1.80	1.90	1.80	0.50	1.90	1.80	1.80	1.70	1.90	1.70	0.50	1.5837	0.0951	1.522
Magwe	2.60	2.60	0.53	0.56	1.00	0.47	0.50	0.44	0.47	0.50	0.50	1.88	0.47	1.88	0.44	0.7650	0.0459	0.735
Shan	2.80	2.80	2.00	0.53	2.13	1.00	1.89	0.47	0.50	1.89	1.89	1.78	0.50	1.78	0.47	1.2248	0.0736	1.177
Rakhine	2.60	2.60	0.53	0.56	2.00	0.53	1.00	0.44	0.47	0.50	0.50	1.88	0.47	1.88	0.44	0.8457	0.0508	0.813
Naypyitaw	3.00	3.00	2.11	2.00	2.25	2.11	2.25	1.00	1.90	1.80	1.80	1.70	1.90	1.70	0.50	1.8021	0.1082	1.731
Kayah	2.80	2.80	2.00	0.53	2.13	2.00	2.13	0.53	1.00	1.89	1.89	1.78	0.50	1.78	0.47	1.3636	0.0819	1.310
Bago	2.60	2.60	0.53	0.56	2.00	0.53	2.00	0.56	0.53	1.00	0.50	1.88	0.47	1.88	0.44	0.9489	0.0570	0.912
Yangon	2.60	2.60	0.53	0.56	2.00	0.53	2.00	0.56	0.53	2.00	1.00	1.88	0.47	1.88	0.44	1.0408	0.0625	1.000
Ayeyarwaddy	2.40	2.40	0.56	0.59	0.53	0.56	0.53	0.59	0.56	0.53	0.53	1.00	0.44	0.50	0.41	0.6722	0.0404	0.646
Mon	2.80	2.80	2.00	0.53	2.13	2.00	2.13	0.53	2.00	2.13	2.13	2.29	1.00	1.78	0.47	1.5450	0.0928	1.484
Kayin	2.40	2.40	0.56	0.59	0.53	0.56	0.53	0.59	0.56	0.53	0.53	2.00	0.56	1.00	0.41	0.7497	0.0450	0.720
Tanintharyi	3.00	3.00	2.11	2.00	2.25	2.11	2.25	2.00	2.11	2.25	2.25	2.43	2.11	2.43	1.00	2.1656	0.1301	2.081
(sum)																16.6496	1	

Note: The priority vector denotes W^M, the Market Weights

Table 6-14 shows an example for infrastructure, with the comparison matrix having the size of 15 matrix tables. The comparison is made for each market, and thus,

there are four tables in total as shown in Appendix F. These pairwise comparisons are made as the infrastructure of Yangon has larger potential than other regions such as Kachin. Although Yangon is more important than regions like Kachin, its importance is less than that of some other regions. Thereby, the comparison is made for all the four markets. In the analysis, Yangon is taken to be the base or 1 with all the priority vectors being adjusted to it.

In this table, the geometric average and priority vector are calculated similarly as in Table 6-10; however, one more adjustment is made for the relative weight. The values are the relative numbers against the maximum priority vector. In the above table, the priority vector is 0.0625 for Yangon. Thus, for example, by using it, the relative weight for Kachin is 0.386 ($= 0.0241 / 0.0625$), with the relative weight for Yangon being 1.000 by definition. Table 6-15 shows the relative weights for each market by region, as calculated in Appendix F.

Table 6-15. Summary of Market Weights: W^M

State/Region	Urban	Land	Real Estate	Infra
Kachin	0.1810	0.3246	0.2094	0.3860
Sagaing	0.4917	0.3561	0.6243	0.4233
Mandalay	0.5838	0.6354	0.8752	1.0571
Chin	0.1730	0.2787	0.2552	1.5216
Magwe	0.4032	0.7298	0.5070	0.7350
Shan	0.4423	0.6218	0.7340	1.1769
Rakhine	0.3703	0.4408	0.3837	0.8126
Naypyitaw	0.2504	0.2597	0.3090	1.7315
Kayah	0.2827	0.5063	0.6563	1.3102
Bago	0.3101	0.3515	0.5968	0.9117
Yangon	1.0000	1.0000	1.0000	1.0000
Ayeyarwaddy	0.6944	0.3339	0.3869	0.6459
Mon	0.5441	0.6116	0.9316	1.4844
Kayin	0.3761	0.3081	0.4886	0.7204
Tanintharyi	0.9231	0.7558	0.5377	2.0808

6.4.5 Market Expected Economic Return: EER^M

Finally, at Stage 5, The market EER^M s are obtained. However, in the same calculation as the regional EER^R s, EER^M s are the sum of regional EER^R and Market Weights W^M . Evidently, the Market EER^M s arise from the interrelations among states/regions.

In this sense, the numbers are relative among states/regions, as they are used to identify which state/region has higher priority compared to others, market by market. Therefore, the Market EER^M s are interpreted as the national index that is used by the decision makers in the central government.

From Tables 6-13 and 6-15, the adjusted EER for Kachin can be calculated, 1.20 ($= 6.65 \times 0.1810$). Similarly, all other EERs can be computed as shown in Table 6-16. Finally, the EERs in the tables can be used to compare the attractiveness of each market among states/regions.

Table 6-16. Summary of Market Expected Economic Return: EER^M

State/Region	Urban	Land	Real	Infra	Total
Kachin	1.20	4.96	2.69	3.29	12.14
Sagain	7.51	3.96	18.16	2.54	32.17
Mandalay	9.93	13.38	28.87	9.82	62.00
Chin	0.92	3.51	2.48	37.05	43.95
Magwe	4.21	19.32	10.17	7.79	41.49
Shan	5.02	10.87	19.36	15.85	51.10
Rakhine	4.79	6.40	6.60	9.50	27.29
Naypyitaw	2.08	1.02	3.41	41.89	48.40
Kayah	2.05	7.53	16.45	22.79	48.82
Bago	2.76	4.16	15.80	11.72	34.44
Yangon	24.75	22.96	26.77	7.90	82.38
Ayeyarwaddy	16.48	1.28	3.33	7.20	28.28
Mon	6.51	7.30	28.23	17.84	59.87
Kayin	3.71	0.72	11.68	9.46	25.56
Tanintharyi	18.60	11.79	7.47	43.33	81.19

6.5 The outputs

6.5.1 Comparisons of EER^B and EER^R

Graphical demonstrations, which are useful tools to visualize the relationships between calculated values, prove that the formula of road infrastructure investment and economic development is meaningful in practice.

EER^B is not an inter-relative value, as it only shows the attractiveness of the economic return for states and regions. In others words, it demonstrates the initial economic condition of a region so that policy makers can understand its general economic condition. On the other hand, EER^R is obtained by adjusting the weights of pairwise comparisons between states and regions. Hence, it shows the economic return for each state and region in accordance with their economic and demographic conditions. The EER^R calculation is based on regional conditions; it does not consider the comparisons among other states and regions.

Figures 6-3 presents the correlation between EER^B and EER^R overall. EER^B and EER^R are proportional to each other, or highly correlated. For example, both the EER^B and EER^R of Yangon (YGN) are almost the same, approximately 80%. Similarly, those of Kachin (KCHIN) are around 40%.

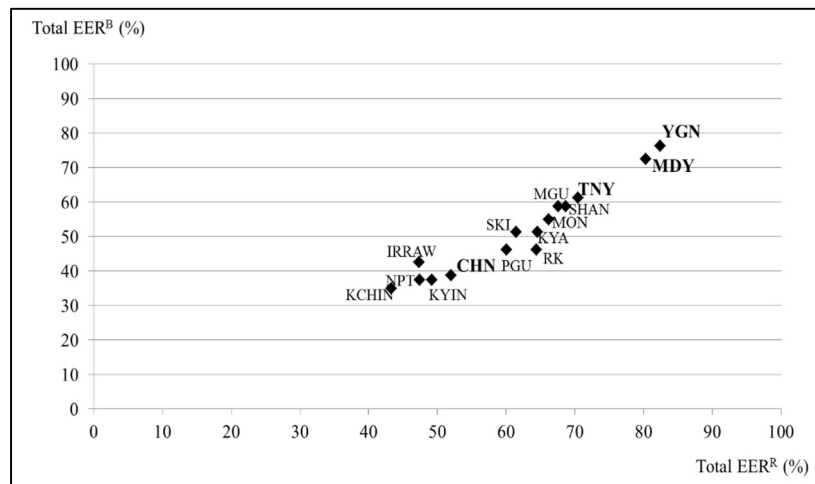


Figure 6-3. Total EER^B and EER^R

Where,

YGN = Yangon Region

MDY = Mandalay Region

TNY = Tanintharyi Region

MGU = Magwe Region
 SKI = Sagaing Region
 PGU = Bago Region
 IRRRAW = Ayeyarwaddy Region
 NPT = Naypyitaw Region
 SHAN = Shan State
 MON = Mon State
 KYA = Kayah State
 RK = Rakhine State
 CHN = Chin State
 KYIN = Kayin State
 KCHIN = Kachin State

The above figure shows the plots between the total base EER^B and the total regional EER^R , showing the underlying potential of investment, with YGN having the largest attractiveness potential and KCHIN being the least attractive according to the regional analysis. One assumption to explain the low underlying investment attractiveness of KCHIN is its location at the border with China, thus receiving significant Chinese investment. Therefore, the inherent attractiveness becomes low from Myanmar's perspective.

However, these numbers have to be scrutinized more in detail. For example, the EER^R of YGN is higher than its EER^B . In general, all the EER^R s of all regions and states are higher than the EER^B s. Since the EER^R is calculated as a weighted sum of the importance of the sub-criteria that comprise the four markets, the more attractive markets are highly weighted than the less attractive ones. Additionally, if there are some regions in which the EER^R is EER^B , the policy maker may need to find the reasons. In other words, if the difference between EER^B and EER^R is larger in some states or regions, the high EER^B may be less weighted.

Therefore, the EER^R shall be used when policy makers need to determine investment priorities in individual states and regions, independently. For example, if there are five investment projects in one region and the EER^R of each project is used as decision criteria for prioritization, it becomes more important to scrutinize the EER^B - EER^R relationship, market by market. The breakdown is shown in Figures 6-4 to 6-7.

Additionally, it should also be noted that, for example, the figure presents that YGN is mostly attractive if investment is equally made among all the states and

regions. However, this is not always true because the calculation of EER^R is obtained using the pairwise comparisons between the sub-criteria within each state and region, independently. This problem is tackled using the EER^M as discussed later.

Figure 6-4 shows the relation between EER^B and EER^R for the urban economy. In this figure, YGN has the highest urban market EER^R of 24.75%, while IRRAW is 23.73%. However, the EER^R reduction EER^B in IRRAW is larger than that of YGN. Therefore, the investment in some of the other markets has more importance in IRRAW. That is, the urban economic development may be more critical compared to the other markets within YGN. Similarly, the EER^R in TNY is 20.15%. By comparing this with YGN and IRRAW, the relative importance of urban economy may have less priority compared to the other markets within TNY.

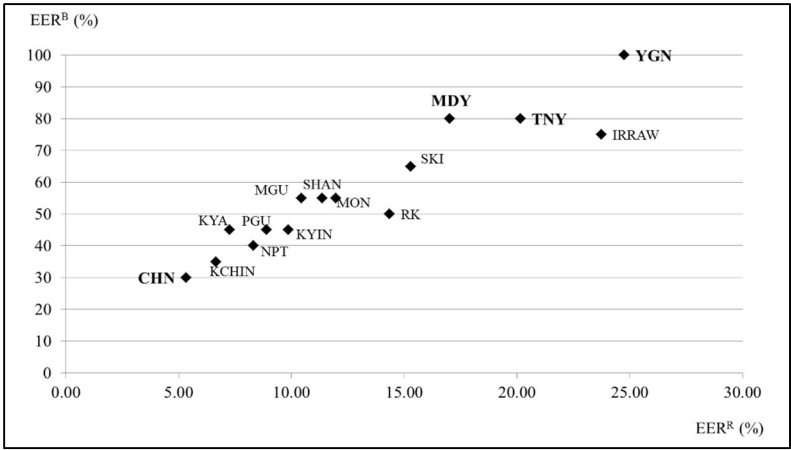


Figure 6-4. EER^B and EER^R for Urban Economy

In general, the higher initial (base) EER^B will give higher expected regional EER^R in the urban economy market, with the attractiveness of EER^B dominating the expected outcome of regional EER^R in urban economics. The regions which have $EER^B > 50\%$ and $EER^R > 15\%$ are YGN, IRRAW, TNY, and MDY, and therefore, can get more potential development in urban economics when attracting some investments.

Figures 6-5 to 6-7 present the same results for the other markets as shown in Figure 6-4. From Figure 6-5, the regions which have $EER^B > 50\%$ and $EER^R > 15\%$ are YGN, MGU, MDY, and SHAN, and thus, can get more return on investment in the land development market. Similarly, from Figure 6-6, real estate is more important within

MDY, while it has less priority in IRRAW. From Figure 6-7, the infrastructure development in YGN and SKI are the least important within each region.

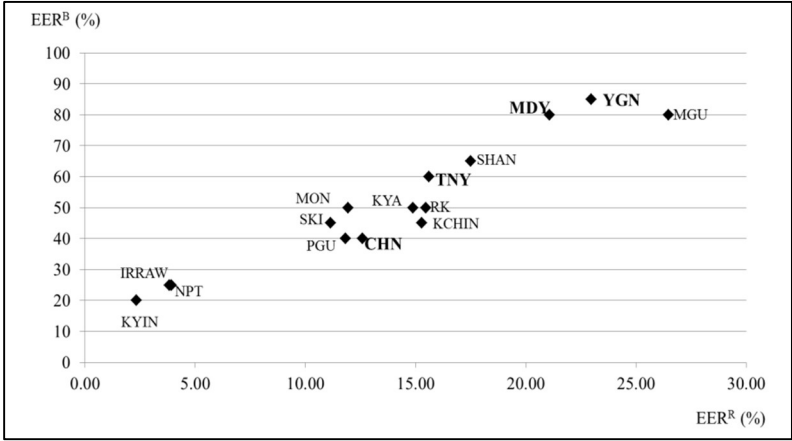


Figure 6-5. EER^B and EER^R for Land Development

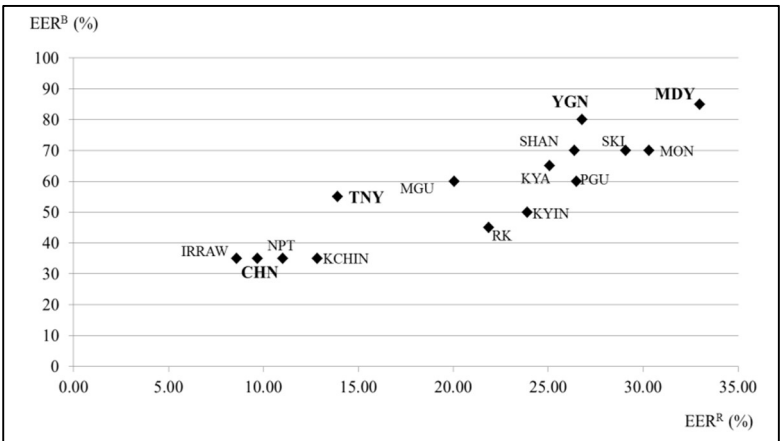


Figure 6-6. EER^B and EER^R for Real Estate

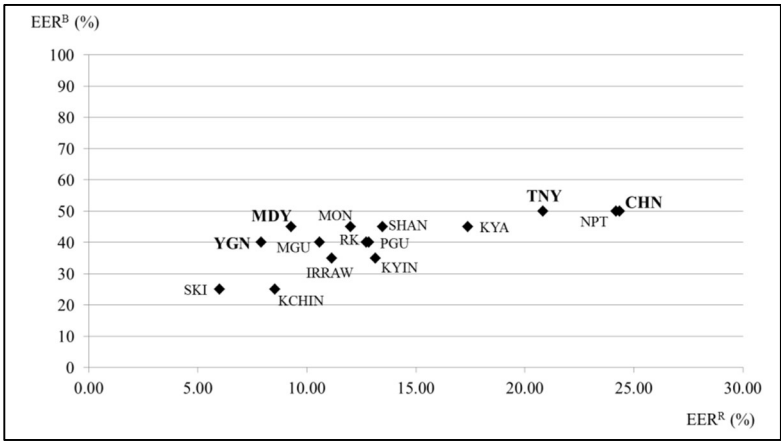


Figure 6-7. EER^B and EER^R for Infrastructure

From Figure 6-7, the base EER^B s are relatively equal for all the states/regions. However, after the pairwise comparisons among the sub-criteria are made, different degrees of importance can be observed, indicating that the base EER^B may not be an appropriate index when the interactions between the markets are considered.

In general, while the base EER^B of the four markets are equally high, when considering the relative importance of the markets, the attractiveness of infrastructure becomes much smaller than that of urban, land, and real estate. A similar observation is also made for MDY. These are the biggest two cities, with the infrastructure investment being less important in these cities. Next, by observing CHN, the base EER^B is almost the same; however, the absolute order of its infrastructure development is much higher. Thereby, from this figure, we have different perspectives of investment priority that cannot be obtained by the base EER^B .

6.5.2 Comparisons of EER^B and EER^M

EER^M s are the values of national economic return among states and regions in Myanmar, which are calculated from the market-weighted values among these states and regions so that it represents national values. Therefore, policy makers shall use these EER^M s values as criteria when determining priority if the investment projects are situated in all states and regions.

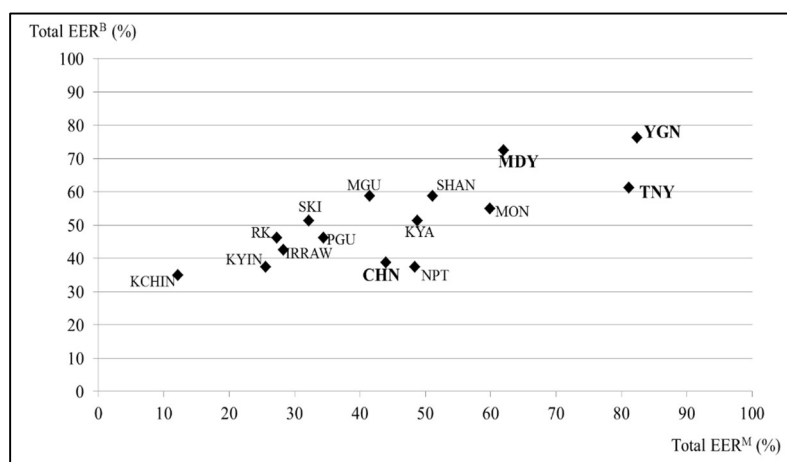


Figure 6-8. Total EER^B and EER^M

Figure 6-8 represents the relations between the total value attractiveness EER^B and the national values EER^M of all states and regions. It shows that the two EERs are directly related to each other, namely, the values of attractiveness of EER^B reflect the national values of EER^M s of each state and region. As seen in the figure, with regard to attractiveness, KCHIN is the smallest from the central government perspective, whereas YGN and TNY are the most significant in the whole country.

Figures 6-9 to 6-12 show the relations between the initial (base) attractiveness of EER^B and EER^M with regard to each market. Figure 6-9 shows the relation between EER^B and EER^M of each states and regions in terms of urban economy. The values of EER^M s are relative values among the 15 states and regions, indicating that these EER^M reflect the national EERs of investment between all states and regions. In this comparison, YGN has the highest EER^M of 24.75% with also a high attractiveness EER^B of 100%, while the TNY and IRRRAW regions are favorable with higher EER^M as higher EER^B . The others states and regions have low EER^M with respect to their attractiveness base, EER^B .

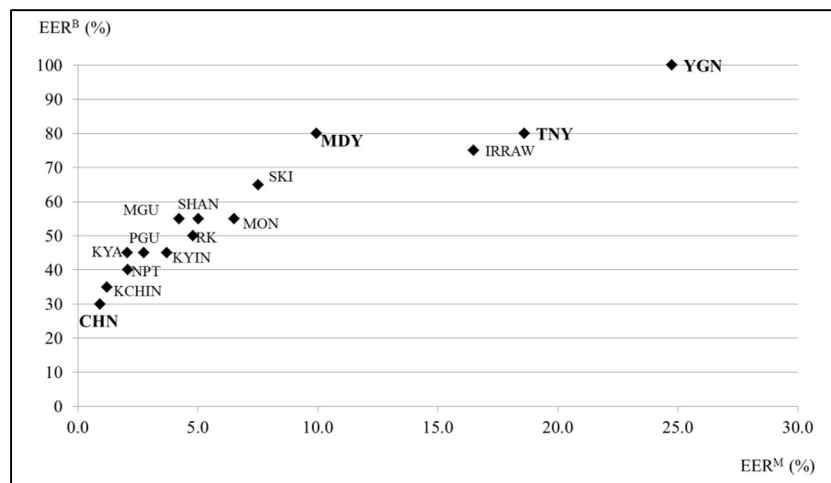


Figure 6-9. EER^B and EER^M for Urban Economy

Figure 6-10 shows the relation between the EER^B and EER^M of each state and region with regard to the land development market. The attractiveness EER^B of the YGN and MGU regions dominate the EER^M , indicating that the attractiveness of these regions can be used as decision-making criteria. The MDY region has the same attractiveness value

as the MGU region, but with low EER^M , while the other regions have low EER^M with respect to their EER^B .

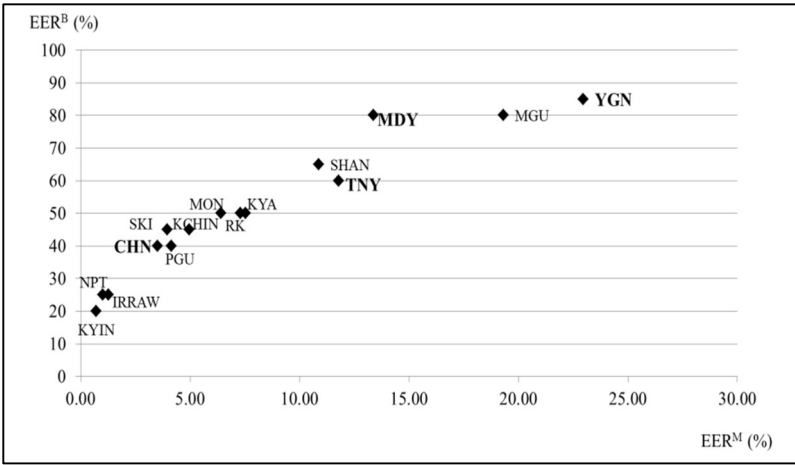


Figure 6-10. EER^B and EER^M for Land Development

Figure 6-11 presents the EER^B and EER^M for states and regions with regard to the real estate market, with the higher attractiveness of EER^B reflecting a higher EER^M . MDY, MON, and YGN have nearly the same EER^B , but only YGN has a lower EER^M than MON and MDY, since its real estate market has less potential for future development (i.e., the market has already matured). However, other states and regions are in the first stages of the life cycle, thus having a considerable potential.

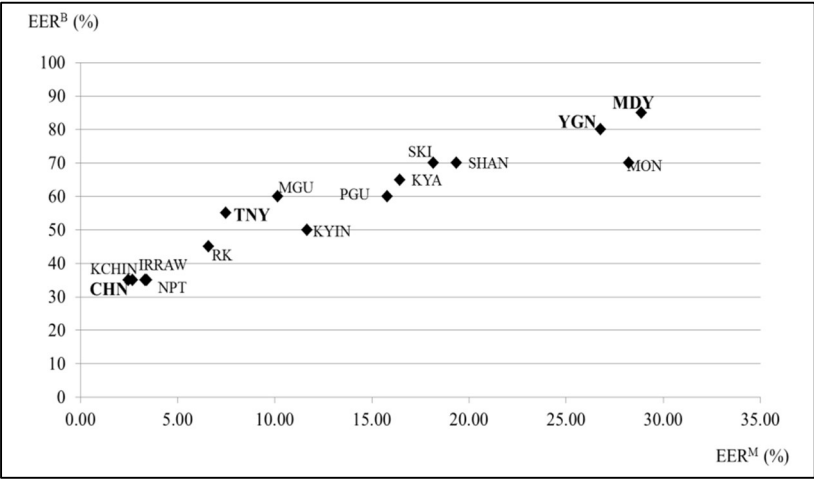


Figure 6-11. EER^B and EER^M for Real Estate

Figure 6-12 presents the relation between EER^B and EER^M of all states and regions with respect to the infrastructure market. The attractiveness EER^B s of all states and regions are low; however, TNY, NPT, and CHN have higher EER^M s, indicating that the infrastructure investments are more preferable in these regions than the other regions.

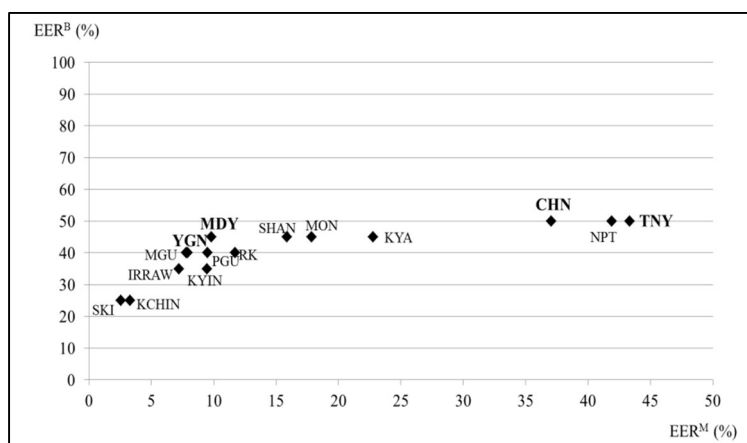


Figure 6-12. EER^B and EER^M for Infrastructure

In the previous Figure 6-7, the absolute importance of CHN is larger than that of TNY; however, its relative importance of infrastructure is higher than that of CHN in Figure 6-12. This is the central government observation after making the pairwise comparisons among states/regions, market by market, which is very beneficial to decision makers for budget allocation to local governments. Therefore, the market EER^M is the index for the harmonious development of a country as a whole, whereas the regional EER^R is a local government issue, since its budget is allocated by local governments, not the central government.

6.5.3 Comparisons of EER^R and EER^M

Regional EER^R is the economic return of each region within itself, while the national EER^M is the economic return of each region among all states and regions. Figure 6-13 shows the comparison of regional economic return EER^R and national economic return EER^M among all states and regions. From this figure, the author notes that most regions have high EER^R values in their regions, but with lower national values of EER^M when compared to all states and regions, with the exception of the YGN region that has the same values of EER regionally and nationally. Therefore, the

YGN region has the highest potential return on investment both regionally and nationally, with other potential regions being MDY and TNY because they have the same values regionally and nationally.

Generally, the regional EER^R values for all states and regions are higher than the national EER^M values, indicating the existence of more opportunities within regions, but lesser opportunities among the states and regions because of the related and weighted values of socioeconomic and demographic data of all states and regions. This figure shows the regions with both high EER^R and EER^M .

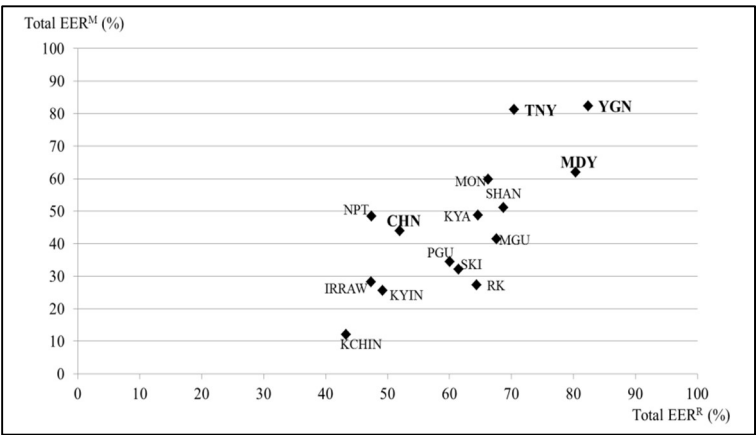


Figure 6-13. Total EER^R and EER^M

Figure 6-14 shows the relation between regional EER^R and national EER^M of states and regions with respect to the urban economy market, with the YGN, TNY, and IRRAW regions having the same EER^R and EER^M . This means that the YGN, TNY, and IRRAW regions have the same economic return values in terms of the regional urban economy when compared to all states and regions. However, the MDY region has different conditions with high value of urban economy within its region, but a low national value when compared to all states and regions. The other regions have lower national values than their respective regional values.

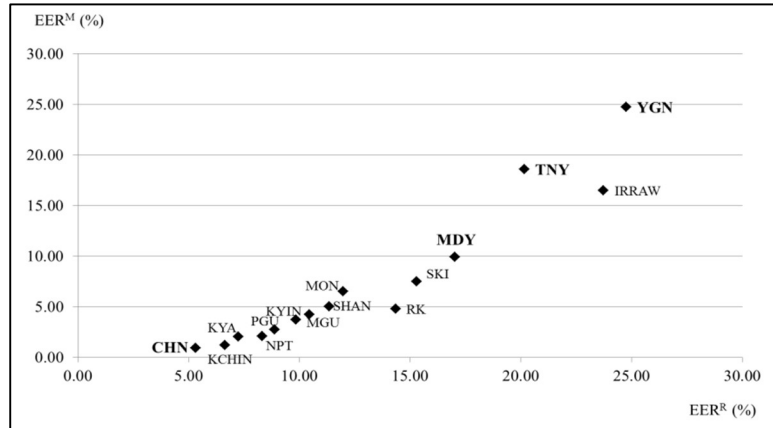


Figure 6-14. EER^R and EER^M for Urban Economy

Figure 6-15 shows that the regional values of EER^R are lower than the national values of EER^M, except for the YGN and MGU regions, which have nearly the same values of both EER^M and EER^R.

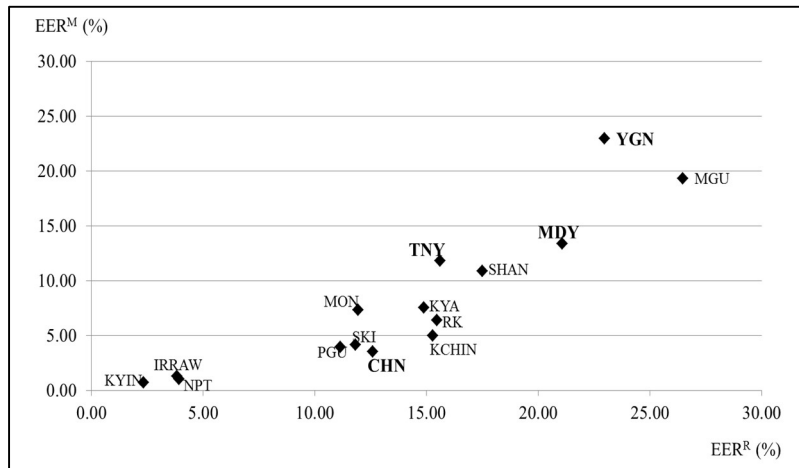


Figure 6-15. EER^R and EER^M for Land Development

Figure 6-16 demonstrates the regional values of EER^R and the national values of EER^M for all states and regions with respect to the real estate market. Most regions have higher regional values than their respective national values, except for the MDY, MON, and YGN regions, which have the same values. In particular, the MDY, YGN, MON, SHAN, and SKI regions have high opportunities regionally and nationally, indicating a high competitiveness in the real estate market. Therefore, policy makers can decide upon the investment in real estate in these regions.

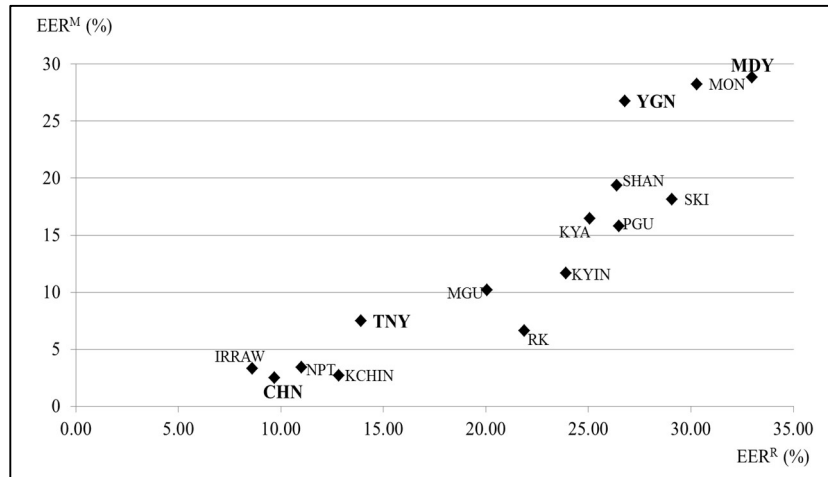


Figure 6-16. EER^R and EER^M for Real Estate

Figure 6-17 presents the values of EER^R and EER^M for all states and regions with regard to the infrastructure market. All the regional values of EER^R are higher than their related values of EER^M , except for TNY and NPT, which have the same values. From this figure, policy makers can recognize that the rate of return on investment differs regionally and nationally; thus, it would be significantly beneficial for policy makers, if Myanmar transitioned to federalism.

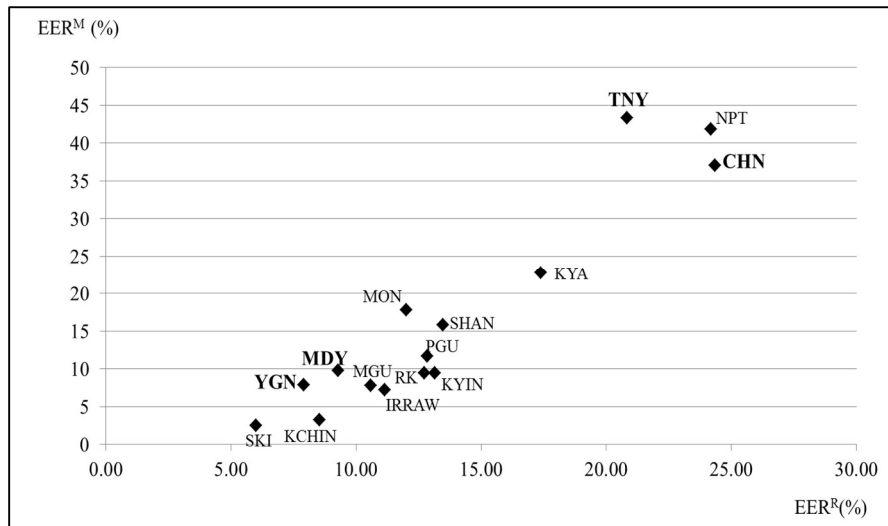


Figure 6-17. EER^R and EER^M for Infrastructure

6.6 An Application Example of Output

6.6.1 EER^M and Budget

In terms of the EER^M value, YGN has the greatest value, then TNY in the second place, with the MDY region, MON state, SHAN state, KYA state, and NPT region, ranking third, fourth, fifth, sixth, seventh, respectively. Figure 6-18 shows the national values of EER^M for all states and regions. It also shows which state/region has the biggest value and which one has the smallest.

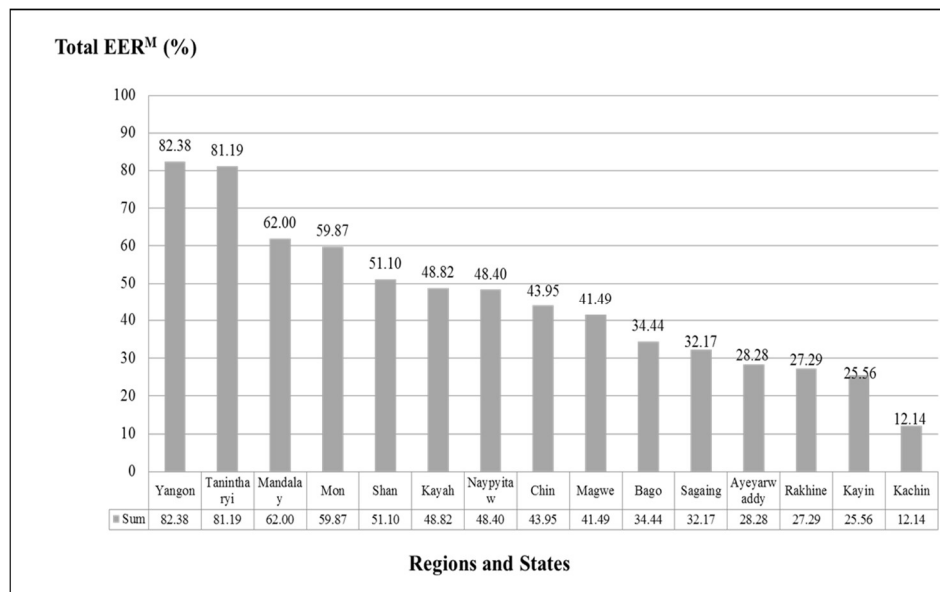


Figure 6-18. Expected Economic Returns (EER^M) for Regions/States

Figure 6-19 presents the relation between 10 years road infrastructure investment and EER^M, with YGN, TNY, MDY, and MON being able to achieve high EER^M with less investment in road infrastructure, indicating that they are first potential regions for investment. Additionally, KYA, KYIN, and NPT are second potential regions for investment because they can get low EER^M with less investment; therefore, policy makers need to maximize the EER^M by leveraging the market. For example, MON and MDY regions have values of 28.23 and 28.87 values in the real estate market, respectively; thus, the investment in real estate will trigger other markets development. Moreover, the other states and regions are third potential regions that can get low EER with high investment; therefore, the policy makers need to use the potential market as a trigger for development of these regions. For example, the MGU region can use the

land development market as the trigger because of the market value of 19.32, while the CHN state also uses the infrastructure market as the development trigger with a market value of 37.05.

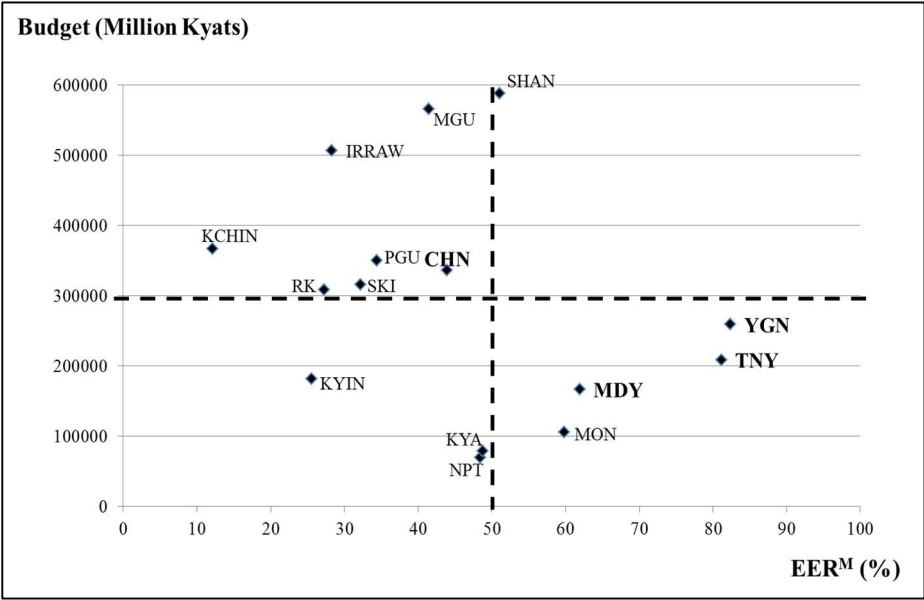


Figure 6-19. EER Achievement in terms of Budget

Therefore, the budgets allocated to YGN, and TNY from the central government were relatively low. However, more budgets need to be allocated to these regions because their potential is very high compared to others. YGN is the capital, while TNY is located in lower Myanmar along the Andaman Sea. The results indicate that decision makers can find huge opportunities in TNY, which is 250 kilometers to the east of Bangkok with a big harbor connecting it to the east-west economic corridor planned by the Asian Development Bank (ADB). However, why did the central government allocate more budgets to KCHIN and SHAN? A political motive is probably the best explanation, since KCHIN is located at the border with China, and if the government does not allocate sufficient budget, it may lose the control over this region to of China. Similarly, SHAN is also located at the borders of China and Thailand. Therefore, the budget allocation may have been important for these states due to political reasons. While it is not addressed in this thesis, it is possible to clarify some of the common political assumptions.

6.6.2 Comparison of the EER^M and Gross Regional Domestic Product (GRDP) Growth Rate

The calculated EER^M results can be used only by the policy makers or the government for investments. For example, the CHN state has a high value of EER^M in the infrastructure market, while the MON state has a higher value than the YGN region in the real estate market. Therefore, private investors could not get robust EER, if they were to invest in these regions. If private investors want to invest in individual states or regions, the following comparisons should be used.

Table 6-17. Values of the EER^M and GRDP Growth Rate

State/Region	Total EER ^M	GRDP Growth Rate (%)
Kachin	12.1	1.95
Sagaing	32.2	10.89
Mandalay	62.0	10.4
Chin	44.0	0.33
Magwe	41.5	9.17
Shan	51.1	6.48
Rakhine	27.3	3.63
Naypyitaw	48.4	1.84
Kayah	48.8	0.21
Bago	34.4	7.96
Yangon	82.4	22.72
Ayeyarwaddy	28.3	12.49
Mon	59.9	4.04
Kayin	25.6	1.73
Tanintharyi	81.2	6.16

In Figure 6-20, the upper-right group shows a continuous investment potential; while the lower-right regions indicate a bright future, although their past performance was not significant. However, the lower-left states/regions might be a concern from a harmonious development perspective.

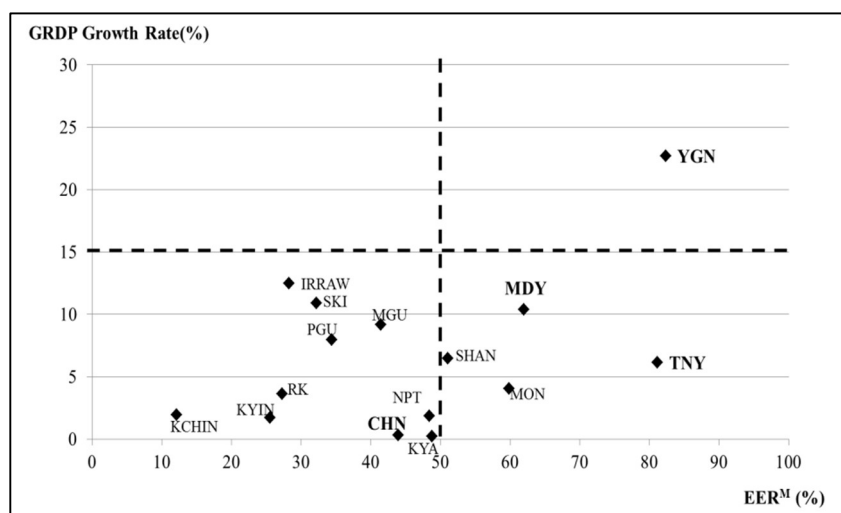


Figure 6-20. EER^M and GRDP Growth Rate

According to the figure, YGN has the highest value in terms of both GRDP and EER^M, thus being the best region to invest in among the 15 states/regions for private investors. MDY should be chosen as the second region for private investors, with TNY region, MON state, and SHAN state being in the third place because of their great potential for the future, since they have good EER^M and despite their low GRDP. More consideration would be required, if private investors were to invest in the KCHIN, KYIN, RK, and CHN states, as they have low value in terms of GRDP and EER^M.

The growth rate has been very small in CHN. Similarly, KCHIN, KYIN, and RK also have little impact on Myanmar's GDP. In the case of KCHIN, it is located near to China, so Chinese investors come into it and invest in calibration, banana planting, sugar cane planting, and so on, while the KYIN state is near to Thailand. However, RK is slightly different from the aforementioned two regions. At present, RK has the biggest problem in Myanmar, which is the Bengali problem. Approximately 700,000 people run away to Bangladesh; thus, both the Rakhine's GDP growth rate and EER^M value are low. Although the IRRRAW, SKI, and PGU regions are good for investment, since their GRDPs are high, the best one among the four markets should be chosen, since their EER^M values are low.

Probably, at this point, this perspective may not change drastically; however, the central government may need to find other socioeconomic benefits for them. While it is not the scope of this thesis, the priorities could be natural resources, forestry, fishery,

agriculture, etc., that are the responsibilities of other ministries. In this regard, the analytical framework of this thesis can also be applied by other ministries and agencies.

6.6.3 Comparison of EER^M and Unemployment rate

Table 6-18 and Figure 6-21 shows comparisons of the unemployment rates in respective states/regions and their EER^M values, with the unemployment rate being almost the same between about 2%-6 %; however, YGN, MDY, TNY, and MON have bigger EER^M values. For KCHIN, KYIN, IRRRAW, and SKI, these regions have smaller EER^M values. RK has the highest unemployment rate in addition to the KYIN state. However, the unemployment rate is almost the same in KCHIN, IRRRAW, SKI region, MGU, NPT, MDY, and YGN, accounting for about 2%-4%.

As seen in YGN, its unemployment rate is low, whereas its expected market EER^M is the highest indicating that the unemployment may be alleviated in the future because of the high expectation. However, it also necessitates suitable investment in the four markets by the central government.

Table 6-18. Values of the EER^M and Unemployment rate

State/Region	Total EER ^M	Unemployment rate (%)
Kachin	12.1	3.7
Sagaing	32.2	3.6
Mandalay	62.0	3.1
Chin	44.0	5.4
Magwe	41.5	3.3
Shan	51.1	2
Rakhine	27.3	10.4
Naypyitaw	48.4	2.9
Kayah	48.8	2.7
Bago	34.4	5.1
Yangon	82.4	4.1
Ayeyarwaddy	28.3	3.4
Mon	59.9	6.2
Kayin	25.6	7.5
Tanintharyi	81.2	4.6

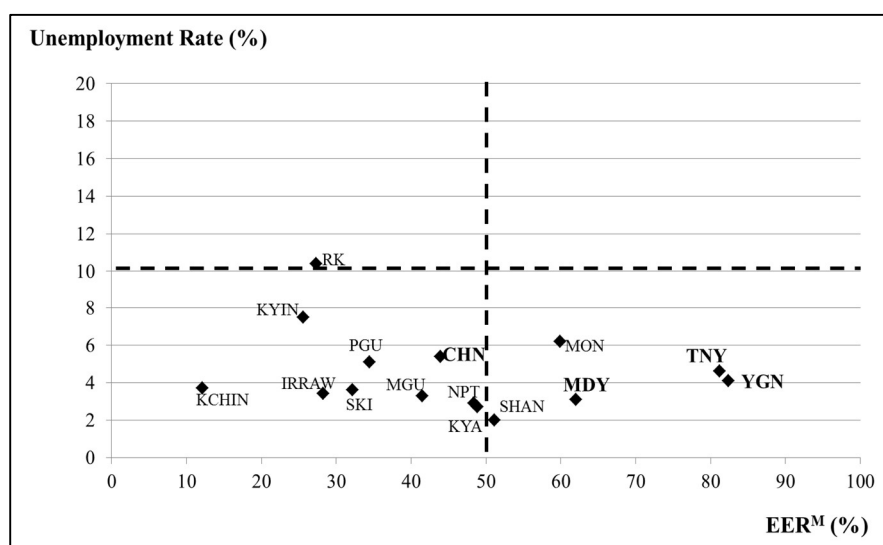


Figure 6-21. EER^M and Unemployment rate

6.7 Findings

The main findings can be summarized as follows. In the analysis of the economic effects of road infrastructure investment, the following four findings can be drawn:

- **Finding 1.** The urban economy market has a crucial role in the relation between road infrastructure investment and economic development.
- **Finding 2.** The land development market also plays a key role in the relation between road infrastructure investment and economic development, since the land development pressure of an area controls the requirement of road infrastructure.
- **Finding 3.** Based on the importance of the real estate market, its defined factors are the market demand, building plans, new buildings, rental rates, and the vacancy rate of buildings.
- **Finding 4.** An actual demand should be based on the provision of road infrastructure, thus having a greater probability of meaningful economic activities and stimulation.
- **Finding 5.** The regional values of EER^R can be used when the investment projects, that undergoes the decision-making process, are in the same region.
- **Finding 6.** The national values of EER^M can be used when the investment projects, that undergoes the decision-making process, are in all regions.

From these findings, it is clear that the following four markets have an important role in deciding the relationship between road infrastructure investment and economic development:

- the urban economy market
- the land development market
- the real estate market
- the infrastructure development market

6.8 Conclusion

This chapter develops an appropriate formula for evaluating road investment that is applicable as an early and cost-effective method to prioritize road infrastructure projects in terms of their economic potential. Additionally, different road infrastructure projects can be depicted graphically to assist with the comparisons and ranking processes.

This thesis starts with the motivation of harmonious development in Myanmar and concludes with measurable, visible, and practical outputs. The analytical framework can be also be shared with other ministries such as the Ministry of Electricity and Energy and other decision makers. Therefore, this research makes a significant contribution to government investment decision-making.

It was shown that the demand for development as well as the potential for maximum expected returns could be evaluated using the formula of road infrastructure investment and economic development introduced in this chapter. This formula is an excellent tool for evaluating road infrastructure investment decisions at an early stage of the process. The provision of road infrastructure should be based on actual demand; hence, there must be an actual market for such infrastructure. This will ensure a higher probability of meaningful economic activities and stimulation.

In conclusion, YGN has the highest scores in terms of the attractiveness (base) value EER^B , regional value EER^R , and national value EER^M , thus having the highest priority ranking among other states and regions. After studying the four markets of the YGN region, the urban economy market is the first one that is mainly supporting the EER, with the second being the land development market, the third being the real estate

market, and the last being the infrastructure market.

The economic return of the YGN region in terms of the national value of EER^M is 82.38%. The percentages of criteria for the four markets are as follows: urban economic market (24.75%), land market (22.96%), real estate market (26.77%), and infrastructure market (7.9%).

The four sub-criteria of the urban economic market are BA, AE, MM, and ME. The percentages of all these four sub-criteria are 100%, thus indicating the robustness of the YGN urban economic market. The sub-criteria of the real estate market are MD (60%), BP (60%), RR (100%), and VR (100%). Thus, if the decision maker wants to increase the real estate market of the YGN region, the values of MD and BP should be increased initially, with the value of MD increasing according to the percentage of GRDP. Regarding the other component, since BP is the ratio of the floor area of permitted households and the road investment cost of the region, if the permitted household's floor area is increased and the road investment cost is decreased, the BP value (%) will increase.

When considering the land market, the percentage of the land market is 85%, with its sub-criteria being DS (80%), DP (100%), DA (60%), and IL (100%). Thus, DS and DP should be improved, if the decision maker wants a better land market's value.

The last market is the infrastructure market, with its sub-criteria being MP (60%), TD (40%), LI (20%), and TC (40%). The infrastructure market has the least percentage among the markets of YGN. Therefore, to get better infrastructure market, all of the sub-criteria, namely, MP, TD, LI, and TC should be developed more than the other markets.

Among the 15 states and regions, the YGN region has the best expected returns followed by the TNY region, then the MDY region in the third place. After this, the MON state, the SHAN state, and the MGU region stand in their respective places, with the KCHIN State having the least expected returns. Therefore, to develop their expected returns, the four criteria should be improved and the sub-criteria of these markets should be invested in efficiently.

In conclusion, first, the quantitative analysis facilitates the consistency of the decision maker's evaluation that was done on personal base previously, thus reducing the

bias in the decision-making process. It also enhances the information sharing among the stakeholders such as politicians, government officials, the private sector, and so on.

Technically, the investment attractiveness, or priority of the four markets, namely, urban, land, real Estate, and infrastructure is quantitatively analyzed from both the local and central governments' perspectives.

Second, it provides the logic for decision makers to “maximize” their use of investment in Myanmar. In other words, the analytical framework offers the rationale for decisions such as budget allocation, with the outcome leading to better coordination between the local and central governments with regard to their roles and responsibilities.

Third, the market EER^Ms, combined with macro and micro indexes such as budget, GRDP, and unemployment rate, provide a better understanding of the current situation and the future possibilities.

CHAPTER 7

SUMMARY AND CONCLUSIONS

7.1 Thesis Summary

This paper focuses on socio-economic development in Myanmar, and presents an analytical framework for evaluating socio-economic benefits of public–private partnerships (PPPs) as a means of infrastructure procurement. The concept of PPP comes into existence when the private sector participates in the financing, construction, operation, and maintenance of infrastructure under certain concessions provided by the public. It is a business procurement method that aims to improve the public services as it reduces the government's financial burden by incorporating the private sector's knowhow.

The purpose of this paper is to analyze the effectiveness of investment in four areas (infrastructure, land, real estate, and urban economy) by PPP as the socio-economic benefit index, which is referred to as “EER” in this thesis. Accordingly, the four investment areas are also termed as “government markets.” In the analytical framework, the four government markets have four further sub-criteria each (4x4). Then, based on pairwise comparison of the 16 components, EERs of the government markets are calculated for each of the 15 provinces and regional governments in Myanmar, both independently and interactively. This is the major contribution of this thesis.

This research considered a framework that utilizes the huge data that the Myanmar government has, including those related to not only economic indicators but also individual infrastructures. Such data has been effectively utilized within the MOC, but only as reference. However, within the analytical framework of this research, such data should be used and shared more effectively among stakeholders as information sources. This is a derivative property of this research, but it nevertheless adds value to this paper.

Analytic hierarchy process (AHP) is used as a basic framework for this study. AHP structures any considerable problems (construction of hierarchical structure), correlates the examination of proposed elements (paired comparison), quantifies these elements (calculation of weights), and evaluates further alternatives (total evaluation)

within the entire system. In other words, it is a mathematical quantification method, which includes calculating integrated evaluation values. In decisions regarding infrastructure investment, it is often based on subjective human judgment; however, the subjectiveness of this paper is based on large data and experiences in government agencies, which are incorporated using mathematical tools. In this sense, it can be concluded that the above study is a form of applied research conducted to prove an academic theory.

This thesis consists of seven chapters. Chapter 1 introduces the research, and Chapter 2 provides a background of the thesis. PPP definitions, scheme, and practices are included in Chapter 3. Chapter 4 discusses PPP implementation in different countries. The three PPP projects carried out in Myanmar are presented in Chapter 5. The analytical framework to determine socio-economic value of Myanmar is expressed in Chapter 6, and Chapter 7 provides a summary and conclusions.

Chapter 1 shows the history of PPP in Myanmar, the current economic conditions, and the requirement of PPP for infrastructure development in Myanmar. Myanmar transitioned from a military government to an elected government in 2011. Subsequently, the government has embarked aggressively on a series of economic, political, and social reforms that have resulted in unparalleled development and economic growth. While much has been achieved (over a limited period), stakeholders have recognized the need to enhance and upgrade Myanmar's public infrastructure, which they believe to be the basis for sustained development and growth. However, substantial participation from the private sector is required to achieve this goal, because the private sector is in a better position to provide funding, knowhow, and expertise in the development, management, and operation of Myanmar's public infrastructure. The government may, therefore, look to PPPs as an effective tool for mobilizing private sector investment in a way that aligns with the government's development goals.

Infrastructure is considered the "life-support" and has long been under the control of government. Inadequate infrastructure has been a problem for most countries, and the problem is exacerbated by a lack of funds in the public sector. Further, government monopoly over infrastructure is seen as a cause of low efficiency in the development and operation of infrastructure facilities. A public-private partnership (PPP), as an innovative alternative for project delivery, has been widely implemented in

many countries during the past two decades, attempting to resolve the problems, the most significant, worldwide trend in the public sector, and good governance is an important factor for the success of PPP projects in terms of developing sound economic policy and administrating projects.

Chapter 2 discusses the major motivations behind proposing PPP and its requirement in Myanmar. The first motivation is the country's budget problem. It is essentially the budget shortage to be used in government investment. Myanmar is a developing country, and it is difficult to meet the capital demands for social and infrastructure development with the government's limited budget. For large-scale development of infrastructure in Myanmar, large sums of investment are required in many sectors, particularly in transportation, power generation, special economic zones, and resource development. as well as other supporting demands within a short period of time, Privatization is one method of increasing funding. This requires rapid GFCF increments, which will be a major challenge for Myanmar.

Second, this chapter discusses the PPP needs in the national infrastructure development plan. This section reveals the master plan of infrastructure development. By considering only road/highway and bridges, the MOC assumes a total of 26784 billion kyat (or 22.32 billion USD) of infrastructure investment by the government during 2016–2030, consisting of 3804 billion kyat for bridges and 22980 billion kyat for road/highways. In this way, the efficient implementation of PPP may be inevitable because the national budget cannot cover the necessary funds, and the government also does not wish to shoulder an excessive burden of loans from international lenders such as the World Bank, ADB, or JICA.

Third, Myanmar's unique social conditions make for a major motivation. Myanmar is a country of unions, consisting of 135 ethnic groups, with seven major groups of Burma. Each ethnic group has different social values. This means that socio-economic values are diversified, and it is not enough to consider only the economic values in social development. PPP is a model based on the financial feasibility of private sector; however, when implementing PPP, the socio-economic impact of infrastructure implementation should also be considered. This, in turn, means that the government needs its own evaluation model to decide which project should be under PPP. In this section, the author discusses the “secondary effect” of infrastructure by

depending on the research of “technological politics” in social science. The aforementioned motivations form the foundation of the analytical framework of the governmental evaluation scheme, which is the major contribution of this thesis in Chapter 6.

Recently in Myanmar, certain ministries have implemented PPP. However, there are no specific rules and regulations to implement projects using PPP, and the decision to develop and implement PPP is made at the ministerial level. Therefore, there are no specific rules and regulations about public sector participation that investors can rely on, and consequently, there is not enough interest among potential investors.

Chapter 3 defines PPP from the viewpoint of developing partners and multilateral banks, such as JICA, WB, ADB, and IMF, to enable researchers to better understand the concept. A public–private partnership (PPP), as an innovative alternative for project delivery, has been widely implemented in many countries during the past two decades, attempting to resolve the problems, the most significant, worldwide trend in the public sector, and good governance is an important factor for the success of PPP projects in terms of developing sound economic policy and administrating projects.

Allowing the private sector to participate in public infrastructure development, including providing finance, is not a new phenomenon; it is rather a revival of an old tradition. The origin of such a relationship goes as far back as the Roman Empire, 2,000 years ago. However, joint involvement of both sectors disappeared with the fall of the Roman Empire and reappeared in the 12th and 13th centuries in southwestern France. Since then, collaboration between the public and private sectors has been widely implemented by most of the governments of southwestern France. PPP was found to be a source of concession contracts in those days. Public participation in France at the time occurred in the form of public works concessions.

Later, during the 16th and 17th centuries, European sovereigns, particularly in France, began much more expansive public works concession programs in canal construction, road paving, waste collection, public lighting, mail distribution, and public transportation. Hence, private capital was heavily involved in public investments since the turn of the 17th and 18th centuries until the end of the 19th century, when infrastructure development (water channels, roads, railways) in Europe, and later in the Americas, China, and Japan, was privately funded under concession contracts.

The World Bank defined PPP as “a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration, is linked to performance.” This definition encompasses PPPs that provide new assets and services as well as those for existing assets and services. It can include PPPs in which the private party is paid entirely by the service users and those in which a government agency makes some or all of the payments. The responsibility transferred to the private party varies from design and construction to financing, operations, and maintenance, depending on the type of contract. But in all cases, the private party is accountable for project performance and thus bears significant risk and management responsibility. This definition also encompasses contracts in many sectors and for many services, provided there is a public interest in the provision of the service and the project involves long-life assets concomitant with the long term of the PPP contract.

The ADB mentioned defines PPP as a range of possible relationships between public and private entities in the context of infrastructure and other services. Other terms used for this type of activity include private sector participation (PSP) and privatization. The European Investment Bank defines PPP as “relationships formed between the private sector and public bodies often with the aim of introducing private sector resources and/or expertise in order to help provide and deliver public sector assets and services.” The OECD defines PPP as a relationship in which the “private sector provides service and shares risk on a project in which goals of government (providing service) and private (profit) are met.” The IMF defines it as a relationship where the “private sector finances infrastructure of a project while government delegates risk to private sector.” Japan views PPP as a concept wherein “through partnership with private sector, public sector reduces risk of Japanese firms in partner countries and encourages employment, technology, trade and investment with public fund such as ODA.” According to the United Kingdom, in a PPP, “public sector finances a project the while private sector shares its risk.” PPPs present a framework wherein the private sector is engaged with the country’s development, while the government still plays a crucial role in ensuring that social obligations are met and sector reforms and public investments achieved.

Chapter 4 discusses PPP implementation in different countries. A growing number of developing countries are interested in using PPPs to provide public

infrastructure assets and services. The PPP Cycle section of the PPP Knowledge Lab is set up to help them achieve their goal. This chapter aims to help government officials and other interested parties to answer the following specific questions:

(1) The Need for PPPs: What are PPPs, and why would governments want to implement them?

(2) Legal/Policy Framework: What kind of legal, policy, and institutional framework needs to be in place to ensure PPPs achieve their objectives efficiently and effectively? What is the process for designing and tendering a PPP project? How can a government manage the implementation of a PPP post-bid?

(3) Experiences: What insights can be gained from their experiences?

(4) Other issues.

PPP is that the government allows the private partners to invest in his projects. PPP is a government service or private business venture which is funded and operated through a partnership of government and one or more private sector companies.

Effective implementation of PPP requires the right enabling conditions, including a suitable legal framework and a favorable political environment. It also requires significant institutional capacity and a shift in convention within government agencies—from traditionally planning and carrying out projects to partnering with the private sector.

Build-Operate-Transfer (BOT) is one of the popular forms of PPP. The basic challenge is structuring the required projects in a way that they meet public service delivery objectives and generate acceptable returns to the private investors. An internal rate of return of 12 and above for BOT projects in the road sector is considered acceptable.

For the successful implementation of PPP, the right strategic framework should also be in place, such as appropriate PPP legislation and a national strategy. Additionally, the government cannot assimilate both international and local investors in a PPP program. Therefore, private investors were successful in generating profits for some projects but not for others.

The strengths and weaknesses of PPP as implemented in various countries are discussed in this section. In Australia, the strengths of PPP were discount rates

availability payment model with key performance indicators and monitored with public sector comparator such as showdown toll. The weakness was a lack of financing by the government. In Canada, the DBFOM under the PPP scheme was more effective than traditional methods. In China (Taipei), PPP is implemented via the BOT model, and its strengths include close supervision by organizers and agreement to use bank financing, but financial independence and lack of Viability Gap Funding (VGF) are the main weaknesses. In Japan too, the BOT model is used, and the strengths include the use of Transit Oriented Development, amortization repayment by a legal entity, and PFI is availability based type, whereas high demand risk by the government constitutes a weakness. In Korea, PPP is implemented through the BTO and BTL models. Strength is public and private sector working in cooperation and partnership. No guaranteed minimum revenue is a weakness. The Philippines uses the BOT model, and it is the best PPP model with risk-sharing in Asia. Singapore uses the DBOO model, and it shares demand risk. Thailand uses the BTO model, and its strength is that investors can use both equity and debt financing, but its weakness is that the toll rate is based on the value of investment. The UK improved public sector capability through PPP. The USA uses the DBFO model, which can be funded by the federal government.

It is also recommended in Chapter 5 with the three case studies of Myanmar in Yangon such as Lanthit Housing Project and U Wisara Housing Project, the economic hub of Myanmar, and Yangon Outer Ring Road Project which is vital to traffic access to other regions via Yangon, together with the evaluations of IRR, NPV, and ROI.

Myanmar aims to become a developed nation, and it will be through a huge transitional phase during which there will be many challenges. One such challenge is that the government does not have the skill, in terms of human capital, necessary to meet for the demands for massive infrastructure improvement. Although the nation has a large population, is rich in natural resources, and boasts a young labor force, the government cannot proceed with infrastructure development because of shortage of funds. Infrastructure projects take a long time to be implemented. Therefore, it may be years before the investors see any signs of profits. Slow development of infrastructure can sometimes negatively impact socio-economic development and may become a barrier to economic growth and foreign direct investment. Thus, the government intends to create a fund for infrastructure projects through a PPP scheme.

The first case study is about the Lanthit public housing. It was constructed by the Public Housing Department in 1957, and today, it is occupied by legal as well as illegal residents. The land area for housing is 4.717 acres. (4) Storied type of buildings with (6) units are included and totally amounted to (11) buildings in which (264) no of apartments are included. The objectives of the project are as follows:

- To uplift the living conditions and existing housing quality, which are deteriorating and make for insufficient infrastructure for the citizens of Yangon.
- To contribute to the sustainable development of the Yangon central area.
- To provide the required socio-economic infrastructure and urban utilities in project surrounding.
- To implement a system of tangible social benefits for residents and citizens.
- To enhance the participation of the private sector to enable a win-win scenario.
- To compete the urban development of the country.
- To build the budget allowance for the redevelopment project.

The PPP model implemented in the Lanthit Housing project is the Build-Operate-Share (BOS) model. This model is an agreement between the government and developers based on a sharing mechanism in which the government shares the land and the developer invests in the infrastructural development on that land. In this model, the cost for the government is the land area invested into the project, and the developer invests money. The developer also undertakes responsibility for shifting costs for resettlement. Therefore, the cost of land is not a burden for the developer, and the entire project cost can be reduced through government subsidy. During the construction period, the government helps the developer obtain a bank loan, if required, because the developer only needs to pay the original residents of that land. After finished the project, the users can buy the apartments by the housing bank loan with the low interest and long payment.

The second case study is the UWISARA Housing project, constructed by the Public Housing Department in 1957. The total area was 20 acres. Four storied building type and total apartments (684) no were included and the area was varied (398 sft to 818 sft). This project also implements PPP through the BOS model.

In this model, the government invests the land area and the developer invests the infrastructure cost. The developer provides shifting cost for resettlement. And then demolish the old building and start the redevelopment project. Therefore the land cost cannot burden for developer and the whole project cost be reduce by the government subsidy. This investment cost in this project is quite high, and hence, the developer can have another party in the project (a co-developer) through a bidding process. During the construction period, the government helps for international and domestic banks loan if developer required. After finished the project, the users can buy the apartments by the housing bank loan with the low interest and long payment. The developer only needs to pay the apartments area for original residents and some public areas and do not need to transfer the infrastructure building and the net profit.

The last project is the Yangon Outer Ring Road and Integrated Industrial Estate Project, which intends to further develop Yangon City and create a national industrial zone. The population of Yangon is now seven million (as of 2018) and is expected to reach ten million by 2030. The infrastructure in Yangon City was originally planned for a population of 300,000, but it has gradually increased every year, making the city one of the most crowded cities in the region. Yangon is also the country's hub for trade and logistics, and it hosts the main air and sea ports, which are in turn linked by a dense network of roads and railways. The number of vehicles have increased to 13 million in 2018, and this number is expected to reach 20 million in 2030. Therefore, The Elevated Express Way Project (Yangon Inner Ring Road and Outer Ring Road) will go a long way in tackling this level of growth. The Yangon Inner Ring Road project is now in its initial stages and will be implemented through the PPP model.

The Outer Ring Expressway of Yangon is a two-way road (four lanes each) and is built as per expressway standards with a speed limit of 100 km/h. The total length of the entire route is approximately 143.2 km. The proposed alignment will connect seven townships in YCDC and, consequently, play a major role in advancing the economic and social welfare of the townships. This project can be divided two parts:

- (1) The Outer Ring Road
- (2) The Integrated Industrial Estate Project

The BOT model is used here as well. In this model, the government invests land and the developer invests money for road, bridges, and industrial construction. After

completion, the developer build a national industrial zone and collect toll fees for 50 years. Government subsidizes to get the loans from the international Bank and Risk transferring. The developer can choose the local company by tendering to implement the project simultaneously. Considering such evaluations, similar projects in the Yangon region can be easily undertaken for investment. PPP in Myanmar is the need of the hour, given the government's budget constraints and huge infrastructure needs of the country, which can help uplift millions from the current living conditions. The country consists of multiple ethnic groups that are diverse in culture, economic level, geographical conditions, and so on. Therefore, at the same time, socio-economic considerations are inevitable to provide urban utilities in each area that are harmonious to the people. Chapter 5 tries to rationalize the above premises by showing on-going PPP projects.

The aim of Chapter 6 is to develop an analytical framework for a socio-economic valuation. In so doing, the chapter proposes that socio-economic values can be measured in the four markets of urban economy (U), land development (L), real estates (R), and infrastructure (I) in terms of their EER. In other words, harmony among urban utilities in Myanmar can be achieved through simultaneous returns from all the four markets. This chapter presents a useful technique for checking the consistency of the decision-makers' evaluations, thus reducing bias in the decision-making process. Data are collected on the availability and extent of ICT usage, manpower, skilled labor, electricity, water, and quality of education. Then, a rating system is applied and correlated with the hotel and tourism sector, livestock and food sector, agriculture and value-added products sector, labor-intensive textile sector, economic development based on mineral resources sector in all States and Regions, therefore, investors can select the potential projects together with desired investment areas. Therefore, this research will surely benefit local and international investors as well as developers.

7.2 Contributions

The paper further explains that PPP is an effective tool for business operation in Myanmar to assist with removing fiscal deficits, providing funding for future business plans, and creating harmonized socio-economic development. Due to strict military administrations since 1962, the country was deprived of the above developments, until it was democratized in 2011. Currently, the GDP is approximately 73 trillion kyat (\$ 60

billion) and the debt-to-GDP ratio is approximately 5%. There is an annual decrease of infrastructure investments within the government budget. However, the renewal and maintenance of aging infrastructure is essential for socio-economic development under such financial conditions. 2015 onwards, more than 300 roads and bridges were proposed to be built as a part of the country's 15-year plan, which required an expenditure of \$ 30 billion. Furthermore, Myanmar is a multi-ethnic country consisting of 135 ethnic groups, and it is essential to properly allocate the budget among its 15 provinces and regional governments to assure harmonized socio-economic development across the nation. This paper presumes that PPP needs to be combined with other funding schemes such as the ODA, to be applied successfully. Thus, through the above combinations, this paper has meaningful implications for the country's social demands.

Through an analysis of secondary literature (papers and magazines), the study examined 96 PPP cases, along with detailed global case studies of PPP projects in 11 countries. A majority of these case studies were related to financial business effectiveness and associated risks, focusing on private interests in PPPs. This research also identified some needs within Myanmar from three implemented PPP projects, and concluded that governmental socio-economic evaluation is crucial in achieving harmonious nationalistic development. This is an ambitious and novel view because numerous past studies focused on financial issues in PPP through a private view and only a few dealt with its socio-economic aspects.

To demonstrate that the four government markets are appropriate socio-economic indicators, this thesis presented a qualitative analysis of inherent socio-economic variables from residential real estate and expressway projects that implemented PPP. Using the, a relevance diagram method which shows causal relationship among the variables, it was assumed that the interaction of the four government markets were implicitly analyzed.

In the analytical example, with the help of 16 sub-criteria as components of the government markets, existing data were used to calculate the initial EER. Next, the pairwise comparison of the sub-criteria was used as subjective data, and the respective weights were calculated. Two stages of weighting were performed. The first comparison showed the importance of the government markets and its components in each state/region independently. The comparison is used to calculate the absolute importance,

or weight, of the four markets within each state/region independently. In other words, the weights represent the adjusted EER within each state/region. Second, subjective pair-wise comparison of each state/region with the four government markets is input by considering the relative importance among the state/regions. This comparison is used to calculate the relative weight for each market. The weights represent the relative priority among the states/regions individually.

The two most important quantitative inferences can be drawn from the analysis in this paper:

- (1) The subjective judgment of the central government or of the state/regional government, with respect to four government markets or 16 sub-components, is quantitatively shown as a "weight" (priority) by pair-wise comparison. For example, infrastructure investment may be given priority in urban areas, but land development should be the top priority in some rural areas. This information makes it possible for each state/regional government to understand which government market investment should be prioritized.
- (2) The central government can compare the four government markets to each state/regional government on the basis of the 16 pair-wise comparisons of the state/regional governments. For example, although the infrastructure EER in urban and rural areas may be the same numerically, investment in urban regions may be more effective than in rural areas. Such information may be useful for budget allocation towards each state/region. The timing of the budget allocation may also be important, and it may help the central government decide whether the project should be by funded through ODA or PPP, and more importantly, how to combine these schemes in time for the portfolio of the four government markets.

In Myanmar, many development projects are currently in the planning stage. These include, for example, the Thilawa Industrial Park with assistance from Japanese developers, the YIRR and YORR as a route to the GMS Economic Corridor, the development of a large-scale SEZ such as Dawei, or the NYC project. In these projects, not only infrastructure but also all the four government markets are combined, and decision-making regarding asset allocation is critical. Such decision-making involves effectively combining PPP and ODA, and could thus benefit from EER analysis for the development of infrastructure, land, real estate, and the economy. The author of this

paper, who is currently the Deputy Minister in Myanmar's MOC, is a top government decision-maker. Therefore, the analytical framework in this paper had already been based on the premise that the findings of this research would be implemented in government investment decisions. and the value of research is socially ripple and its practicality actually and potentially very large.

In conclusion, this thesis describes the prevalent conditions in each states and region of Myanmar, providing detailed data and analysis from the viewpoint of investment using the PPP system, a concept that is useful for both local and international investors. Moreover, the four markets model described in this thesis can be used not only in Myanmar but also in other developing countries that are in similar stages of development, where PPP can be a great potential for economic development projects.

References

- [ADB(2008)] “Public-Private Partnership Handbook,” ADB, Philippines, 2008.
- [ADB(2014)] “Republic of the Union of Myanmar: Support for Public–Private Partnership Framework Development,” Technical Assistance Report, ADB, 2014.
- [ADBG(2013)] African Development Bank Group., “NAIROBI OUTER-RING ROAD IMPROVEMENT PROJECT,” Environmental and Social Impact Assessment Summary, 2013.
<https://www.afdb.org/fileadmin/uploads/afdb/Documents/Environmental-and-Social-Assessments/Kenya%20-%20Nairobi%20Outer-Ring%20Road%20Improvement%20Project%20%E2%80%93%20ESIA%20Summary.pdf>
- [APEC(2014)] “Infrastructure Public-Private Partnership Case Studies of APEC Member Economies,” APEC, 2014.
- [Associates(2017)] Nathan Associates, “Public-Private Partnerships: A Basic Introduction for Non-Specialists,” Economic and Private Sector, Professional Evidence and Applied Knowledge Services, 2017.
- [Chotchai(2014)] Chotchai Charoenngam, Santi Charoenpornpattana “Session 3 Public Private Partnerships,” Lecture on Master of Project Management Course, Nay Pyi Taw, Myanmar, 2014.
- [COA(2008)] Commonwealth of Australia, National PPP Guidelines Overview, 2008.
- [COA(2018)] Commonwealth of Australia, “Infrastructure Australia,” 2018.
http://www.infrastructureaustralia.gov.au/public_private/
- [DICA-JICA(2016)] “Financing Infrastructure Development and Public-Private Partnership (PPP) Framework for Myanmar,” Summary of Analytical Paper based on DICA-JICA Discussion Series on PPP for Infrastructure, Nay Pyi Taw, Myanmar, 2016.

- [Donahue(1989)] Donahue, J.D., “The Privatization Decision,” Basic Books, 1989.
- [ENR] Engineering News-Record, <https://www.enr.com/>
- [Farquharson(2008)] Ed Farquharson, “Lessons Learned from PPP Project Preparation and Implementation,” Partnership UK , 2008.
- [Fauziah Zen et al.(2014)] Fauziah Zen, Michael Regan, “ASEAN Public Private Partnership Guideline,” Economic Research Institute for ASEAN and East Asia, 2014.
- [France(2014)] 21st Finance Ministers’ Meeting, “Infrastructure Public-Private Partnership Case Studies of APEC Member Economies,” 21st Finance Ministers’ Meeting, Beijing, 2014.
- [Fraquharson(2008)] Ed Fraquharson, “Lessons Learnt from PPP PROJECT Preparation And Implementation, “ Partnerships UK, 2008.
- [Freedman et al.(2011)] Freedman, Matthew & Owens, Emily G., "Low-income housing development and crime," Journal of Urban Economics, Elsevier, vol. 70(2), pages 115-131, 2011.
- [GCI (2016)], “Global Competitiveness Index 2015-2016,” 2016.
- [GITT(2015)] Global Infrastructure Think Tank, “Myanmar: The New PPP Frontier?,” Global Infrastructure Think Tank, Mobilizing Community, 2015.
- [Graham M. Winch et al.(2012)] Graham M. Winch, Masamitsu Onishi, Sandra Schmidt, “Taking Stock of PPP and PFI around the World,” Summary of Research Report 126, ACCA, London, 2012.
- [Hemming(2006)] Richard Hemming, “Public-Private Partnerships,” Richard Hemming, International Monetary Fund, Tunisia, 2006.
- [Henry Kasper et al.(2014)] “2014 Telecom Sector Update,” Henry Kasper, Jenny J. Chao, Public-Private Partnership Group, World Bank, Private Participation in Infrastructure Database, 2014.
- [HKIS(2009)] Hong Kong Institute of Surveyors, “Practical Guide to Public Private Partnership (PPP) Projects,” The Hong Kong Institute of Surveyors, Hong Kong, China,

2009.

[Howard (1989)] Howard, R.A., “Knowledge Maps,” Working Paper, Department of Engineering-Economic Systems, Stanford University, Strategic Decisions Group, Menlo Park, California, 1989.

[Hubert(2014)] Hubert, J., “Maximising the Economic Returns of Road Infrastructure Investment”, University of South Africa. November, 2014.

[IMF (2013)] IMF’s “Myanmar Staff-Monitored Program,” X(IMF Country Report No.13/13),2013.

[India(2016)] “PPP Guide for Practitioners,” Department of Economic Affairs, Ministry of Finance, Government of India, 2016.

[Jay-Hyung et al.(2011)] Jay-Hyung Kim, Jungwook Kim, Seok Joon Choi, “Public–Private Partnership Infrastructure Projects: Case Studies from the Republic of Korea,” ADB, 2011.

[JICA(2014)] “Public-Private Partnerships: New Partnerships that Support Social and Economic Growth,” JICA Annual Report, 2014.

[JICA(2014)] JICA, “National Transport Master Plan,” 2014.

[JICA(2014)] JICA, “The Survey Program for the National Transport Development Plan in the Republic of the Union of Myanmar”, 2014.

[JICA(2015)] “Project for Comprehensive Urban Transport Plan of the Greater Yangon (YUTRA), Data Collection Survey for the Yangon Urban Expressway (YUEX) Project,” Final Report, 2015.

[JICA(2017)] “JICA’s Partnership with the Japanese Private Sector,” JICA, 2017.

[JICA(2013)] “Project for the Strategic Urban Development Plan of the Greater Yangon Final Report I,” 2013.

[JICA(2014)]IMF’s “World Economic Outlook database,” 2014.

[Kazamovskyil et al.(2018)] Valeriy Kazarnovskiy¹, and Mohammad Kazem Hadavi.

“The main factors affecting the character of housing construction in Iran”, Moscow State University of Civil Engineering, 26, Yaroslavskoye Shosse, 129337, Moscow, Russia, 2018.

[KDI(2017)] “Introduction to Public-Private Partnership System and Case Studies of Korea,” KDI, 2017.

[KOICA(2015)] KOICA, “Arterial Road Network Master Plan,” 2015.

[Kozłowski(2014)] Waldemar Kozłowski. “A Model Valuation of Economic and Social Effects – A Case Study of the Olsztyn Ring Road Construction,” *Acta Sci.Pol. Oeconomia* 13.2 (2014): 93-103, 2014.

[KPMG(2013)] “Infrastructure in Myanmar,” KPMG, Myanmar, 2013.

[KyiZawMyint(20xx)] Yangon Elevated Expressway Project Inner Ring Road (Phase-I) Slide no. 15, presented by U Kyi Zaw Myint at the 20xx conference, Yangon, 20xx.

[Maffini et al.(2018)] Ana Luisa Maffini and Clarice Maraschin. “Urban Segregation and Socio-Spatial Interactions: A Configurational Approach,” *Urban Sci.* 2018.

[Mane et al.(2013)] Sharmila Mane and Dr. S.S. Pimplikar. “Risk Assessment of BOT Projects,” *International Journal of Computational Engineering Research*, 2013.

[McDonald et al.(2007)] Heather MacDonald, Richard Funderburg, David Swenson, Anne Russett and Malynne Simeon, 2007. “Housing’s Economic and Social Impacts”. A Report to the Iowa Finance Authority.

<http://housingtrustfundproject.org/wp-content/uploads/2011/10/Iowa-Economic-Impact-Final1.pdf>.

[Minato(2018)] Minato, T., “PPP Principles,” JICA Seminar on PPP for Road and Housing Development in Myanmar, Nay Pyi Taw, Myanmar, 2018.

[MKIF(2019)] Macquarie Korea Infrastructure Fund, “Incheon International Expressway,” 2019.

<https://www.macquarie.com/mgl/mkif/en/mkif-assets/incheon-international-airport-expressway>

[MLCS(2017)] Myanmar Living Conditions Survey, 2017.

[MMTimes(2018)] “Chinese firms finalizes new Yangon city proposal,” Myanmar Times, Myanmar, 2018.

[MNPED(2015)] Myanmar Statistical Year Book , 2015.

[MOC(2016)] MOC, “Integrated Master Plan for Construction Industry, Transport Sector, Infrastructure and Urban Planning,” 2016.

[MOC(2018)] Ministry of Construction, Statistics Section, Department of Highway.

[MOC(2019)] MOC, “Budget Section, Department of Bridge, 2019.

[MOFA] Ministry of Foreign Affairs of Japan.

https://www.mofa.go.jp/policy/oda/white/2017/html/honbun/b3/s2_3_3.html

[MOHT(2017)] Myanmar Tourism Statistics Year Book, Ministry of Hotels and Tourism.

[MONRE(2016)] Annual Report, Ministry of Natural Resources and Environmental Conservation.

[MOPF(2016)] “Myanmar Public-Private Partnership, Policy Document (including a Legal Review of PPP-related issues),” Ministry of Planning and Finance, Republic of the Union of Myanmar, 2016.

[MPGP(2015)]

<http://documents.worldbank.org/curated/en/2014/06/20136963/myanmar-myingyan-power-generation-project-mpgp>

[Myanmar(2014)] Myanmar Population and Housing Census, 2014.

[Myanmar(2015)] Master Plan for Arterial Road Network Development in Myanmar, Final Report, July 2015.

[Nan Lwin (2019)] Nan Lwin, “Chinese Firm Involved in New Yangon City Has Long List of Controversies Abroad,” 2019.

<https://www.irrawaddy.com/opinion/analysis/chinese-firm-involved-new-yangon-city-l ong-list-controversies-abroad.html>

[Nandar et al.(2016)] Nandar Tun, Akare Zaw, Kyaw Linn, and Takayuki Minato, “Direct and Indirect Effects of PPP projects in Yangon region,” unpublished paper, 2016.

[NAO(2006)] “A Framework for evaluating the implementation of Private Finance Initiative Projects: Volume 1,” National Audit Office, Victoria, London, 2006.

[NAO(2006)] “A Framework for evaluating the implementation of Private Finance Initiative Projects: Volume 2,” National Audit Office, Victoria, London, 2006.

[Natalya Stankevich et al.(2005)] Natalya Stankevich, Navaid Qureshi, Cesar Queiroz, “Performance-based Contracting for Preservation and Improvement of Road Assets,” The World Bank, Washington DC, 2005.

[NYDC(2019)] New Yangon Development Company Ltd, Myanmar, 2019.
<https://www.nydc.com.mm/>

[OECD(2008)] “Public-Private Partnerships in Pursuit of Risk Sharing and Value for Money,” OECD, France, 2008.

[Paul Boothe et al.(2015)] Paul Boothe, Felix Boudreault, Dave Hudson, David Moloney, Sandra Octaviani, “The Procurement of Public Infrastructure: Comparing P3 and Traditional Approaches,” Lawrence National Centre for Policy and Management, Canada, 2015.

[PPIAF(2009)] “Overview of PPP experience,” Toolkit for Public-Private Partnership in Roads and Highways, PPIAF, 2009.

[PUK(2016)] “Report on Operational PFI Projects”, Partnerships UK, 2016.

[Saaty(1980)] Saaty, T.L., “The Analytic Hierarchy Process.” McGraw-Hill, New York, 1980.

[Shuibo Zhang et al.(2014)] Shuibo Zhang, Ying Gao, Zhuo Feng, Weizhuo Sun, “PPP

application in infrastructure development in China: Institutional analysis and implications,” *International Journal of Project Management*, 2014.

[Steadman(XXXX)] Steadman T., “Key Lessons from the UK Experiences of PPP,” Partner, PPP Group, Clifford Chance LLP, London, United Kingdom.

[Trop(2017)] Tamar Trop. “Social Impact Assessment of Rebuilding an Urban Neighbourhood: A Case Study of Demolition and Reconstruction Project in Petah Tikva,” *Israel. Sustainability*, 9, 2076.
<https://doi.org/10.3390/su9061076>.

[UN/CEC(2000)] “Guidelines on Private Public Partnership for Infrastructure Development,” UN/ECE Forum on Public-Private Partnership for Infrastructure: The Next Steps (PPPs), Palais des Nations, 2000.

[UNESCAP(2014)] “Public-Private Partnerships in Myanmar,” UNESCAP Workshop on Public-Private Partnerships for Infrastructure Development in Myanmar, Nay Pyi Taw, Myanmar, 2014.

[USDOT(2014)] “I-595 Corridor Roadway Improvements, Fort Lauderdale, FL,” United States Department of Transportation, 2014.
<https://www.transportation.gov/policy-initiatives/build-america/i-595-corridor-roadway-improvements-fort-lauderdale-fl>

[WB(1998)] “Concessions for infrastructure: A guide to their design and award,” World Bank Technical paper no. 399, Washington DC, 1998.

[WB(2015)] “Project Information Document (PID) Concept Stage,” Report No: 90081, The World Bank, Washington DC, 2015.

[WB(2015)] World Bank, Stage (1) , Report No. 90081, 2015.
[ments.worldbank.org/curated/en/2014/06/20136](https://documents.worldbank.org/curated/en/2014/06/20136)

[WB(2017)] “Public-Private Partnership Reference Guide, Version 3,” International Bank for Reconstruction and Development, World Bank, Washington DC, 2017.

[Whitfield (2014)] Tony Whitfield, “Auditing Public Private Partnerships,” Experience in New South Wales, Australia, 2014.

[Wikipedia(2019)] https://en.wikipedia.org/wiki/Engineering_News-Record

[Winch et al.(2012)] “Taking Stock of PPP and PFI Around the World,” edited by Graham M. Winch, Masamitsu Onishi, Sandra Schmidt, Certified Accountants Educational Trust, 2012.

, Asanga Gunawansa, “The use of the public private partnership concept in Singapore,” National University of Singapore.

, Myungsik Do, “Current status and perspectives of public private partnership for infrastructure projects in South korea,” Hanbat National University, Korea.

, ShouQuing Wang, Yongjian Ke, “Public private partnership implementation in China,”

[Wurtzebach et al.(1994)] Wurtzebach & Miles 1994:47.

[Yeo(2004)] Yeo, Hyung-Koo, “Public-Private partnetship in IIA Project,” Ministry of Construction and Transportation, KOREA, 2004.

[Zhou et al.(2003)] Tao Zhou, Rui Zhou and Yulin Zhou. “Factors Influencing Land Development and Redevelopment during China’s Rapid Urbanization: Evidence from Haikou City 2003-2016.” Sustainability, 2003.

Appendix A

ENR review

o.	Title	Country/ Sector	Author/ Date	Contract	Background/Risks/Strategy, etc
1	Amid PPP Slowdown, India Turns to Cash Contracts	India/ National Highway Authority	Tudor Van Hampton Sep., 2012	NHAI try to release the amount about 3 billion on around 40 highway projects totalling 2485 miles by applying EPC cash contract	<ul style="list-style-type: none"> - Indian government want to invest 1 trillion USD on infrastructure within five years - NHAI try to release the amount about 3 billion on around 40 highway projects totaling 2485 miles by applying EPC cash contract - In 2011, 4970 miles of road construction was conducted under PPP acheme but two-third of projects were incompleted - high interest rates, growing public debt, policies on investment - land acquisition and environmental issues cannot complete before contractor selected - growth rate high compare to other countries and less confidence in the construction sector - increase tax on fuel cuased lower interest rates
2	Balfour Beatty Uses PPP for \$123M FAU Student Housing Project	U.S./ Housing	May, 2010	<ul style="list-style-type: none"> - 3.4 million USD was invested by Balfour Beatty Capital - 123 million USD by Balfour Beatty Construction 	<ul style="list-style-type: none"> - development and management of new student residential facilities with 1216 beds (JV) and invested as tax-exempted bond - construction of student housing community - tax-exempted bond - Build American Bond - Invested as a bond
3	Spanish-U. S.-Israeli Team Is Preferred Bidder for \$1B PPP Houston Toll Road	U.S./ Texas Transport . Dept.	Mar., 2015	- \$800 million (consortium) by Shikun & Binui	<ul style="list-style-type: none"> - toll lanes project (SH 288) to design, build, finance, operate and maintain with a length of 10.3 miles that connects to Houston -upon roject award, the consortium will execute a concession agreement with TxDOT and to secure project financing - the firm's backlog had reached about \$2.4 billion, of which 70% was from international operations
4	VDOT Mulls PPP Options for \$2-Billion U.S. 460 Project	U.S./ Virginia Dept. of Transport	Oct., 2010	- The new solicitation envisions a concession term of up to 75 years, with a possible maximum term of 99 years	<ul style="list-style-type: none"> - to develop, construct and operate a 55 miles, four-lane toll road that is parallel to existing one, which has all at-grade intersections and passes through several small towns with lower speed limits - VDOT would accept a phased approach with a minimum initial scope of work, such as only one interchange at each end, and future interchanges constructed as funding becomes available - The concessionaire will also be responsible for all land acquisition costs, but have the opportunity to construct facilities adjacent to the highway that could help generate revenue to pay for it. - took the “if at first you don’t succeed” approach to luring private-sector interest - would liekt to reflect “dramatically” changed market conditions, such as the absence of any federal or state funding contribution, and significant reductions in the agency’s staffing

5	Spanish-Le d Team Wins PPP Bridge Project in North Carolina	U.S./ North Carolina	May, 2009	- \$650 million	<ul style="list-style-type: none"> - design, finance and build a new seven miles long two-lane Mid-Currituck toll bridge - PPP developmment deal with Spain's ACS Infrastructure Development (leading firm) and North Carolins Tumpike Authority
6	India's \$60-Billion PPP Port Project Takes Off	India/ Port	Aug., 2011		<ul style="list-style-type: none"> - India government expects a \$60 billion investment in its port by 2020 to esae infrastructure bottlenecks '- focus on awarding projects under PPP '- to increase the capacity in ports and 600 million tons planned between 2012 and 2017 - the overall capacity of major ports would reach about 616 metric tonnes, a shortfall of 200 metric tonnes would remain '- federal government also planned to raise money through private equity to partly finance the expansions to create infrastructure of \$1.5 billion - the expenditure of investment in port would be part of the planned \$1-trillion revamp of India's choked transport and power networks '- The Ministry of Shipping also is planning special-purpose vehicles (SPVs), to help the government raise funds from the market, by 2017 at seven major ports which is expected to cost approximately \$1.1 billion.
7	Public-Priv ate Transportati on Jobs Face Hurdles in U.S., Says Study	U.S./ Transport	May, 2009		<ul style="list-style-type: none"> - analysis is based on detailed interviews of 75 state and municipal public-works officials with varying levels of PPP experience - U.S. faced with political opposition and inconsistent rules from state to state, and PPP is used to finance public transportation projects lag in the U.S., compared to Europe and Australia - the biggest PPP obstacle is respondents' perception of "unacceptable profits" by private developers - Other negative perceptions are tolling concerns, higher costs, reduced maintenance and lack of community support
8	Hochtief Teams Wins \$1-billion Private-Pub lic Partnership Job in San Francisco	U.S., Transport	Oct., 2010	- \$1-billion concession	<ul style="list-style-type: none"> - A German consortium won a \$1-billion concession to run San Francisco's Presidio Parkway project for 33 years. '- The state of California, the California Dept. of Transportation and the San Francisco County Transportation Authority issued a notice of intent to sign a public-private partnership deal with Essen, Germany-based Hochtief Concessions - The German firm set up Hochtief PPP Solutions North America in 2009 to bid on PPP projects in Canada. - the frim worked on 10 schools in Canada's Alberta province and 18 provincial police facilities in Ontario province

9	Conference Emphasizes Better Tolling, Stewardship	U.S./ Transport	Feb., 2007		<ul style="list-style-type: none"> - To reduce the congestion and pollution on U.S highways needs to apply innovative approach to the projects and better methodologies for congestion tolling - highways to relieve the congestion by tolling - future greenfield PPP should include environmental performance specifications, toll price that vary according to time of day (rather than peak-hour tolls) and use of toll revenue to invest in transit and carpool lanes - to turn to technology and invest in innovation - tolls would have to vary by time of day, segment used and direction
10	Caltrans, SFCTA Picks European Consortium as P3 Builder of Presidio Parkway Phase Two	U.S./ California , Transport	Nov., 2010	- 1 billion USD (San Francisco's Presidio Parkway project)	<ul style="list-style-type: none"> - PPP project to a consortium as a concession for the design, construction, finance, operation and maintenance for 33 years of San Francisco's Presidio Parkway project including demolishing of current approach to the Golden Gate Bridge and construction of a six-lane replacement facility as a first phase - the project is needed to improve traffic mobility and public safety - The developer would be paid a \$173.43 million milestone payment at the end of construction - California Transportation Commission eliminated competitive bidding to put a fully funded project in debt for the next 30 years, may cost the Bay Area jobs, increase traffic congestion, and waste more than half a billion taxpayer dollars - California government lauded the legislation as a way to build transportation projects more efficiently and achieve faster delivery while transferring risk to the private sector and reducing overall project costs
11	UK's Balfour Beatty Is Set to Sell P3 Assets		Peter Reina Dec., 2014,		<ul style="list-style-type: none"> - For the investment of Balfour Beatty on the target PPP projects, around 40% are in the U.S. and mainly in the military housing sector - The rest of the projects are spread across various sectors in the U.K., including 13 highways - Balfour Beatty's PPP portfolio of some 60 projects represents a key pillar of the group's business built up over many years - John Laing Infrastructure Fund valued its own existing project portfolio at nearly \$1.3 billion in November 2014 - John Laing Group, the infrastructure developer/operator created the fund four years ago through a \$425 million initial public offering on the London Stock Exchange - John Laing Group, one of Europe's largest, was vested with 19 projects, which the Laing group continues to manage
12	In Phoenix, Women of Transportation Survey the Landscape	U.S./ Transport	June, 2005		<ul style="list-style-type: none"> - Phoenix is appropriately enough highway and light rail construction plans which are going like gangbusters - PPP and increased use of technology are key to future transportation projects - House version contains \$1 billion in seed money for a program that would encourage investigation of new materials to be put on an incentive list for states and municipalities to use in projects - prediction is that states will likely have more

					<p>access to GARVEE bonds, TIFIA loans, toll roads and public-private partnerships when the transportation reauthorization bill finally passes</p> <ul style="list-style-type: none"> - Language in the Senate bill will allow for extra money for the PPP approach and would clarify design-build - depending heavily on the gas tax to fund future construction of highways and transit may need to change - flexibility is as important as the amount of money - government should not make the private sector take all the risks and should be more open to sharing the risk - utilizing new kinds of building materials for projects are more often than not far more costly than using the standard concrete and steel at Michigan Dept. of Transportation - Virginia and Georgia are looking at developing incentive fee concepts tied to value under PPP projects - In the U.S., the government try to fit the need into the money that is given and the the U.S. transportation industry is hung up on distinctions between public and private roles
13	House Critics, Backers Mull Public-Private Deals	U.S./ Transport	May, 2007		<ul style="list-style-type: none"> - plans to have the private sector play a large role in running major public highways - Vital infrastructure tools (1. need tolling to generate critically needed revenues for transportation, 2. need tolling to help manage congestion) - long-term lease with a private entity - PPPs will play a key role in solving our impending transportation funding crisis
14	Experts: Spanish-Le d Consortium to Build \$4-Billion Texas Freeway Project	U.S./ Transport	Mar., 2009	- 4 billion USD (LBJ-635)	<ul style="list-style-type: none"> - PPP contract to finance, design, construct, operate and maintain the 13 miles LBJ-635 corridor in Dallas - the project is a victory for North Texas residents, businesses and visitors - PPP's main partner, Spanish toll road developer Cintra, will lead the design and construction team - the project was expected to finish in four to five years - the design will be enable the new highway with minimizing the additional right of way, new managed toll lanes below the existing non-tolled main lanes - the depressed lanes, three in each direction, will operate as managed lanes, and eight main lanes will be widened and cantilevered above the managed lanes - The project includes two-lane frontage roads in each direction, adding a third lane in several sections, for a total of 18-20 lanes at build-out

15	The Top Owners: State DOTs See Lean Times Ahead	U.S./ Transport	Bruce Buckley Nov., 2011	<ul style="list-style-type: none"> - Innovative financing Virginia DOT plans to expand use of PPP on projects in the suburbs of D.Cx - In New York state, tight budgets come at a crucial time for aging infrastructure - According to NYSDOT, more than 6,000 of the state's roughly 17,400 bridges are structurally deficient or functionally obsolete, and , numerous roads and bridges suffered damage from Hurricane Irene - Design-build has been met with some resistance in the past - the state awarded again a \$14.1-million design-build contract for reconstruction of bridges and six miles of road damaged by Hurricane Irene - Act largely spent and most states grappling with declines in revenue, the impact of the economic downturn is hitting the transportation sector hard - focusing every dollar can keep Missouri's roads and bridges in as good a condition as we canx - The state has limited experience with alternative delivery methods, but those options could gain traction in light of its funding challenges - Creative financing, creative delivery methods and making hard decisions are necessary in this environment - MoDOT moved to cut staff by 1,200 and close 131 facilities to free up \$117 million for its capital improvement program in 2011 - state lawmakers are considering the use of public-private partnerships to fund projects
16	Lagging Infrastructure Partnerships Need an Educational Push: Report	U.S./ Transport	Richard Korman May, 2009	<ul style="list-style-type: none"> - According to the survey of government officials, past PPPs leads to a positive outlook in U.S. - however, svrvey shown that three out of four officials without PPP experience have not made up their minds about them - The ambivalent officials need all the support they can get because there is a perception in the public and among elected officials that private companies make too much profit in PPPs - From the private developers' and dealmakers' perspective, one of the most discouraging problems with PPPs is their tendency to drag out over many years before closing and sometimes not to close at all - Faced with political opposition and inconsistent rules from state to state, partnerships that channel private investment into public works have lagged badly in the U.S. compared to Europe and Australia -experieced public officials building via public-private partnerships should consider the method an important and useful development tool - the suggession of education on behalf of PPPs could go a long way toward converting the large number of ambivalent transportation and highway officials

17	Construction on Final Phase of Presidio Parkway Project Begins	U.S./Transport	Oct., 2012	- 1.4 billion USD (Parkway project)	<ul style="list-style-type: none"> - Construction of Phase II of the Presidio Parkway Project in the heart of San Francisco's Golden Gate National Recreation Area which included includes the construction of three cut-and-cover tunnels, seven bridges, the High Viaduct, and the Girard Road interchange - At the east end of the project, where tunnels will be constructed near the water, there are layers of sedimentary rock and bay mud which goes down about 30 ft - traffic was shifted onto a seismically-safe temporary bypass that will carry traffic until the replacement of the roadway since from the starting time till completion - this project is not only critical for seismic and traffic safety, but it also provides an opportunity for major design improvements - Doyle Drive, that was build in 1936, was found to be structurally and seismically deficient - ThisPhase II, world-class project, will not only improve earthquake safety, it will also support jobs and preserve the natural, cultural, and recreational resources of the Presidiox
18	Firms Say World Market Is Thawing, Albeit Slowly		Bruce Buckley Oct., 2012		<ul style="list-style-type: none"> - London-based Balfour Beatty, a contractor, still have several projects moving ahead under the program but in January 2012, it closed on a program that will deliver \$715 million in major capital improvements for two school districts and some other projects have been cancelled. In April, Balfour Beatty was awarded a \$150-million contract to rebuild or replace six schools for the Hartlepool Borough Council, but some projects have been jettisoned. (UK) - Developers are already planning for housing, recreational and some commercial properties (new town in east London) - In Scandinavia, prices on homes are back to where they were before the economic crisis and all of the residential builders are pushing hard to start as many projects as possible to take advantage of the market - The U.K. has been one of the more worrisome markets for many contractors, as sweeping austerity measures by the British government have replaced massive public-sector spending - the central and Eastern Europe markets have been spotty
19	Spain's Contractors See Green in Ireland	Ireland	Peter Reina Jan., 2010	<ul style="list-style-type: none"> - 360 million USD (M50) - over 1 billion USD (N11 and N17/18)x - 3 million USD (Dart) 	<ul style="list-style-type: none"> - widening 23 km of M50 toll road, that across the airport road, under a design, build, finance and operate (DBFO) lasting 35 years - Construction of Dublin's new 18-km Metro North, with 15 stations - Construction of Dart underground regional railroad link, with twin 7-km-long, large-diameter tunnels - 9.2 km long urban project as a 25-year DBFO - Spanish firms control 85% of the consortium - Government is leaning increasingly toward public-private partnerships to plug its infrastructure funding gap - One of the most successful Spanish bidding team is organized as joint venture, and have long-term DBFOs for both M50 and N6 (the country's second largest 58-km highway)

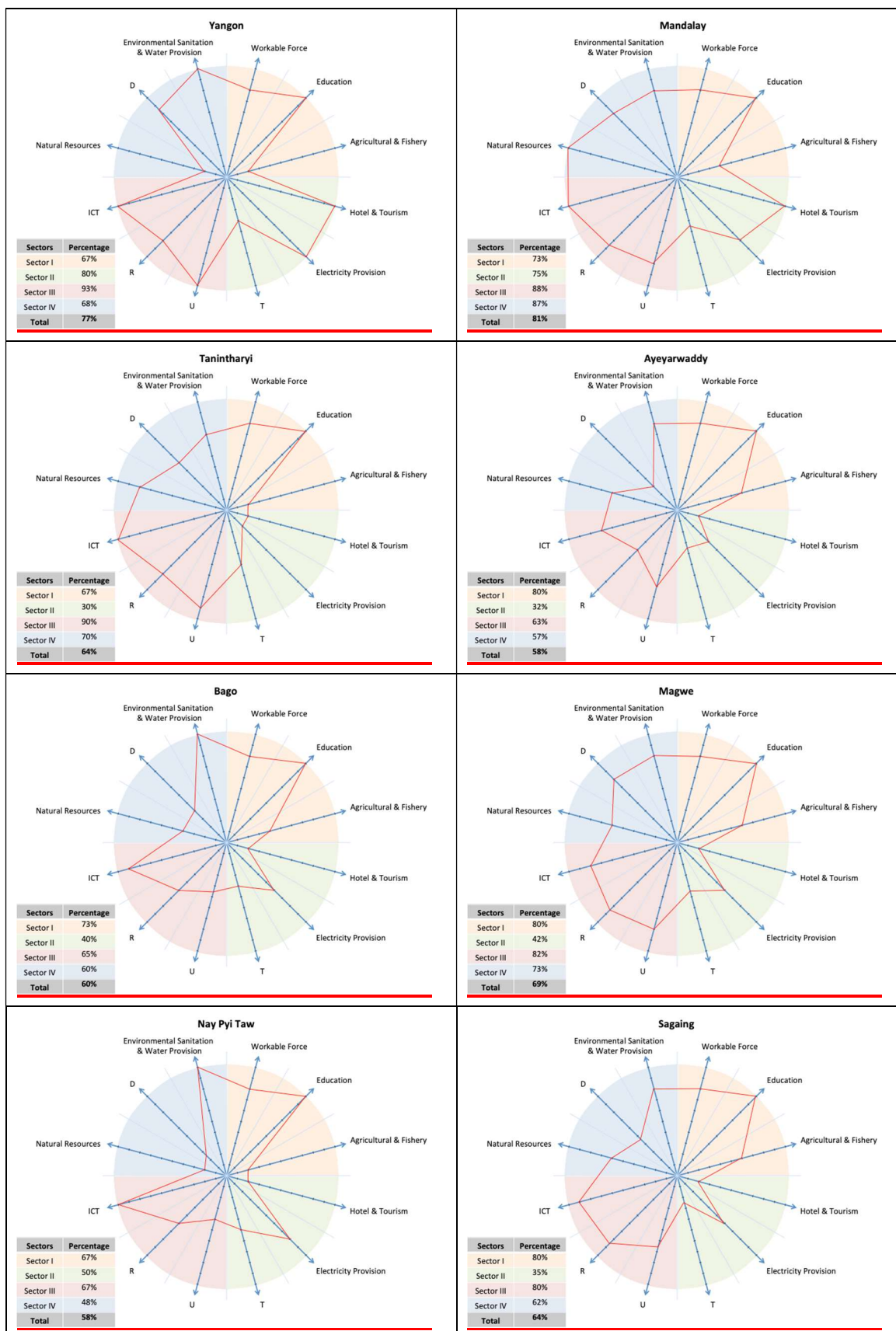
20	Finrock Starts Dania Beach Parking Garage		May, 2010/		- Design and construction of four-level garage for 440 cars
21	Skanska to Construct \$49-Million Facility for City of Gainesville	U.S.	May, 2010	49 million USD	- Construction of nine-building Gainesville's Regional Utilities unit for energy, water and wastewater, telephone and data network - The buildings will be designed to achieve LEED Silver certification
22	J.L. Wallace to Build Ave Maria University Field House		May, 2010		- Construction of 38,107 sq-ft Ave Maria University's Tom Golisano Field House including a basketball court, training room, weight room, locker rooms, offices and conference room
23	Florida Contracts: Value of New Projects Drops 11% in February	U.S./ Florida	May, 2010		- the value of new nonresidential contracts fell 23% compared to the last year for a total of \$370.3 millionx - The residential category is increased 31% to total \$685.5 millionx - 11% drop in the value of new construction contracts signed in February 2010, leaving its year-to-date total 2% down from 2009's pace - For the year-to-date, Florida's contract activity is 2% behind 2009's early pace, with nearly \$4.9 billion in new projectsx - nonresidential market is 14% behind last year, with \$1.2 billion in new startsx - Nonbuilding contracts are down, by 9%, for a \$2.3-billion totalx - Residential starts are 33% ahead for a roughly \$1.4-billion
24	Suffolk, Webcor Team Up for Miami Science Museum	U.S./ Miami	May, 2010	- construction of the 250,000 sq-ft Miami Science Museum with 35,000-sq-ft aquarium, planetarium and 55,000 sq ft of exhibits	
25	R.R. Simmons Scores USF Project	U.S./ Housing	May, 2010	-\$30-million school project	- Tampa-based R.R. Simmons Construction Corp. was selected by the University of South Florida to work with the architecture firm Populous to design-build several new athletic facilities for the school that includes the construction of training and playing facilities for softball and baseball; practice fields for football; and a basketball training center - Current football practice facilities will be moved and expanded, and a new artificial playing surface installed - A 50,580-sq-ft basketball training center for the men's and women's teams will house practice courts, locker rooms, weight training centers, sports medicine facilities, film and video facilities, and administrative offices

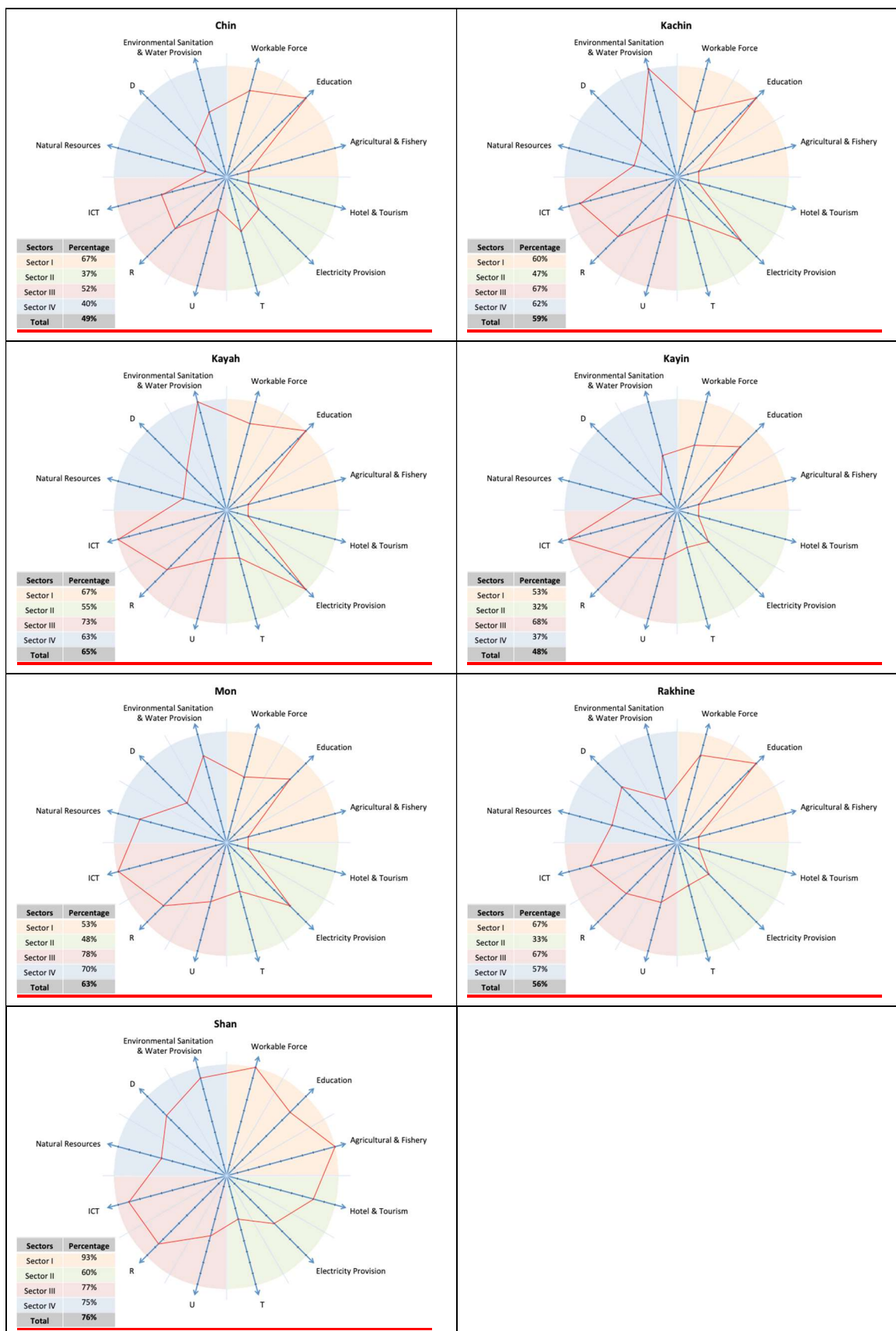
26	India Grapples With Crippling Labor Shortage	India/ Labor	MriduKhullar Nov., 2013		<ul style="list-style-type: none"> - Construction labor in India draws from the migrant population - Construction industry in India depends on the skilled laborer of 20% of the workforce use on-site - human-resource deficit in India, a nation of more than 1.2 billion people - the construction industry in India is grappling with a 30% labor shortage - Indian construction sites tend to be very laborious, so they're very people-intensive - Skilled laborers' pay rates have escalated sharply in recent years (Carpenters who were making Rs 15,000 [\$240] a month, with a little bit of training, are today demanding as much as Rs 80,000 [\$1,279] a month)
27	India Unveils Annual Budget to Skittish Infra Investors	India/ Budget	Neelam Mathews Mar., 2013		<ul style="list-style-type: none"> - India's economic growth slowed to a 5.3% annual rate in 2012's first quarter, the lowest in nine years, and inflation has averaged 9.2% a year since the start of 2010 - communication with investors should be improved to remove any apprehension or distrust, including fears about undue regulatory burden - there is a "need for new and innovative instruments to mobilize funds for investment in infrastructure sector - Defense spending, the largest portion of the budget, comprises roughly \$37 billion, a 4.5% increase from 2012 - The second largest outlay and also the largest year-on-year increase went to the Ministry of Rural Development, with a 46% increase to \$15 billion - Many projects are stuck because of land issues and environment clearances - a new factor is the rise of political activists holding up construction
28	AIA, Commerce Slate Trade Mission to India	India/ Services	Tom Ichniowski Sep., 2012		<ul style="list-style-type: none"> - To promote the services of U.S. design and architecture firms in India and Sri Lanka, the American Institute of Architects and the Commerce Dept. are gearing up for a trade mission to major cities in India - the market opportunities for U.S. design firms in India and Sri Lanka are substantial and span a wide range of facility types: in India such as airport projects, new towns along a corridor between Mumbai and Delhi, K-12 and higher-education facilities and in health care, and in Sri Lanka many opportunities for architecture firms as the country seeks to rebuild after a long civil war - AIA is one of nine organizations that will share a total of about \$2.4 million from Commerce's Market Development Cooperator program, which is managed by the department's International Trade Administration - The Commerce and AIA funds will support training programs to educate AIA members about how to do business in India and other foreign countries and let members know about assistance programs available from agencies such as Commerce, the U.S. Export-Import Bank and the Small Business Administration

29	Growth in India's Infrastructure Markets Projected	India/ Infrastructure	Neelam Mathews Jan., 2013		<ul style="list-style-type: none"> - Participants in India's infrastructure construction sector are hopeful of market growth in 2014, as economic conditions recover and the government steps up efforts to remove bottlenecks that have deferred or delayed projects - for the construction of first phase of new freight corridors, the Dedicated Freight Corridor Corp. of India Ltd. will build two corridors (eastern corridor and western corridor) spanning a total length of about 3,300 kilometers - the bid for first phase was released for a design-build, lump sum award of special steel bridges and approaches to be built in the western corridor that will include testing and commissioning - In the past year, the National Highway Authority of India cancelled two projects due to lack of proper financing - contractors are concerned about the need for government-led changes in problematic contract and arbitration rules, particularly as India's elections approach in early 2014 and there is a tendency not to make decisions and Disputes need to be sorted out and timelines by the government adhered to - the government would set up a National Investment Board, led by Prime Minister, to fast-track execution of approved projects by obtaining all regulatory clearances - The Ministry of Railways is creating a separate holding company to free up resources and changing its concession cost-sharing model on projects. The ministry recently will share 95% of net project revenue, after deducting operation and maintenance costs. There will also be no takeover of private infrastructure by the railways. - With the minimum 25-year concession period extendable to 35 years, it is expected that banks will be comfortable in lending money to projects such as new lines and rail-gauge conversions - Indian government has earmarked for public-private partnership financing seven hydroelectric power projects
30	India Constructs Mountain Highway Tunnels Near Border With Pakistan		Neelam Mathews Apr., 2017/		
31	International Firms Eye Ripe India Airport Market		Tom Ichniowski Sep., 2012		

32	India Builds Monuments to Its Political Past		Tom Ichniowski Sep., 2012		
33					
34					
35					
36					
37	Investors and Voters Are Willing To Pay To Pave U.S. Highways				<ul style="list-style-type: none"> - At 50 years in U.S, population and number of vehicle miles traveled are increasing, however, fuel tax revenue is decreasing. Road-use fees and private-sector investors will play ever-stronger roles. - Development concessions and private-public partnerships (PPP) will spur more design-build and partnering.
38	Sliding Economy Hammers State Transportation Projects	U.S.			<ul style="list-style-type: none"> - Decreasing revenue, uncertainty of federal highway trust fund and unstable lending market have led many state authorities to delay projects. - Reduced revenue from fuel taxes and vehicle fees and Congress' authorization of only a portion of 2009 federal highway funds have contributed to the state's need to Drastically reduce its program
39	Belgian Diabolo Project Opens On Schedule				
40	WCCC Slates Thinnual Alternative Project Delivery Summit				<ul style="list-style-type: none"> - Western Council of Construction Consumers is hosting its third-annual Alternative Project Delivery Summit, set for Sept. 14 at the Ziggurat Auditorium of the Department of General Services Building in West Sacramento - The full-day conference included a panel discussion and case studies on design-build, and public-private partnerships
41	Caltrans Will Ramp Up Innovative Project Delivery Methods				

Appendix B
Background Information for Base EER





Appendix C

Data Collection for Background Information

(Area, Road Length, and Population by Region/State)

State/Region	Area (sq-km)	Total Road Length(km)	Population
Kachin	89,039	3,836	1,642,841
Kayah	11,731	931	286,627
Kayin	30,382	2,024	1,504,326
Chin	36,018	2,119	478,801
Sagaing	94,621	4,698	5,325,347
Tanintharyi	43,343	1,560	1,408,401
Bago	39,403	2,069	4,867,373
Magwe	44,819	3,530	3,917,055
Mandalay	29,954	2,438	6,165,723
Mon	12,296	939	2,054,393
Rakhine	36,777	1,972	2,098,807
Yangon	10,171	1,064	7,360,703
Shan	155,796	10,732	5,824,432
Ayeyarwaddy	35,136	2,850	6,184,829
Naypyitaw	7,068	1,068	1,160,242
Total	676,553	41,831	50,279,900

(Natural Resources)

State/Region	Gas/	Lead/	Gold	Ruby	Pearl	Teak	Jade	Results		
	Petroleum/	Antimony/ Copper/Iron								
	Coal									
Kachin	No	No	Yes	No	No	No	Yes	28.6	2	40%
Kayah	No	Yes	No	No	No	Yes	No	28..57	2	40%
Kayin	No	Yes	No	No	No	Yes	No	28.6	2	40%
Chin	No	Yes	No	No	No	No	No	14.3	1	20%
Mon	Yes	Yes	Yes	No	No	Yes	No	57.1	4	80%
Rakhine	Yes	No	No	No	Yes	Yes	No	43.0	3	60%
Shan	No	Yes	Yes	No	No	Yes	No	43.0	3	60%
Sagaing	Yes	No	Yes	No	No	Yes	No	43.0	3	60%
Mandalay	Yes	Yes	Yes	Yes	No	Yes	No	71.4	5	100%
Magwe	Yes	Yes	No	No	No	Yes	No	43.0	3	60%
Nay Pyi Taw	No	No	No	No	No	Yes	No	14.3	1	20%
Bago	No	No	Yes	No	No	Yes	No	28.6	2	40%
Yangon	No	No	No	No	No	No	No	0.0	1	20%
Ayeyarwaddy	No	Yes	No	No	Yes	Yes	No	43.0	3	60%
Tanintharyi	Yes	Yes	No	No	Yes	Yes	No	57.1	4	80%

Electricity
Provision

State/Region	In connected village or ward, and household connected	In connected village or ward, and household not connected	In unconnected village or ward	Results		
Tanintharyi	0	0	100	0	1	20%
Rakhine	14	8	78	22	2	40%
Ayeyarwady	15	8	77	23	2	40%
Chin	17	4	79	21	2	40%
Kayin	23	8	69	31	2	40%
Sagaing	34	13	53	47	3	60%
Bago	36	14	50	50	3	60%
Magway	37	12	51	49	3	60%
Shan	37	12	51	49	3	60%
Kachin	48	22	30	70	4	80%
Nay Pyi Taw	54	13	32	67	4	80%
Mon	55	17	28	72	4	80%
Mandalay	63	10	27	73	4	80%
Kayah	75	22	3	97	5	100%
Yangon	79	13	8	92	5	100%

(ICT)

States & Regions	A		B	Results					
	Smart	Only	Internet Users in last 7 days (%)	A			B		Final Results
	Phone Users	Keypad Users							
	of Population	of Population							
	(%)	(%)							
Ayeyarwaddy	58	16	15	74	4	80%	3	60%	70%
Bago	68	12	21	80	4	80%	5	100%	90%
Chin	48	8	15	56	3	60%	3	60%	60%
Kachin	78	7	20	85	5	100%	4	80%	90%
Kayah	83	0	29	83	5	100%	5	100%	100%
Kayin	76	7	24	83	5	100%	5	100%	100%
Magwe	70	10	17	80	4	80%	4	80%	80%
Mandalay	81	5	25	86	5	100%	5	100%	100%
Mon	73	11	23	84	5	100%	5	100%	100%
Naypyitaw	56	28	26	84	5	100%	5	100%	100%
Rakhine	50	20	16	70	4	80%	4	80%	80%
Sagaing	74	9	19	83	5	100%	4	80%	90%
Shan	69	6	20	75	4	80%	5	100%	90%
Tanintharyi	77	5	21	82	5	100%	5	100%	100%
Yangon	91	2	42	93	5	100%	5	100%	100%

(Education)

State & Regions	Population's Literacy (%)	Results	
Ayeyarwaddy	93	5	100%
Bago	91	5	100%
Chin	81	5	100%
Kachin	90	5	100%
Kayah	81	5	100%
Kayin	75	4	80%
Magwe	92	5	100%
Mandalay	94	5	100%
Mon	79	4	80%
Naypyitaw	93	5	100%
Rakhine	87	5	100%
Sagaing	93	5	100%
Shan	65	4	80%
Tanintharyi	94	5	100%
Yangon	96	5	100%

(Hotels and Tourism)

State / Region	Number of Hotels, Motels, Guest Houses	%	Results	
Kachin	29	1.82	1	20%
Sagaing	33	2.1	1	20%
Mandalay	381	24	5	100%
Chin	6	0.4	1	20%
Magwe	34	2.14	1	20%
Shan	313	20	4	80%
Rakhine	60	3.7	1	20%
Naypyitaw	65	4	1	20%
Kayah	17	1	1	20%
Bago	70	4.4	1	20%
Yangon	387	24.3	5	100%
Ayeyarwaddy	79	5	1	20%
Mon	57	3.5	1	20%
Kayin	18	1.1	1	20%
Tanintharyi	41	2.6	1	20%
Total	1590			

(Workable Force)

State/Region	Workable Force of Population	%	Results	
	(%)			
Kachin	47.9	5.4	3	60%
Kayah	65.6	7.4	4	80%
Kayin	47.2	5.33	3	60%
Chin	55.9	6.3	4	80%
Sagaing	68.2	7.7	4	80%
Tanintharyi	57.1	6.45	4	80%
Bago	57.7	6.5	4	80%
Magwe	62.5	7.1	4	80%
Mandalay	66.7	7.53	4	80%
Mon	51.3	5.79	3	60%
Rakhine	55.6	6.28	4	80%
Yangon	58.4	6.59	4	80%
Shan	70.8	8	5	100%
Ayeyarwaddy	55.8	6.3	4	80%
Nay Pyi Taw	65.1	7.35	4	80%
	885.8			

(Environmental Sanitation and Water Provision)

States &	A		B			Results				
Region	holds without		(Percentage of Population access to							
			Improved Water)							
	2017	%	Dry Season	Rainy Season	Average	A		B		Final
										Result
Nay Pyi Taw	1	1	95	96	95.5	5	100%	5	100%	100%
Ayeyarwady	4	4	53	85	69	4	80%	4	80%	80%
Shan	4	4	85	87	86	4	80%	5	100%	90%
Yangon	0	0	86	95	90.5	5	100%	5	100%	100%
Rakhine	46	42	42	45	43.5	1	20%	3	60%	40%
Mon	5	5	92	94	93	3	60%	5	100%	80%
Mandalay	5	5	92	92	92	3	60%	5	100%	80%
Magway	7	6	82	84	83	3	60%	5	100%	80%
Bago	2	2	76	89	82.5	5	100%	5	100%	100%
Tanintharyi	7	6	80	80	80	3	60%	4	80%	70%
sagaing	6	5	91	92	91.5	3	60%	5	100%	80%
Chin	10	9	78	84	81	1	20%	5	100%	60%
Kayin	12	11	72	74	73	1	20%	4	80%	50%
Kayah	1	1	87	92	89.5	5	100%	5	100%	100%
Kachin	0	0	95	95	95	5	100%	5	100%	100%

(Agricultural and Fishery)

States and Regions	Skilled Agricultural Forestry and Fishery Workers	%		Results
Kachin	238,475	3	1	20%
Kayah	73,074	1	1	20%
Kayin	239,783	3	1	20%
Chin	114,199	1	1	20%
Tanintharyi	214,008	3	1	20%
Mon	221,738	3	1	20%
Rakhine	281,377	3	1	20%
Yangon	293,595	3	1	20%
Nay Pyi Taw	142,333	2	1	20%
Bago	730,197	9	2	40%
Mandalay	811,677	10	2	40%
Sagaing	1,197,753	14	3	40%
Magway	922,003	11	3	60%
Ayeyarwady	1,147,086	14	3	60%
Shan	1,808,385	21	5	100%

Appendix D :
Pair-Wise Comparison (1)

(Kachin)

	Urban				Land				Real Estate				Infra				Geometric Average	Priority Vector
Criteria	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC		
BA	1.00	1.25	1.25	1.25	1.25	0.44	1.50	1.25	1.25	0.50	1.25	1.25	1.25	1.50	1.25	1.25	1.116	0.0624
AE	0.80	1.00	0.50	0.50	0.50	0.17	0.33	0.50	0.50	0.20	0.50	0.50	0.50	0.33	0.50	0.50	0.451	0.0252
MM	0.80	2.00	1.00	0.50	0.50	0.17	0.33	0.50	0.50	0.20	0.50	0.50	0.50	0.33	0.50	0.50	0.491	0.0275
ME	0.80	2.00	2.00	1.00	0.50	0.17	0.33	0.50	0.50	0.20	0.50	0.50	0.50	0.33	0.50	0.50	0.536	0.0300
DS	0.80	2.00	2.00	2.00	1.00	0.17	0.33	0.50	0.50	0.20	0.50	0.50	0.50	0.33	0.50	0.50	0.584	0.0327
DP	2.25	6.00	6.00	6.00	6.00	1.00	1.40	1.20	1.20	1.80	1.20	1.20	1.20	1.40	1.20	1.20	1.929	0.1079
DA	0.67	3.00	3.00	3.00	3.00	0.71	1.00	1.50	1.50	0.33	1.50	1.50	1.50	0.50	1.50	1.50	1.341	0.0750
IL	0.80	2.00	2.00	2.00	2.00	0.83	0.67	1.00	0.50	0.20	0.50	0.50	0.50	0.33	0.50	0.50	0.736	0.0411
MD	0.80	2.00	2.00	2.00	2.00	0.83	0.67	2.00	1.00	0.20	0.50	0.50	0.50	0.33	0.50	0.50	0.803	0.0449
BP	2.00	5.00	5.00	5.00	5.00	0.56	3.00	5.00	5.00	1.00	1.25	1.25	1.25	1.50	1.25	1.25	2.168	0.1212
RR	0.80	2.00	2.00	2.00	2.00	0.83	0.67	2.00	2.00	0.80	1.00	0.50	0.50	0.33	0.50	0.50	0.954	0.0534
VR	0.80	2.00	2.00	2.00	2.00	0.83	0.67	2.00	2.00	0.80	2.00	1.00	0.50	0.33	0.50	0.50	1.041	0.0582
MP	0.80	2.00	2.00	2.00	2.00	0.83	0.67	2.00	2.00	0.80	2.00	2.00	1.00	0.33	0.50	0.50	1.135	0.0635
TD	0.67	3.00	3.00	3.00	3.00	0.71	2.00	3.00	3.00	0.67	3.00	3.00	3.00	1.00	1.50	1.50	1.897	0.1061
LI	0.80	2.00	2.00	2.00	2.00	0.83	0.67	2.00	2.00	0.80	2.00	2.00	2.00	0.67	1.00	0.50	1.293	0.0723
TC	0.80	2.00	2.00	2.00	2.00	0.83	0.67	2.00	2.00	0.80	2.00	2.00	2.00	0.67	2.00	1.00	1.410	0.0788
(sum)																	17.885	1.000

(Sagain)

	Urban				Land				Real Estate				Infra				Geometric Average	Priority Vector
Criteria	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC		
BA	1.00	1.50	1.75	0.50	1.50	0.44	1.25	1.25	1.50	0.44	0.44	1.50	1.50	1.25	1.25	1.25	1.037	0.0597
AE	0.67	1.00	0.40	0.33	0.50	0.29	1.50	1.50	0.50	0.29	0.29	0.50	0.50	1.50	1.50	1.50	0.649	0.0374
MM	0.57	2.50	1.00	0.43	1.67	0.38	1.33	1.33	1.67	0.38	0.38	1.67	1.67	1.33	1.33	1.33	1.003	0.0578
ME	2.00	3.00	2.33	1.00	1.50	0.44	1.25	1.25	1.50	0.44	0.44	1.50	1.50	1.25	1.25	1.25	1.202	0.0692
DS	0.67	2.00	0.60	0.67	1.00	0.29	1.50	1.50	0.50	0.29	0.29	0.50	0.50	1.50	1.50	1.50	0.758	0.0437
DP	2.25	3.50	2.67	2.25	3.50	1.00	1.20	1.20	1.40	0.50	0.50	1.40	1.40	1.20	1.20	1.20	1.423	0.0820
DA	0.80	0.67	0.75	0.80	0.67	0.83	1.00	0.50	0.33	0.17	0.17	0.33	0.33	0.50	0.50	0.50	0.491	0.0283
IL	0.80	0.67	0.75	0.80	0.67	0.83	2.00	1.00	0.33	0.17	0.17	0.33	0.33	0.50	0.50	0.50	0.535	0.0308
MD	0.67	2.00	0.60	0.67	2.00	0.71	3.00	3.00	1.00	0.29	0.29	0.50	0.50	1.50	1.50	1.50	0.954	0.0550
BP	2.25	3.50	2.67	2.25	3.50	2.00	6.00	6.00	3.50	1.00	0.50	1.40	1.40	1.20	1.20	1.20	2.009	0.1158
RR	2.25	3.50	2.67	2.25	3.50	2.00	6.00	6.00	3.50	2.00	1.00	1.40	1.40	1.20	1.20	1.20	2.191	0.1262
VR	0.67	2.00	0.60	0.67	2.00	0.71	3.00	3.00	2.00	0.71	0.71	1.00	0.50	1.50	1.50	1.50	1.167	0.0672
MP	0.67	2.00	0.60	0.67	2.00	0.71	3.00	3.00	2.00	0.71	0.71	2.00	1.00	1.50	1.50	1.50	1.272	0.0733
TD	0.80	0.67	0.75	0.80	0.67	0.83	2.00	2.00	0.67	0.83	0.83	0.67	0.67	1.00	0.50	0.50	0.813	0.0468
LI	0.80	0.67	0.75	0.80	0.67	0.83	2.00	2.00	0.67	0.83	0.83	0.67	0.67	2.00	1.00	0.50	0.887	0.0511
TC	0.80	0.67	0.75	0.80	0.67	0.83	2.00	2.00	0.67	0.83	0.83	0.67	0.67	2.00	2.00	1.00	0.967	0.0557
(sum)																	17.359	1.000

(Mandalay)

	Urban				Land				Real Estate				Infra				Geometric Average	Priority Vector
Criteria	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC		
BA	1.00	0.43	0.43	0.38	0.43	0.38	0.38	1.67	1.67	0.38	0.38	0.38	1.67	0.50	1.67	1.67	0.663	0.0386
AE	2.33	1.00	0.50	0.44	0.50	0.44	0.44	1.50	1.50	0.44	0.44	0.44	1.50	1.75	1.50	1.50	0.839	0.0488
MM	2.33	2.00	1.00	0.44	0.50	0.44	0.44	1.50	1.50	0.44	0.44	0.44	1.50	1.75	1.50	1.50	0.914	0.0532
ME	2.67	2.25	2.25	1.00	1.80	0.50	0.50	1.40	1.40	0.50	0.50	0.50	1.40	1.60	1.40	1.40	1.124	0.0654
DS	2.33	2.00	2.00	0.56	1.00	0.44	0.44	1.50	1.50	0.44	0.44	0.44	1.50	1.75	1.50	1.50	1.011	0.0588
DP	2.67	2.25	2.25	2.00	2.25	1.00	0.50	1.40	1.40	0.50	0.50	0.50	1.40	1.60	1.40	1.40	1.243	0.0723
DA	2.67	2.25	2.25	2.00	2.25	2.00	1.00	1.40	1.40	0.50	0.50	0.50	1.40	1.60	1.40	1.40	1.356	0.0789
IL	0.60	0.67	0.67	0.71	0.67	0.71	0.71	1.00	0.50	0.29	0.29	0.29	0.50	0.40	0.50	0.50	0.529	0.0308
MD	0.60	0.67	0.67	0.71	0.67	0.71	0.71	2.00	1.00	0.29	0.29	0.29	0.50	0.40	0.50	0.50	0.577	0.0336
BP	2.67	2.25	2.25	2.00	2.25	2.00	2.00	3.50	3.50	1.00	0.50	0.50	1.40	1.60	1.40	1.40	1.658	0.0965
RR	2.67	2.25	2.25	2.00	2.25	2.00	2.00	3.50	3.50	2.00	1.00	0.50	1.40	1.60	1.40	1.40	1.808	0.1052
VR	2.67	2.25	2.25	2.00	2.25	2.00	2.00	3.50	3.50	2.00	2.00	1.00	1.40	1.60	1.40	1.40	1.972	0.1147
MP	0.60	0.67	0.67	0.71	0.67	0.71	0.71	2.00	2.00	0.71	0.71	0.71	1.00	0.40	0.50	0.50	0.747	0.0435
TD	2.00	0.57	0.57	0.63	0.57	0.63	0.63	2.50	2.50	0.63	0.63	0.63	2.50	1.00	1.67	1.67	0.998	0.0581
LI	0.60	0.67	0.67	0.71	0.67	0.71	0.71	2.00	2.00	0.71	0.71	0.71	2.00	0.60	1.00	0.50	0.836	0.0486
TC	0.60	0.67	0.67	0.71	0.67	0.71	0.71	2.00	2.00	0.71	0.71	0.71	2.00	0.60	2.00	1.00	0.911	0.0530
(sum)																	17.188	1.000

(Chin)

Criteria	Urban				Land				Real Estate				Infra				Geometric Average	Priority Vector
	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC		
BA	1.00	0.50	0.25	0.50	0.50	0.17	0.50	0.50	0.50	0.33	0.33	0.33	0.20	0.20	0.50	0.50	0.386	0.0203
AE	2.00	1.00	0.25	0.50	0.50	0.17	0.50	0.50	0.50	0.33	0.33	0.33	0.20	0.20	0.50	0.50	0.421	0.0221
MM	4.00	4.00	1.00	1.33	1.33	0.38	1.33	1.33	1.33	1.67	1.67	1.67	0.43	0.43	1.33	1.33	1.256	0.0660
ME	2.00	2.00	0.75	1.00	0.50	0.17	0.50	0.50	0.50	0.33	0.33	0.33	0.20	0.20	0.50	0.50	0.491	0.0258
DS	2.00	2.00	0.75	2.00	1.00	0.17	0.50	0.50	0.50	0.33	0.33	0.33	0.20	0.20	0.50	0.50	0.536	0.0282
DP	6.00	6.00	2.67	6.00	6.00	1.00	1.20	1.20	1.20	1.40	1.40	1.40	1.80	1.80	1.20	1.20	2.019	0.1061
DA	2.00	2.00	0.75	2.00	2.00	0.83	1.00	0.50	0.50	0.33	0.33	0.33	0.20	0.20	0.50	0.50	0.646	0.0340
IL	2.00	2.00	0.75	2.00	2.00	0.83	2.00	1.00	0.50	0.33	0.33	0.33	0.20	0.20	0.50	0.50	0.705	0.0370
MD	2.00	2.00	0.75	2.00	2.00	0.83	2.00	2.00	1.00	0.33	0.33	0.33	0.20	0.20	0.50	0.50	0.769	0.0404
BP	3.00	3.00	0.60	3.00	3.00	0.71	3.00	3.00	3.00	1.00	0.50	0.50	0.33	0.33	1.50	1.50	1.290	0.0678
RR	3.00	3.00	0.60	3.00	3.00	0.71	3.00	3.00	3.00	2.00	1.00	0.50	0.33	0.33	1.50	1.50	1.406	0.0739
VR	3.00	3.00	0.60	3.00	3.00	0.71	3.00	3.00	3.00	2.00	2.00	1.00	0.33	0.33	1.50	1.50	1.534	0.0806
MP	5.00	5.00	2.33	5.00	5.00	0.56	5.00	5.00	5.00	3.00	3.00	3.00	1.00	0.50	1.25	1.25	2.487	0.1307
TD	5.00	5.00	2.33	5.00	5.00	0.56	5.00	5.00	5.00	3.00	3.00	3.00	2.00	1.00	1.25	1.25	2.712	0.1425
LI	2.00	2.00	0.75	2.00	2.00	0.83	2.00	2.00	2.00	0.67	0.67	0.67	0.80	0.80	1.00	0.50	1.135	0.0596
TC	2.00	2.00	0.75	2.00	2.00	0.83	2.00	2.00	2.00	0.67	0.67	0.67	0.80	0.80	2.00	1.00	1.238	0.0650
(sum)																	19.029	1.000

(Magwe)

Criteria	Urban				Land				Real Estate				Infra				Geometric Average	Priority Vector
	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC		
BA	1.00	1.67	0.50	0.50	1.67	0.38	0.43	0.38	1.67	0.50	1.67	0.38	1.67	1.67	1.33	0.50	0.818	0.0468
AE	0.60	1.00	0.40	0.40	0.50	0.29	0.33	0.29	0.50	0.40	0.50	0.29	0.50	0.50	1.50	0.40	0.470	0.0269
MM	2.00	2.50	1.00	0.50	1.67	0.38	0.43	0.38	1.67	0.50	1.67	0.38	1.67	1.67	1.33	0.50	0.915	0.0523
ME	2.00	2.50	2.00	1.00	1.67	0.38	0.43	0.38	1.67	0.50	1.67	0.38	1.67	1.67	1.33	0.50	0.998	0.0571
DS	0.60	2.00	0.60	0.60	1.00	0.29	0.33	0.29	0.50	0.40	0.50	0.29	0.50	0.50	1.50	0.40	0.539	0.0308
DP	2.67	3.50	2.67	2.67	3.50	1.00	1.80	0.50	1.40	1.60	1.40	0.50	1.40	1.40	1.20	1.60	1.560	0.0892
DA	2.33	3.00	2.33	2.33	3.00	0.56	1.00	0.44	1.50	1.75	1.50	0.44	1.50	1.50	1.25	1.75	1.410	0.0806
IL	2.67	3.50	2.67	2.67	3.50	2.00	2.25	1.00	1.40	1.60	1.40	0.50	1.40	1.40	1.20	1.60	1.725	0.0987
MD	0.60	2.00	0.60	0.60	2.00	0.71	0.67	0.71	1.00	0.40	0.50	0.29	0.50	0.50	1.50	0.40	0.688	0.0393
BP	2.00	2.50	2.00	2.00	2.50	0.63	0.57	0.63	2.50	1.00	1.67	0.38	1.67	1.67	1.33	0.50	1.243	0.0711
RR	0.60	2.00	0.60	0.60	2.00	0.71	0.67	0.71	2.00	0.60	1.00	0.29	0.50	0.50	1.50	0.40	0.770	0.0440
VR	2.67	3.50	2.67	2.67	3.50	2.00	2.25	2.00	3.50	2.67	3.50	1.00	1.40	1.40	1.20	1.60	2.178	0.1246
MP	0.60	2.00	0.60	0.60	2.00	0.71	0.67	0.71	2.00	0.60	2.00	0.71	1.00	0.50	1.50	0.40	0.889	0.0508
TD	0.60	2.00	0.60	0.60	2.00	0.71	0.67	0.71	2.00	0.60	2.00	0.71	2.00	1.00	1.50	0.40	0.969	0.0554
LI	0.75	0.67	0.75	0.75	0.67	0.83	0.80	0.83	0.67	0.75	0.67	0.83	0.67	0.67	1.00	0.25	0.699	0.0399
TC	2.00	2.50	2.00	2.00	2.50	0.63	0.57	0.63	2.50	2.00	2.50	0.63	2.50	2.50	4.00	1.00	1.617	0.0925
(sum)																	17.486	1.000

(Shan)

Criteria	Urban				Land				Real Estate				Infra				Geometric Average	Priority Vector
	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC		
BA	1.00	1.33	0.43	0.50	1.67	0.50	0.43	0.43	1.67	0.38	0.38	1.67	0.43	1.67	1.33	1.67	0.798	0.0448
AE	0.75	1.00	0.20	0.25	0.33	0.25	0.20	0.20	0.33	0.17	0.17	0.33	0.20	0.33	0.50	0.33	0.300	0.0168
MM	2.33	5.00	1.00	1.75	1.50	1.75	0.50	0.50	1.50	0.44	0.44	1.50	0.50	1.50	1.25	1.50	1.142	0.0641
ME	2.00	4.00	0.57	1.00	1.67	0.50	0.43	0.43	1.67	0.38	0.38	1.67	0.43	1.67	1.33	1.67	0.949	0.0533
DS	0.60	3.00	0.67	0.60	1.00	0.40	0.33	0.33	0.50	0.29	0.29	0.50	0.33	0.50	1.50	0.50	0.555	0.0312
DP	2.00	4.00	0.57	2.00	2.50	1.00	0.43	0.43	1.67	0.38	0.38	1.67	0.43	1.67	1.33	1.67	1.062	0.0596
DA	2.33	5.00	2.00	2.33	3.00	2.33	1.00	0.50	1.50	0.44	0.44	1.50	0.50	1.50	1.25	1.50	1.348	0.0757
IL	2.33	5.00	2.00	2.33	3.00	2.33	2.00	1.00	1.50	0.44	0.44	1.50	0.50	1.50	1.25	1.50	1.470	0.0825
MD	0.60	3.00	0.67	0.60	2.00	0.60	0.67	0.67	1.00	0.29	0.29	0.50	0.33	0.50	1.50	0.50	0.677	0.0380
BP	2.67	6.00	2.25	2.67	3.50	2.67	2.25	2.25	3.50	1.00	0.50	1.40	1.80	1.40	1.20	1.40	1.959	0.1100
RR	2.67	6.00	2.25	2.67	3.50	2.67	2.25	2.25	3.50	2.00	1.00	1.40	1.80	1.40	1.20	1.40	2.136	0.1199
VR	0.60	3.00	0.67	0.60	2.00	0.60	0.67	0.67	2.00	0.71	0.71	1.00	0.33	0.50	1.50	0.50	0.828	0.0465
MP	2.33	5.00	2.00	2.33	3.00	2.33	2.00	2.00	3.00	0.56	0.56	3.00	1.00	1.50	1.25	1.50	1.798	0.1009
TD	0.60	3.00	0.67	0.60	2.00	0.60	0.67	0.67	2.00	0.71	0.71	2.00	0.67	1.00	1.50	0.50	0.943	0.0529
LI	0.75	2.00	0.80	0.75	0.67	0.75	0.80	0.80	0.67	0.83	0.83	0.67	0.80	0.67	1.00	0.33	0.772	0.0433
TC	0.60	3.00	0.67	0.60	2.00	0.60	0.67	0.67	2.00	0.71	0.71	2.00	0.67	2.00	3.00	1.00	1.074	0.0603
(sum)																	17.812	1.000

(Rakhine)

	Urban				Land				Real Estate				Infra				Geometric Average	Priority Vector
Criteria	BA	AE	MM	ME	DS	DP	DA	IL	RD	BP	RR	VR	MP	TD	LI	TC		
BA	1.00	1.333	0.5	0.5	1.333	1.667	1.667	0.375	1.333	1.667	0.375	1.333	1.667	1.667	1.667	1.667	1.090	0.0607
AE	0.75	1.00	0.25	0.25	0.50	0.333	0.333	0.17	0.50	0.33	0.17	0.50	0.33	0.33	0.33	0.33	0.358	0.0200
MM	2.00	4.00	1.00	0.50	1.33	1.667	1.667	0.38	1.33	1.67	0.38	1.33	1.67	1.67	1.67	1.67	1.273	0.0709
ME	2.00	4.00	2.00	1.00	1.33	1.667	1.667	0.38	1.33	1.67	0.38	1.33	1.67	1.67	1.67	1.67	1.388	0.0773
DS	0.75	2.00	0.75	0.75	1.00	0.333	0.333	0.17	0.50	0.33	0.17	0.50	0.33	0.33	0.33	0.33	0.448	0.0250
DP	0.60	3.00	0.60	0.60	3.00	1.00	0.5	0.286	1.5	0.5	0.286	1.5	0.5	0.5	0.5	0.5	0.723	0.0403
DA	0.60	3.00	0.60	0.60	3.00	2.00	1.00	0.286	1.5	0.5	0.286	1.5	0.5	0.5	0.5	0.5	0.788	0.0439
IL	2.67	6.00	2.67	2.67	6.00	3.50	3.50	1.00	1.20	1.40	0.50	1.20	1.40	1.40	1.40	1.40	1.914	0.1066
MD	0.75	2.00	0.75	0.75	2.00	0.67	0.67	0.83	1.00	0.33	0.17	0.50	0.33	0.33	0.33	0.33	0.590	0.0328
BP	0.60	3.00	0.60	0.60	3.00	2.00	2.00	0.71	3.00	1.00	0.29	1.50	0.50	0.50	0.50	0.50	0.951	0.0529
RR	2.67	6.00	2.67	2.67	6.00	3.50	3.50	2.00	6.00	3.50	1.00	1.20	1.40	1.40	1.40	1.40	2.444	0.1361
VR	0.75	2.00	0.75	0.75	2.00	0.67	0.67	0.83	2.00	0.67	0.83	1.00	0.333	0.333	0.333	0.333	0.743	0.0414
MP	0.60	3.00	0.60	0.60	3.00	2.00	2.00	0.71	3.00	2.00	0.71	3.00	1.00	0.50	0.50	0.50	1.147	0.0638
TD	0.60	3.00	0.60	0.60	3.00	2.00	2.00	0.71	3.00	2.00	0.71	3.00	2.00	1.00	0.50	0.50	1.250	0.0696
LI	0.60	3.00	0.60	0.60	3.00	2.00	2.00	0.71	3.00	2.00	0.71	3.00	2.00	2.00	1.00	0.50	1.364	0.0759
TC	0.60	3.00	0.60	0.60	3.00	2.00	2.00	0.71	3.00	2.00	0.71	3.00	2.00	2.00	2.00	1.00	1.487	0.0828
(sum)																	17.958	1.0000

(Naypyitaw)

	Urban				Land				Real Estate				Infra				Geometric Average	Priority Vector
Criteria	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC		
BA	1.00	1.50	0.40	0.50	0.50	1.50	1.50	1.50	1.50	1.50	0.40	0.50	0.40	0.33	0.50	1.50	0.789	0.0421
AE	0.67	1.00	0.25	0.33	0.33	0.50	0.50	0.50	0.50	0.50	0.25	0.33	0.25	0.20	0.33	0.50	0.398	0.0212
MM	2.50	4.00	1.00	1.67	1.67	1.33	1.33	1.33	1.33	1.33	0.50	1.67	0.50	0.43	1.67	1.33	1.271	0.0678
ME	2.00	3.00	0.60	1.00	0.50	1.50	1.50	1.50	1.50	1.50	0.40	0.50	0.40	0.33	2.00	1.50	1.006	0.0536
DS	2.00	3.00	0.60	2.00	1.00	1.50	1.50	1.50	1.50	1.50	0.40	0.50	0.40	0.33	0.50	1.50	1.006	0.0536
DP	0.67	2.00	0.75	0.67	0.67	1.00	0.50	0.50	0.50	0.50	0.25	0.33	0.25	0.20	0.33	0.50	0.507	0.0270
DA	0.67	2.00	0.75	0.67	0.67	2.00	1.00	0.50	0.50	0.50	0.25	0.33	0.25	0.20	0.33	0.50	0.553	0.0295
IL	0.67	2.00	0.75	0.67	0.67	2.00	2.00	1.00	0.50	0.50	0.25	0.33	0.25	0.20	0.33	0.50	0.603	0.0322
MD	0.67	2.00	0.75	0.67	0.67	2.00	2.00	2.00	1.00	0.50	0.25	0.33	0.25	0.20	0.33	0.50	0.658	0.0351
BP	0.67	2.00	0.75	0.67	0.67	2.00	2.00	2.00	2.00	1.00	0.25	0.33	0.25	0.20	0.33	0.50	0.718	0.0383
RR	2.50	4.00	2.00	2.50	2.50	4.00	4.00	4.00	4.00	4.00	1.00	1.67	0.50	0.43	1.67	1.33	2.056	0.1096
VR	2.00	3.00	0.60	2.00	2.00	3.00	3.00	3.00	3.00	3.00	0.60	1.00	0.40	0.33	0.50	1.50	1.397	0.0745
MP	2.50	4.00	2.00	2.50	2.50	4.00	4.00	4.00	4.00	4.00	2.00	2.50	1.00	0.43	1.67	1.33	2.299	0.1226
TD	3.00	5.00	2.33	3.00	3.00	5.00	5.00	5.00	5.00	5.00	2.33	3.00	2.33	1.00	1.50	1.25	2.934	0.1564
LI	2.00	3.00	0.60	0.50	2.00	3.00	3.00	3.00	3.00	3.00	0.60	2.00	0.60	0.67	1.00	1.50	1.496	0.0798
TC	0.67	2.00	0.75	0.67	0.67	2.00	2.00	2.00	2.00	2.00	0.75	0.67	0.75	0.80	0.67	1.00	1.068	0.0569
(sum)																	18.759	1.000

(Kayah)

	Urban				Land				Real Estate				Infra				Geometric Average	Priority Vector
Criteria	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC		
BA	1.00	0.50	0.40	0.50	1.50	0.29	0.40	1.50	1.50	0.29	0.33	0.40	0.40	1.50	1.50	0.33	0.617	0.0332
AE	2.00	1.00	0.40	0.50	1.50	0.29	0.40	1.50	1.50	0.29	0.33	0.40	0.40	1.50	1.50	0.33	0.673	0.0362
MM	2.50	2.50	1.00	1.67	1.33	0.38	0.50	1.33	1.33	0.38	0.43	0.50	0.50	1.33	1.33	0.43	0.885	0.0476
ME	2.00	2.00	0.60	1.00	1.50	0.29	0.40	1.50	1.50	0.29	0.33	0.40	0.40	1.50	1.50	0.33	0.753	0.0405
DS	0.67	0.67	0.75	0.67	1.00	0.17	0.25	0.50	0.50	0.17	0.20	0.25	0.25	0.50	0.50	0.20	0.386	0.0208
DP	3.50	3.50	2.67	3.50	6.00	1.00	1.60	1.20	1.20	2.00	1.80	1.60	1.60	1.20	1.20	1.80	1.932	0.1039
DA	2.50	2.50	2.00	2.50	4.00	0.63	1.00	1.33	1.33	0.38	0.43	0.50	0.50	1.33	1.33	0.43	1.095	0.0589
IL	0.67	0.67	0.75	0.67	2.00	0.83	0.75	1.00	0.50	0.17	0.20	0.25	0.25	0.50	0.50	0.20	0.498	0.0268
MD	0.67	0.67	0.75	0.67	2.00	0.83	0.75	2.00	1.00	0.17	0.20	0.25	0.25	0.50	0.50	0.20	0.543	0.0292
BP	3.50	3.50	2.67	3.50	6.00	0.50	2.67	6.00	6.00	1.00	1.80	1.60	1.60	1.20	1.20	1.80	2.237	0.1203
RR	3.00	3.00	2.33	3.00	5.00	0.56	2.33	5.00	5.00	0.56	1.00	1.75	1.75	1.25	1.25	0.50	1.813	0.0975
VR	2.50	2.50	2.00	2.50	4.00	0.63	2.00	4.00	4.00	0.63	0.57	1.00	0.50	1.33	1.33	0.43	1.440	0.0774
MP	2.50	2.50	2.00	2.50	4.00	0.63	2.00	4.00	4.00	0.63	0.57	2.00	1.00	1.33	1.33	0.43	1.570	0.0844
TD	0.67	0.67	0.75	0.67	2.00	0.83	0.75	2.00	2.00	0.83	0.80	0.75	0.75	1.00	0.50	0.20	0.820	0.0441
LI	0.67	0.67	0.75	0.67	2.00	0.83	0.75	2.00	2.00	0.83	0.80	0.75	0.75	2.00	1.00	0.20	0.894	0.0481
TC	3.00	3.00	2.33	3.00	5.00	0.56	2.33	5.00	5.00	0.56	2.00	2.33	2.33	5.00	5.00	1.00	2.437	0.1311
(sum)																	18.591	1.000

(Bago)

	Urban				Land				Real Estate				Infra				Geometric	Priority
Criteria	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC	Average	Vector
BA	1.00	0.25	0.25	0.33	0.50	0.50	0.17	0.50	0.33	0.50	0.20	0.17	0.33	0.25	0.50	0.33	0.341	0.0181
AE	4.00	1.00	0.50	1.67	1.33	1.33	0.38	1.33	1.67	1.33	0.43	0.38	1.67	0.50	1.33	1.67	1.043	0.0552
MM	4.00	2.00	1.00	1.67	1.33	1.33	0.38	1.33	1.67	1.33	0.43	0.38	1.67	0.50	1.33	1.67	1.137	0.0602
ME	3.00	0.60	0.60	1.00	1.50	1.50	0.29	1.50	0.50	1.50	0.33	0.29	0.50	0.40	1.50	0.50	0.755	0.0400
DS	2.00	0.75	0.75	0.67	1.00	0.50	0.17	0.50	0.33	0.50	0.20	0.17	0.33	0.25	0.50	0.33	0.446	0.0236
DP	2.00	0.75	0.75	0.67	2.00	1.00	0.17	0.50	0.33	0.50	0.20	0.17	0.33	0.25	0.50	0.33	0.486	0.0257
DA	6.00	2.67	2.67	3.50	6.00	6.00	1.00	1.20	1.40	1.20	1.80	0.50	1.40	1.60	1.20	1.40	1.929	0.1021
IL	2.00	0.75	0.75	0.67	2.00	2.00	0.83	1.00	0.33	0.50	0.20	0.17	0.33	0.25	0.50	0.33	0.586	0.0310
MD	3.00	0.60	0.60	2.00	3.00	3.00	0.71	3.00	1.00	1.50	0.33	0.29	0.50	0.40	1.50	0.50	0.993	0.0526
BP	2.00	0.75	0.75	0.67	2.00	2.00	0.83	2.00	0.67	1.00	0.20	0.17	0.33	0.25	0.50	0.33	0.667	0.0353
RR	5.00	2.33	2.33	3.00	5.00	5.00	0.56	5.00	3.00	5.00	1.00	0.44	1.50	1.75	1.25	1.50	2.135	0.1131
VR	6.00	2.67	2.67	3.50	6.00	6.00	2.00	6.00	3.50	6.00	2.25	1.00	1.40	1.60	1.20	1.40	2.762	0.1463
MP	3.00	0.60	0.60	2.00	3.00	3.00	0.71	3.00	2.00	3.00	0.67	0.71	1.00	0.40	1.50	0.50	1.250	0.0662
TD	4.00	2.00	2.00	2.50	4.00	4.00	0.63	4.00	2.50	4.00	0.57	0.63	2.50	1.00	1.33	1.67	1.911	0.1012
LI	2.00	0.75	0.75	0.67	2.00	2.00	0.83	2.00	0.67	2.00	0.80	0.83	0.67	0.75	1.00	0.33	0.981	0.0520
TC	3.00	0.60	0.60	2.00	3.00	3.00	0.71	3.00	2.00	3.00	0.67	0.71	2.00	0.60	3.00	1.00	1.460	0.0773
(sum)																	18.883	1.000

(Yangon)

	Urban				Land				Real Estate				Infra				Geometric	Priority
Criteria	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC	Average	Vector
BA	1.00	0.50	0.50	0.50	1.80	0.50	1.60	0.50	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	0.909	0.0541
AE	2.00	1.00	0.50	0.50	1.80	0.50	1.60	0.50	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	0.991	0.0590
MM	2.00	2.00	1.00	0.50	1.80	0.50	1.60	0.50	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	1.081	0.0643
ME	2.00	2.00	2.00	1.00	1.80	0.50	1.60	0.50	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	1.179	0.0701
DS	0.56	0.56	0.56	0.56	1.00	0.44	1.75	0.44	1.75	1.75	0.44	0.44	1.75	1.50	1.25	1.50	0.865	0.0515
DP	2.00	2.00	2.00	2.00	2.25	1.00	1.60	0.50	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	1.303	0.0775
DA	0.63	0.63	0.63	0.63	0.57	0.63	1.00	0.38	0.50	0.50	0.38	0.38	0.50	1.67	1.33	1.67	0.661	0.0393
IL	2.00	2.00	2.00	2.00	2.25	2.00	2.67	1.00	1.60	1.60	0.50	0.50	1.60	1.40	1.20	1.40	1.467	0.0873
MD	0.63	0.63	0.63	0.63	0.57	0.63	2.00	0.63	1.00	0.50	0.38	0.38	0.50	1.67	1.33	1.67	0.744	0.0443
BP	0.63	0.63	0.63	0.63	0.57	0.63	2.00	0.63	2.00	1.00	0.38	0.38	0.50	1.67	1.33	1.67	0.812	0.0483
RR	2.00	2.00	2.00	2.00	2.25	2.00	2.67	2.00	2.67	2.67	1.00	0.50	1.60	1.40	1.20	1.40	1.706	0.1015
VR	2.00	2.00	2.00	2.00	2.25	2.00	2.67	2.00	2.67	2.67	2.00	1.00	1.60	1.40	1.20	1.40	1.860	0.1107
MP	0.63	0.63	0.63	0.63	0.57	0.63	2.00	0.63	2.00	2.00	0.63	0.63	1.00	1.67	1.33	1.67	0.943	0.0561
TD	0.71	0.71	0.71	0.71	0.67	0.71	0.60	0.71	0.60	0.60	0.71	0.71	0.60	1.00	1.50	0.50	0.712	0.0424
LI	0.83	0.83	0.83	0.83	0.80	0.83	0.75	0.83	0.75	0.75	0.83	0.83	0.75	0.67	1.00	0.33	0.763	0.0454
TC	0.71	0.71	0.71	0.71	0.67	0.71	0.60	0.71	0.60	0.60	0.71	0.71	0.60	2.00	3.00	1.00	0.811	0.0483
(sum)																	16.808	1.000

(Ayeyarwaddy)

	Urban				Land				Real Estate				Infra				Geometric	Priority
Criteria	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC	Average	Vector
BA	1.00	1.75	1.75	0.44	1.50	1.25	1.25	1.25	1.50	1.25	1.50	1.50	1.50	1.50	1.50	1.25	1.305	0.0771
AE	0.57	1.00	0.50	0.38	1.67	1.33	1.33	1.33	1.67	1.33	1.67	1.67	1.67	1.67	1.67	1.33	1.190	0.0703
MM	0.57	2.00	1.00	0.38	1.67	1.33	1.33	1.33	1.67	1.33	1.67	1.67	1.67	1.67	1.67	1.33	1.297	0.0767
ME	2.25	2.67	2.67	1.00	1.40	1.20	1.20	1.20	1.40	1.20	1.40	1.40	1.40	1.40	1.40	1.50	1.479	0.0874
DS	0.67	0.60	0.60	0.71	1.00	1.50	1.50	1.50	0.50	1.50	0.50	0.50	0.50	0.50	0.50	1.50	0.784	0.0463
DP	0.80	0.75	0.75	0.83	0.67	1.00	0.50	0.50	0.33	0.50	0.33	0.33	0.33	0.33	0.33	0.50	0.511	0.0302
DA	0.80	0.75	0.75	0.83	0.67	2.00	1.00	0.50	0.33	0.50	0.33	0.33	0.33	0.33	0.33	0.50	0.557	0.0329
IL	0.80	0.75	0.75	0.83	0.67	2.00	2.00	1.00	0.33	0.50	0.33	0.33	0.33	0.33	0.33	0.50	0.607	0.0359
MD	0.67	0.60	0.60	0.71	2.00	3.00	3.00	3.00	1.00	1.50	0.50	0.50	0.50	0.50	0.50	1.50	0.974	0.0575
BP	0.80	0.75	0.75	0.83	0.67	2.00	2.00	2.00	0.67	1.00	0.33	0.33	0.33	0.33	0.33	0.50	0.692	0.0409
RR	0.67	0.60	0.60	0.71	2.00	3.00	3.00	3.00	2.00	3.00	1.00	0.50	0.50	0.50	0.50	1.50	1.109	0.0655
VR	0.67	0.60	0.60	0.71	2.00	3.00	3.00	3.00	2.00	3.00	2.00	1.00	0.50	0.50	0.50	1.50	1.209	0.0714
MP	0.67	0.60	0.60	0.71	2.00	3.00	3.00	3.00	2.00	3.00	2.00	2.00	1.00	0.50	0.50	1.50	1.318	0.0779
TD	0.67	0.60	0.60	0.71	2.00	3.00	3.00	3.00	2.00	3.00	2.00	2.00	2.00	1.00	0.50	1.50	1.438	0.0850
LI	0.67	0.60	0.60	0.71	2.00	3.00	3.00	3.00	2.00	3.00	2.00	2.00	2.00	2.00	1.00	0.50	1.464	0.0865
TC	0.80	0.75	0.75	0.67	0.67	2.00	2.00	2.00	0.67	2.00	0.67	0.67	0.67	0.67	2.00	1.00	0.989	0.0585
(sum)																	16.923	1.000

(Mon)

	Urban				Land				Real Estate				Infra				Geometric Average	Priority Vector
Criteria	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC		
BA	1.00	1.33	0.50	0.43	0.43	1.67	0.50	1.33	1.33	0.38	0.38	0.50	1.67	1.67	1.67	0.50	0.802	0.0440
AE	0.75	1.00	0.25	0.20	0.20	0.33	0.25	0.50	0.50	0.17	0.17	0.25	0.33	0.33	0.33	0.25	0.316	0.0173
MM	2.00	4.00	1.00	0.43	0.43	1.67	0.50	1.33	1.33	0.38	0.38	0.50	1.67	1.67	1.67	0.50	0.937	0.0514
ME	2.33	5.00	2.33	1.00	0.50	1.50	1.75	1.25	1.25	0.44	0.44	1.75	1.50	1.50	1.50	1.75	1.344	0.0737
DS	2.33	5.00	2.33	2.00	1.00	1.50	1.75	1.25	1.25	0.44	0.44	1.75	1.50	1.50	1.50	1.75	1.466	0.0804
DP	0.60	3.00	0.60	0.67	0.67	1.00	0.40	1.50	1.50	0.29	0.29	0.40	0.50	0.50	0.50	0.40	0.635	0.0348
DA	2.00	4.00	2.00	0.57	0.57	2.50	1.00	1.33	1.33	0.38	0.38	0.50	1.67	1.67	1.67	0.50	1.087	0.0596
IL	0.75	2.00	0.75	0.80	0.80	0.67	0.75	1.00	0.50	0.17	0.17	0.25	0.33	0.33	0.33	0.25	0.491	0.0269
MD	0.75	2.00	0.75	0.80	0.80	0.67	0.75	2.00	1.00	0.17	0.17	0.25	0.33	0.33	0.33	0.25	0.536	0.0294
BP	2.67	6.00	2.67	2.25	2.25	3.50	2.67	6.00	6.00	1.00	0.50	1.60	1.40	1.40	1.40	1.60	2.177	0.1193
RR	2.67	6.00	2.67	2.25	2.25	3.50	2.67	6.00	6.00	2.00	1.00	1.60	1.40	1.40	1.40	1.60	2.374	0.1301
VR	2.00	4.00	2.00	0.57	0.57	2.50	2.00	4.00	4.00	0.63	0.63	1.00	1.67	1.67	1.67	0.50	1.449	0.0794
MP	0.60	3.00	0.60	0.67	0.67	2.00	0.60	3.00	3.00	0.71	0.71	0.60	1.00	0.50	0.50	0.40	0.891	0.0489
TD	0.60	3.00	0.60	0.67	0.67	2.00	0.60	3.00	3.00	0.71	0.71	0.60	2.00	1.00	0.50	0.40	0.972	0.0533
LI	0.60	3.00	0.60	0.67	0.67	2.00	0.60	3.00	3.00	0.71	0.71	0.60	2.00	2.00	1.00	0.40	1.060	0.0581
TC	2.00	4.00	2.00	0.57	0.57	2.50	2.00	4.00	4.00	0.63	0.63	2.00	2.50	2.50	2.50	1.00	1.705	0.0935
(sum)																	18.245	1.000

(Kayin)

	Urban				Land				Real Estate				Infra				Geometric Average	Priority Vector
Criteria	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC		
BA	1.00	0.50	0.50	0.40	1.50	1.50	1.50	1.50	1.50	1.50	0.29	0.40	0.40	0.50	1.50	1.50	0.837	0.0451
AE	2.00	1.00	0.50	0.40	1.50	1.50	1.50	1.50	1.50	1.50	0.29	0.40	0.40	0.50	1.50	1.50	0.913	0.0491
MM	2.00	2.00	1.00	0.40	1.50	1.50	1.50	1.50	1.50	1.50	0.29	0.40	0.40	0.50	1.50	1.50	0.996	0.0536
ME	2.50	2.50	2.50	1.00	1.33	1.33	1.33	1.33	1.33	1.33	0.38	0.50	0.50	1.67	1.33	1.33	1.221	0.0657
DS	0.67	0.67	0.67	0.75	1.00	0.50	0.50	0.50	0.50	0.50	0.17	0.25	0.25	0.33	0.50	0.50	0.472	0.0254
DP	0.67	0.67	0.67	0.75	2.00	1.00	0.50	0.50	0.50	0.50	0.17	0.25	0.25	0.33	0.50	0.50	0.515	0.0277
DA	0.67	0.67	0.67	0.75	2.00	2.00	1.00	0.50	0.50	0.50	0.17	0.25	0.25	0.33	0.50	0.50	0.561	0.0302
IL	0.67	0.67	0.67	0.75	2.00	2.00	2.00	1.00	0.50	0.50	0.17	0.25	0.25	0.33	0.50	0.50	0.612	0.0329
MD	0.67	0.67	0.67	0.75	2.00	2.00	2.00	2.00	1.00	0.50	0.17	0.25	0.25	0.33	0.50	0.50	0.667	0.0359
BP	0.67	0.67	0.67	0.75	2.00	2.00	2.00	2.00	2.00	1.00	0.17	0.25	0.25	0.33	0.50	0.50	0.728	0.0392
RR	3.50	3.50	3.50	2.67	6.00	6.00	6.00	6.00	6.00	6.00	1.00	1.60	1.60	1.40	1.20	1.20	2.917	0.1570
VR	2.50	2.50	2.50	2.00	4.00	4.00	4.00	4.00	4.00	4.00	0.63	1.00	0.50	1.67	1.33	1.33	2.075	0.1117
MP	2.50	2.50	2.50	2.00	4.00	4.00	4.00	4.00	4.00	4.00	0.63	2.00	1.00	1.67	1.33	1.33	2.263	0.1218
TD	2.00	2.00	2.00	0.60	3.00	3.00	3.00	3.00	3.00	3.00	0.71	0.60	0.60	1.00	1.50	1.50	1.609	0.0866
LI	0.67	0.67	0.67	0.75	2.00	2.00	2.00	2.00	2.00	2.00	0.83	0.75	0.75	0.67	1.00	0.50	1.051	0.0566
TC	0.67	0.67	0.67	0.75	2.00	2.00	2.00	2.00	2.00	2.00	0.83	0.75	0.75	0.67	2.00	1.00	1.146	0.0617
(sum)																	18.585	1.000

(Tanintharyi)

	Urban				Land				Real Estate				Infra				Geometric Average	Priority Vector
Criteria	BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC		
BA	1.00	1.80	1.60	1.80	1.60	0.50	1.60	1.20	1.40	1.80	1.60	1.40	1.40	1.20	1.40	0.50	1.281	0.0736
AE	0.56	1.00	1.75	0.50	1.75	0.44	1.75	1.25	1.50	0.50	1.75	1.50	1.50	1.25	1.50	0.44	1.045	0.0600
MM	0.63	0.57	1.00	0.43	0.50	0.38	0.50	1.33	1.67	0.43	0.50	1.67	1.67	1.33	1.67	0.38	0.772	0.0443
ME	0.56	2.00	2.33	1.00	1.75	0.44	1.75	1.25	1.50	0.50	1.75	1.50	1.50	1.25	1.50	0.44	1.161	0.0666
DS	0.63	0.57	2.00	0.57	1.00	0.38	0.50	1.33	1.67	0.43	0.50	1.67	1.67	1.33	1.67	0.38	0.857	0.0492
DP	2.00	2.25	2.67	2.25	2.67	1.00	1.60	1.20	1.40	1.80	1.60	1.40	1.40	1.20	1.40	0.50	1.532	0.0879
DA	0.63	0.57	2.00	0.57	2.00	0.63	1.00	1.33	1.67	0.38	0.50	1.67	1.67	1.33	1.67	0.38	0.957	0.0549
IL	0.83	0.80	0.75	0.80	0.75	0.83	0.75	1.00	0.33	0.20	0.25	0.33	0.33	0.50	0.33	0.17	0.486	0.0279
MD	0.71	0.67	0.60	0.67	0.60	0.71	0.60	3.00	1.00	0.33	0.40	0.50	0.50	1.50	0.50	0.29	0.651	0.0374
BP	0.56	2.00	2.33	2.00	2.33	0.56	2.67	5.00	3.00	1.00	0.25	1.50	1.50	1.25	1.50	0.44	1.353	0.0777
RR	0.63	0.57	2.00	0.57	2.00	0.63	2.00	4.00	2.50	4.00	0.40	1.67	1.67	1.33	1.67	0.38	1.255	0.0720
VR	0.71	0.67	0.60	0.67	0.60	0.71	0.60	3.00	2.00	0.67	1.75	1.00	0.50	1.50	0.50	0.29	0.813	0.0467
MP	0.71	0.67	0.60	0.67	0.60	0.71	0.60	3.00	2.00	0.67	0.60	2.00	1.00	1.50	0.50	0.29	0.830	0.0476
TD	0.83	0.80	0.75	0.80	0.75	0.83	0.75	2.00	0.67	0.80	0.75	0.67	0.67	1.00	0.33	0.17	0.705	0.0405
LI	0.71	0.67	0.60	0.67	0.60	0.71	0.60	3.00	2.00	0.67	0.60	2.00	2.00	3.00	1.00	0.29	0.945	0.0542
TC	2.00	2.25	2.67	2.25	2.67	2.00	2.67	6.00	3.50	2.25	2.67	3.50	3.50	6.00	3.50	1.00	2.776	0.1594
(sum)																	17.418	1.000

Appendix E :
Example Calculation of Adjusted EER (1)

(Kachin)

Region/State		Urban				Land				Real Estate				Infra			
Kachin		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
	(1)	0.0624	0.0252	0.0275	0.0300	0.0327	0.1079	0.0750	0.0411	0.0449	0.1212	0.0534	0.0582	0.0635	0.1061	0.0723	0.0788
	(2)	0.145				0.257				0.278				0.321			
	(3)	0.43	0.17	0.19	0.21	0.13	0.42	0.29	0.16	0.16	0.44	0.19	0.21	0.20	0.33	0.23	0.25
	(4)	80	20	20	20	20	100	40	20	20	80	20	20	20	40	20	20
	(5)	45.82				59.46				46.20				26.62			
	(6)	6.65				15.26				12.83				8.53			
	(7)	43.27															

(Sagaing)

Region/State		Urban				Land				Real Estate				Infra			
Sagaing		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
	(1)	0.0597	0.0374	0.0578	0.0692	0.0437	0.0820	0.0283	0.0308	0.0550	0.1158	0.1262	0.0672	0.0733	0.0468	0.0511	0.0557
	(2)	0.224				0.185				0.364				0.227			
	(3)	0.27	0.17	0.26	0.31	0.24	0.44	0.15	0.17	0.15	0.32	0.35	0.18	0.32	0.21	0.23	0.25
	(4)	80	40	60	80	40	100	20	20	40	100	100	40	40	20	20	20
	(5)	68.17				60.22				79.87				26.46			
	(6)	15.28				11.13				29.09				6.01			
(7)	61.50																

(Mandalay)

Region/State		Urban				Land				Real Estate				Infra			
Mandalay		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
	(1)	0.0386	0.0488	0.0532	0.0654	0.0588	0.0723	0.0789	0.0308	0.0336	0.0965	0.1052	0.1147	0.0435	0.0581	0.0486	0.0530
	(2)	0.206				0.241				0.350				0.203			
	(3)	0.19	0.24	0.26	0.32	0.24	0.30	0.33	0.13	0.10	0.28	0.30	0.33	0.21	0.29	0.24	0.26
	(4)	60	80	80	100	80	100	100	40	40	100	100	100	40	60	40	40
	(5)	82.60				87.45				94.24				45.71			
	(6)	17.02				21.06				32.98				9.29			
	(7)	80.35															

(Chin)

Region/State		Urban				Land				Real Estate				Infra			
Chin		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
	(1)	0.0203	0.0221	0.0660	0.0258	0.0282	0.1061	0.0340	0.0370	0.0404	0.0678	0.0739	0.0806	0.1307	0.1425	0.0596	0.0650
	(2)	0.134				0.205				0.263				0.398			
	(3)	0.15	0.16	0.49	0.19	0.14	0.52	0.17	0.18	0.15	0.26	0.28	0.31	0.33	0.36	0.15	0.16
	(4)	20	20	60	20	20	100	20	20	20	40	40	40	80	80	20	20
	(5)	39.67				61.36				36.92				61.20			
	(6)	5.32				12.59				9.70				24.35			
	(7)	51.96															

(Magwe)

Region/State		Urban				Land				Real Estate				Infra			
Magwe		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
	(1)	0.0468	0.0269	0.0523	0.0571	0.0308	0.0892	0.0806	0.0987	0.0393	0.0711	0.0440	0.1246	0.0508	0.0554	0.0399	0.0925
	(2)	0.183				0.299				0.279				0.239			
	(3)	0.26	0.15	0.29	0.31	0.10	0.30	0.27	0.33	0.14	0.25	0.16	0.45	0.21	0.23	0.17	0.39
	(4)	60	40	60	60	40	100	80	100	40	60	40	100	40	40	20	60
	(5)	57.07				88.44				71.89				44.40			
	(6)	10.45				26.47				20.05				10.60			
	(7)	67.57															

(Shan)

Region/State		Urban				Land				Real Estate				Infra			
Shan		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
	(1)	0.0448	0.0168	0.0641	0.0533	0.0312	0.0596	0.0757	0.0825	0.0380	0.1100	0.1199	0.0465	0.1009	0.0529	0.0433	0.0603
	(2)	0.179				0.249				0.314				0.258			
	(3)	0.25	0.09	0.36	0.30	0.13	0.24	0.30	0.33	0.12	0.35	0.38	0.15	0.39	0.21	0.17	0.23
	(4)	60	20	80	60	40	60	80	80	40	100	100	40	80	40	20	40
	(5)	63.40				70.21				83.87				52.31			
	(6)	11.35				17.48				26.37				13.47			
	(7)	68.68															

(Rakhine)

Region/State		Urban				Land				Real Estate				Infra			
Rakhine		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
	(1)	0.0607	0.0200	0.0709	0.0773	0.0250	0.0403	0.0439	0.1066	0.0328	0.0529	0.1361	0.0414	0.0638	0.0696	0.0759	0.0828
	(2)	0.229				0.216				0.263				0.292			
	(3)	0.27	0.09	0.31	0.34	0.12	0.19	0.20	0.49	0.12	0.20	0.52	0.16	0.22	0.24	0.26	0.28
	(4)	60	20	60	60	20	40	40	100	20	40	100	20	40	40	40	40
	(5)	56.51				67.33				65.38				40.00			
	(6)	12.93				14.52				17.21				11.69			
	(7)	56.35															

(Naypyitaw)

Region/State		Urban				Land				Real Estate				Infra			
		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
Naypyitaw	(1)	0.0421	0.0212	0.0678	0.0536	0.0536	0.0270	0.0295	0.0322	0.0351	0.0383	0.1096	0.0745	0.1226	0.1564	0.0798	0.0569
	(2)	0.185				0.142				0.257				0.416			
	(3)	0.23	0.11	0.37	0.29	0.38	0.19	0.21	0.23	0.14	0.15	0.43	0.29	0.29	0.38	0.19	0.14
	(4)	40	20	60	40	40	20	20	20	20	20	60	40	60	80	40	20
	(5)	45.04				27.53				42.82				58.21			
	(6)	8.32				3.92				11.02				24.19			
	(7)	47.45															

(Kayah)

Region/State		Urban				Land				Real Estate				Infra			
		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
Kayah	(1)	0.0332	0.0362	0.0476	0.0405	0.0208	0.1039	0.0589	0.0268	0.0292	0.1203	0.0975	0.0774	0.0844	0.0441	0.0481	0.1311
	(2)	0.157				0.210				0.324				0.308			
	(3)	0.21	0.23	0.30	0.26	0.10	0.49	0.28	0.13	0.09	0.37	0.30	0.24	0.27	0.14	0.16	0.43
	(4)	40	40	60	40	20	100	60	20	20	100	80	60	60	20	20	80
	(5)	46.05				70.72				77.24				56.53			
	(6)	7.25				14.88				25.06				17.40			
	(7)	64.59															

(Bago)

Region/State			Urban				Land				Real			Infra			
Bago		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
	(1)	0.0181	0.0552	0.0602	0.0400	0.0236	0.0257	0.1021	0.0310	0.0526	0.0353	0.1131	0.1463	0.0662	0.1012	0.0520	0.0773
	(2)	0.174				0.182				0.347				0.297			
	(3)	0.10	0.32	0.35	0.23	0.13	0.14	0.56	0.17	0.15	0.10	0.33	0.42	0.22	0.34	0.18	0.26
	(4)	20	60	60	40	20	20	100	20	40	20	80	100	40	60	20	40
	(5)	51.23				64.78				76.26				43.32			
	(6)	8.89				11.82				26.48				12.86			
	(7)	60.05															

(Yangon)

Region/State		Urban				Land				Real Estate				Infra			
		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
Yangon	(1)	0.0541	0.0590	0.0643	0.0701	0.0515	0.0775	0.0393	0.0873	0.0443	0.0483	0.1015	0.1107	0.0561	0.0424	0.0454	0.0483
	(2)	0.247				0.256				0.305				0.192			
	(3)	0.22	0.24	0.26	0.28	0.20	0.30	0.15	0.34	0.15	0.16	0.33	0.36	0.29	0.22	0.24	0.25
	(4)	100	100	100	100	80	100	60	100	60	60	100	100	60	40	20	40
	(5)	100.00				89.82				87.85				41.12			
	(6)	24.75				22.96				26.77				7.90			
	(7)	82.38															

(Ayeyarwaddy)

Region/State		Urban				Land				Real Estate				Infra			
		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
Ayeyarwaddy	(1)	0.0771	0.0703	0.0767	0.0874	0.0463	0.0302	0.0329	0.0359	0.0575	0.0409	0.0655	0.0714	0.0779	0.0850	0.0865	0.0585
	(2)	0.312				0.145				0.235				0.308			
	(3)	0.25	0.23	0.25	0.28	0.32	0.21	0.23	0.25	0.24	0.17	0.28	0.30	0.25	0.28	0.28	0.19
	(4)	80	60	60	100	40	20	20	20	40	20	40	40	40	40	40	20
	(5)	76.17				26.38				36.53				36.20			
	(6)	23.73				3.83				8.60				11.14			
	(7)	47.30															

(Mon)

Region/State		Urban				Land				Real Estate				Infra			
Mon		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
	(1)	0.0440	0.0173	0.0514	0.0737	0.0804	0.0348	0.0596	0.0269	0.0294	0.1193	0.1301	0.0794	0.0489	0.0533	0.0581	0.0935
	(2)	0.186				0.202				0.358				0.254			
	(3)	0.24	0.09	0.28	0.40	0.40	0.17	0.30	0.13	0.08	0.33	0.36	0.22	0.19	0.21	0.23	0.37
	(4)	60	20	60	80	80	40	60	20	20	100	100	60	40	40	40	60
	(5)	64.19				59.17				84.57				47.37			
	(6)	11.96				11.93				30.30				12.02			
	(7)	66.21															

(Kayin)

Region/State		Urban				Land				Real Estate				Infra			
		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
Kayin	(1)	0.0451	0.0491	0.0536	0.0657	0.0254	0.0277	0.0302	0.0329	0.0359	0.0392	0.1570	0.1117	0.1218	0.0866	0.0566	0.0617
	(2)	0.213				0.116				0.344				0.327			
	(3)	0.21	0.23	0.25	0.31	0.22	0.24	0.26	0.28	0.10	0.11	0.46	0.32	0.37	0.27	0.17	0.19
	(4)	40	40	40	60	20	20	20	20	20	20	100	60	60	40	20	20
	(5)	46.15				20.00				69.53				40.22			
	(6)	9.85				2.32				23.90				13.14			
	(7)	49.21															

(Tanintharyi)

Region/State		Urban				Land				Real Estate				Infra			
		BA	AE	MM	ME	DS	DP	DA	IL	MD	BP	RR	VR	MP	TD	LI	TC
Tanintharyi	(1)	0.0736	0.0600	0.0443	0.0666	0.0492	0.0879	0.0549	0.0279	0.0374	0.0777	0.0720	0.0467	0.0476	0.0405	0.0542	0.1594
	(2)	0.245				0.220				0.234				0.302			
	(3)	0.30	0.25	0.18	0.27	0.22	0.40	0.25	0.13	0.16	0.33	0.31	0.20	0.16	0.13	0.18	0.53
	(4)	100	80	60	80	60	100	60	20	40	80	60	40	40	20	40	100
	(5)	82.39				70.92				59.45				69.01			
	(6)	20.15				15.60				13.90				20.82			
	(7)	70.47															

Appendix F :
Pair-Wise Comparison (2)

(Urban)

State/Region	Kachin	Sagaing	Mandalay	Chin	Magwe	Shan	Rakhine	Naypyitaw	Kayah	Bago	Yangon	Ayeyarwaddy	Mon	Kayin	Tanintharyi	Geometric Average	Priority Vector	Relative Weight
Kachin	1.00	0.35	0.30	1.86	0.39	0.39	0.39	0.47	0.44	0.44	0.26	0.33	0.39	0.44	0.28	0.4386	0.0258	0.1810
Sagaing	2.86	1.00	0.45	1.46	1.85	1.85	1.77	1.62	1.69	1.69	0.39	0.48	1.85	1.69	0.45	1.1916	0.0700	0.4917
Mandalay	3.29	2.23	1.00	1.38	1.69	1.69	1.63	1.50	1.56	1.56	0.44	1.94	1.69	1.56	0.47	1.4150	0.0831	0.5838
Chin	0.54	0.68	0.73	1.00	0.35	0.35	0.38	0.43	0.40	0.40	0.23	0.29	0.35	0.40	0.27	0.4193	0.0246	0.1730
Magwe	2.57	0.54	0.59	2.83	1.00	0.50	1.91	1.73	1.82	1.82	0.35	0.42	0.50	1.82	0.41	0.9773	0.0574	0.4032
Shan	2.57	0.54	0.59	2.83	2.00	1.00	1.91	1.73	1.82	1.82	0.35	0.42	0.50	1.82	0.41	1.0719	0.0629	0.4423
Rakhine	2.57	0.57	0.62	2.67	0.52	0.52	1.00	1.80	1.90	1.90	0.33	0.40	0.48	1.90	0.38	0.8974	0.0527	0.3703
Naypyitaw	2.14	0.62	0.67	2.33	0.58	0.58	0.56	1.00	0.47	0.47	0.29	0.35	0.42	0.47	0.33	0.6069	0.0356	0.2504
Kayah	2.29	0.59	0.64	2.50	0.55	0.55	0.53	2.13	1.00	0.50	0.31	0.38	0.45	0.50	0.36	0.6852	0.0402	0.2827
Bago	2.29	0.59	0.64	2.50	0.55	0.55	0.53	2.13	2.00	1.00	0.31	0.38	0.45	0.50	0.36	0.7516	0.0441	0.3101
Yangon	3.86	2.54	2.25	4.33	2.82	2.82	3.00	3.50	3.22	3.22	1.00	1.75	1.55	1.45	1.80	2.4237	0.1423	1.0000
Ayeyarwaddy	3.00	2.08	0.52	3.50	2.36	2.36	2.50	2.88	2.67	2.67	0.57	1.00	1.73	1.60	0.48	1.6831	0.0988	0.6944
Mon	2.57	0.54	0.59	2.83	2.00	2.00	2.10	2.38	2.22	2.22	0.65	0.58	1.00	1.82	0.41	1.3188	0.0774	0.5441
Kayin	2.29	0.59	0.64	2.50	0.55	0.55	0.53	2.13	2.00	2.00	0.69	0.63	0.55	1.00	0.36	0.9116	0.0535	0.3761
Tanintharyi	3.57	2.23	2.13	3.67	2.45	2.45	2.60	3.00	2.78	2.78	0.56	2.07	2.45	2.78	1.00	2.2374	0.1314	0.9231
(sum)																17.0296	1.0000	

(Land)

State/Region	Kachin	Sagaing	Mandalay	Chin	Magwe	Shan	Rakhine	Naypyitaw	Kayah	Bago	Yangon	Ayeyarwaddy	Mon	Kayin	Tanintharyi	Geometric Average	Priority Vector	Relative Weight
Kachin	1.00	0.50	0.36	1.89	0.36	0.41	0.47	1.56	0.47	1.89	0.35	1.56	0.47	1.44	0.43	0.7044	0.0432	0.325
Sagaing	2.00	1.00	0.36	1.89	0.36	0.41	0.47	1.56	0.47	1.89	0.35	1.56	0.47	1.44	0.43	0.7726	0.0474	0.356
Mandalay	2.78	2.78	1.00	1.50	0.50	1.81	1.63	1.31	1.63	1.50	0.48	1.31	1.63	1.25	1.75	1.3785	0.0846	0.635
Chin	0.53	0.53	0.67	1.00	0.33	0.38	0.44	1.63	0.44	0.50	0.32	1.63	0.44	1.50	0.40	0.6047	0.0371	0.279
Magwe	2.78	2.78	2.00	3.00	1.00	1.81	1.63	1.31	1.63	1.50	0.48	1.31	1.63	1.25	1.75	1.5835	0.0971	0.730
Shan	2.44	2.44	0.55	2.63	0.55	1.00	1.77	1.38	1.77	1.62	0.43	1.38	1.77	1.31	1.92	1.3491	0.0828	0.622
Rakhine	2.11	2.11	0.62	2.25	0.62	0.57	1.00	1.50	0.50	1.80	0.37	1.50	0.50	1.40	0.45	0.9564	0.0587	0.441
Naypyitaw	0.64	0.64	0.76	0.62	0.76	0.72	0.67	1.00	0.33	0.38	0.23	0.50	0.33	1.80	0.29	0.5634	0.0346	0.260
Kayah	2.11	2.11	0.62	2.25	0.62	0.57	2.00	3.00	1.00	1.80	0.37	1.50	0.50	1.40	0.45	1.0986	0.0674	0.506
Bago	0.53	0.53	0.67	2.00	0.67	0.62	0.56	2.60	0.56	1.00	0.32	1.63	0.44	1.50	0.40	0.7626	0.0468	0.351
Yangon	2.89	2.89	2.06	3.13	2.06	2.31	2.70	4.40	2.70	3.13	1.00	1.29	1.59	1.24	1.71	2.1697	0.1331	1.000
Ayeyarwaddy	0.64	0.64	0.76	0.62	0.76	0.72	0.67	2.00	0.67	0.62	0.77	1.00	0.33	1.80	0.29	0.7245	0.0444	0.334
Mon	2.11	2.11	0.62	2.25	0.62	0.57	2.00	3.00	2.00	2.25	0.63	3.00	1.00	1.40	0.45	1.3270	0.0814	0.612
Kayin	0.69	0.69	0.80	0.67	0.80	0.76	0.71	0.56	0.71	0.67	0.81	0.56	0.71	1.00	0.25	0.6684	0.0410	0.308
Tanintharyi	2.33	2.33	0.57	2.50	0.57	0.52	2.20	3.40	2.20	2.50	0.59	3.40	2.20	4.00	1.00	1.6399	0.1006	0.756
(sum)																16.3030	1	

(Real Estate)

State/Region	Kachin	Sagaing	Mandalay	Chin	Magwe	Shan	Rakhine	Naypyitaw	Kayah	Bago	Yangon	Ayeyarwaddy	Mon	Kayin	Tanintharyi	Geometric Average	Priority Vector	Relative Weight
Kachin	1.00	0.33	0.29	0.50	0.37	0.33	0.44	0.50	0.35	0.37	0.30	0.50	0.33	0.41	0.39	0.4065	0.0247	0.209
Sagaing	3.00	1.00	0.45	1.50	1.86	0.50	1.64	1.50	1.93	1.86	0.47	1.50	0.50	1.71	1.79	1.2118	0.0735	0.624
Mandalay	3.43	2.21	1.00	1.41	1.71	1.82	1.53	1.41	1.76	1.71	1.94	1.41	1.82	1.59	1.65	1.6988	0.1030	0.875
Chin	2.00	0.67	0.71	1.00	0.37	0.33	0.44	0.50	0.35	0.37	0.30	0.50	0.33	0.41	0.39	0.4954	0.0300	0.255
Magwe	2.71	0.54	0.59	2.71	1.00	0.46	1.75	1.58	0.48	0.50	0.43	1.58	0.46	1.83	1.92	0.9840	0.0597	0.507
Shan	3.00	2.00	0.55	3.00	2.17	1.00	1.64	1.50	1.93	1.86	0.47	1.50	0.50	1.71	1.79	1.4247	0.0864	0.734
Rakhine	2.29	0.61	0.65	2.29	0.57	0.61	1.00	1.78	0.41	0.43	0.36	1.78	0.39	0.47	0.45	0.7448	0.0452	0.384
Naypyitaw	2.00	0.67	0.71	2.00	0.63	0.67	0.56	1.00	0.35	0.37	0.30	0.50	0.33	0.41	0.39	0.5999	0.0364	0.309
Kayah	2.86	0.52	0.57	2.86	2.08	0.52	2.44	2.86	1.00	1.92	0.45	1.54	0.48	1.77	1.85	1.2739	0.0772	0.656
Bago	2.71	0.54	0.59	2.71	2.00	0.54	2.33	2.71	0.52	1.00	0.43	1.58	0.46	1.83	1.92	1.1584	0.0702	0.597
Yangon	3.29	2.14	0.52	3.29	2.33	2.14	2.78	3.29	2.23	2.33	1.00	1.44	1.88	1.63	1.69	1.9411	0.1177	1.000
Ayeyarwaddy	2.00	0.67	0.71	2.00	0.63	0.67	0.56	2.00	0.65	0.63	0.70	1.00	0.33	0.41	0.39	0.7510	0.0455	0.387
Mon	3.00	2.00	0.55	3.00	2.17	2.00	2.56	3.00	2.08	2.17	0.53	3.00	1.00	1.71	1.79	1.8083	0.1097	0.932
Kayin	2.43	0.58	0.63	2.43	0.55	0.58	2.11	2.43	0.57	0.55	0.62	2.43	0.58	1.00	0.48	0.9485	0.0575	0.489
Tanintharyi	2.57	0.56	0.61	2.57	0.52	0.56	2.22	2.57	0.54	0.52	0.59	2.57	0.56	2.10	1.00	1.0438	0.0633	0.538
(sum)																16.4908	1	

(Infra)

State/Region	Kachin	Sagaing	Mandalay	Chin	Magwe	Shan	Rakhine	Naypyitaw	Kayah	Bago	Yangon	Ayeyarwaddy	Mon	Kayin	Tanintharyi	Geometric Average	Priority Vector	Relative Weight
Kachin	1.00	0.50	0.36	0.33	0.38	0.36	0.38	0.33	0.36	0.38	0.38	0.42	0.36	0.42	0.33	0.4017	0.0241	0.386
Sagaing	2.00	1.00	0.36	0.33	0.38	0.36	0.38	0.33	0.36	0.38	0.38	0.42	0.36	0.42	0.33	0.4406	0.0265	0.423
Mandalay	2.80	2.80	1.00	0.47	1.89	0.50	1.89	0.47	0.50	1.89	1.89	1.78	0.50	1.78	0.47	1.1002	0.0661	1.057
Chin	3.00	3.00	2.11	1.00	1.80	1.90	1.80	0.50	1.90	1.80	1.80	1.70	1.90	1.70	0.50	1.5837	0.0951	1.522
Magwe	2.60	2.60	0.53	0.56	1.00	0.47	0.50	0.44	0.47	0.50	0.50	1.88	0.47	1.88	0.44	0.7650	0.0459	0.735
Shan	2.80	2.80	2.00	0.53	2.13	1.00	1.89	0.47	0.50	1.89	1.89	1.78	0.50	1.78	0.47	1.2248	0.0736	1.177
Rakhine	2.60	2.60	0.53	0.56	2.00	0.53	1.00	0.44	0.47	0.50	0.50	1.88	0.47	1.88	0.44	0.8457	0.0508	0.813
Naypyitaw	3.00	3.00	2.11	2.00	2.25	2.11	2.25	1.00	1.90	1.80	1.80	1.70	1.90	1.70	0.50	1.8021	0.1082	1.731
Kayah	2.80	2.80	2.00	0.53	2.13	2.00	2.13	0.53	1.00	1.89	1.89	1.78	0.50	1.78	0.47	1.3636	0.0819	1.310
Bago	2.60	2.60	0.53	0.56	2.00	0.53	2.00	0.56	0.53	1.00	0.50	1.88	0.47	1.88	0.44	0.9489	0.0570	0.912
Yangon	2.60	2.60	0.53	0.56	2.00	0.53	2.00	0.56	0.53	2.00	1.00	1.88	0.47	1.88	0.44	1.0408	0.0625	1.000
Ayeyarwaddy	2.40	2.40	0.56	0.59	0.53	0.56	0.53	0.59	0.56	0.53	0.53	1.00	0.44	0.50	0.41	0.6722	0.0404	0.646
Mon	2.80	2.80	2.00	0.53	2.13	2.00	2.13	0.53	2.00	2.13	2.13	2.29	1.00	1.78	0.47	1.5450	0.0928	1.484
Kayin	2.40	2.40	0.56	0.59	0.53	0.56	0.53	0.59	0.56	0.53	0.53	2.00	0.56	1.00	0.41	0.7497	0.0450	0.720
Tanintharyi	3.00	3.00	2.11	2.00	2.25	2.11	2.25	2.00	2.11	2.25	2.25	2.43	2.11	2.43	1.00	2.1656	0.1301	2.081
(sum)																16.6496	1	