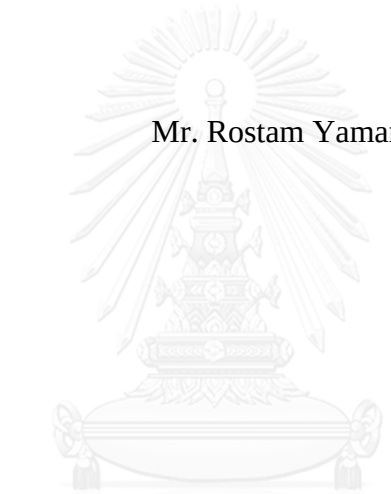
A Post Occupancy Evaluation Model for Sustainable Urban Neighborhood Assessment in Malaysia

Mr. Rostam Yaman



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แบบจำลองการประเมินหลังการใช้งานเพื่อประเมินชุมชนละแวกบ้านสู่การพัฒนาเมืองที่ยั่งยืนในประเทศมาเลเซีย

นายโรสแทม ยามาน

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาศิลปศาสตรดุษฎีบัณฑิต
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Thesis Title	A Post Occupancy Evaluation Model for Sustainable Urban Neighborhood Assessment in Malaysia
By	Mr. Rostam Yaman
Field of Study	Environment Development and Sustainability
Thesis Advisor	Associate Professor Suwattana Thadaniti, Ph.D.
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Accepted by the Graduate School, Chulalongkorn University in Partial Fulfillment of the Requirements for the Doctoral Degree

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โรสแทม ยามาน : แบบจำลองการประเมินหลังการใช้งานเพื่อประเมินชุมชนละแวกบ้านสู่การพัฒนาเมืองที่ยั่งยืนในประเทศมาเลเซีย (A Post Occupancy Evaluation Model for Sustainable Urban Neighborhood Assessment in Malaysia) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: รศ. ดร. สุวัฒนา ธาดานิติ, อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: ดร. บารัต ฎอฮิยะ, รศ. ดร. จามาลลุนไลลี บิน อับดุลลา, 409 หน้า.

พื้นที่เมืองโดยทั่วไปแล้วจะเป็นแหล่งนำมาซึ่งปัญหาสิ่งแวดล้อมมากกว่าพื้นที่ธรรมชาติ เกณฑ์การประเมินสิ่งแวดล้อมส่วนใหญ่จึงเป็นเรื่องของพื้นที่เมืองหรือเพื่อประเมินสิ่งแวดล้อมเกณฑ์ประเมินที่ใช้กันมีอยู่หลายชุดและหลายสำนัก งานวิจัยนี้ได้เสนอเกณฑ์การประเมินพื้นที่เมืองโดยเป็นลักษณะของการประเมินหลังการอยู่อาศัยมาระยะหนึ่ง พัฒนาขึ้นโดยมุ่งหมายที่จะให้เป็นเครื่องมือที่มีประสิทธิภาพสูง สามารถใช้ศึกษาเปรียบเทียบสภาพแวดล้อมเมืองหลังจากพื้นที่ได้มีการวางแผน ออกแบบ และอยู่อาศัยหรือใช้งานเป็นชุมชนละแวกบ้านแล้ว งานวิจัยได้นำเสนอเป็นแบบจำลอง เรียกว่าแบบจำลองการประเมินหลังการใช้งาน (Post Occupancy Evaluation Model-POEM) โพเอ็ม หรือแบบจำลองโพเอ็ม พัฒนาขึ้นบนพื้นฐานเสาหลักของความยั่งยืนที่เป็นองค์รวมเพื่อให้เกิดการพัฒนาสู่อนาคตอย่างยั่งยืน เครื่องมือดังกล่าวนี้ยังเป็นสิ่งที่ค่อนข้างใหม่สำหรับประเทศมาเลเซีย ที่มีอยู่ก่อนหน้านั้นก็เป็นการสร้างเกณฑ์ในรูปของดัชนีชี้วัดอาคารเขียว (Green Building Index Township Assessment Criteria – GBI/TAC) และเป็นการประเมินโครงการก่อนการใช้งานเป็นส่วนใหญ่ โจทย์วิจัยจึงเริ่มด้วยการหาคำตอบว่าการสร้างเกณฑ์ในการประเมินชุมชนละแวกบ้านบนมิติของความยั่งยืนที่นับเป็นเสาหลักการพัฒนา (Sustainability Dimension Pillars – SDP) นำไปสู่การพัฒนาชุมชนละแวกบ้านอย่างยั่งยืนได้หรือไม่และอย่างไร วัตถุประสงค์ของวิทยานิพนธ์ ประกอบด้วยการศึกษาและสร้างตัวแบบจำลองโพเอ็มบนฐานของ SDP ที่นำไปสู่การพัฒนาชุมชนละแวกบ้านอย่างยั่งยืน (SND) ขอบเขตของการศึกษาได้เริ่มต้นเจาะจงที่ GBI-TAC และโครงการชุมชนละแวกบ้าน 3 แห่ง ซึ่งได้รับประกาศนียบัตรรับรองจาก GBI ประเทศมาเลเซีย การศึกษาการวิเคราะห์ในขั้นตอนนี้ใช้เวลามากกว่า 1 ปี มุมมองจากผู้มีส่วนได้ส่วนเสียนำมาพิจารณาร่วมกับความคิดเห็นของนักปฏิบัติผู้เชี่ยวชาญ และประสบการณ์ของผู้ใช้สุดท้ายที่มีต่อร่างโพเอ็ม เพื่อให้โพเอ็มเป็นแบบจำลองการประเมินที่ใช้ได้ต่อสถานการณ์ประเมินหลังการใช้อย่างมีประสิทธิภาพ สรุปขั้นตอนการศึกษาแบ่งออกเป็น 6 ขั้นตอนได้แก่ 1. การวิเคราะห์เนื้อหาสาระ 2. ทำการสำรวจและสัมภาษณ์แบบกึ่งโครงสร้างต่อผู้เชี่ยวชาญ 3. การสำรวจอาคารแบบมืออาชีพ 4. พัฒนาคู่มือ POEM 5. สำรวจครัวเรือนในพื้นที่ 6. ทบทวนและการนำเสนอแบบจำลองการประเมินหลังการใช้งานเพื่อการประเมินชุมชนละแวกบ้านสู่การพัฒนาเมืองที่ยั่งยืน (โพเอ็ม) ฉบับสุดท้าย ส่วนด้านการวิเคราะห์ข้อมูลนั้น ข้อมูลที่ได้มาจะได้รับการวิเคราะห์ด้วยวิธีทั้งเชิงปริมาณและคุณภาพ รวมทั้งแบบจำลองสมการโครงสร้าง (Structural Equation Model – SEM) ผลที่ได้ในขั้นตอนนี้ จะแสดงความพึงพอใจของผู้มีส่วนได้ส่วนเสียในโครงการชุมชนละแวกบ้าน ความคิดเห็นที่มีต่อการแก้ไขคู่มือโพเอ็ม ร่วมกับความเข้าใจในความสำคัญของ SDP ต่อ SND ทำให้สามารถตรวจสอบ เฝ้าระวังและดูแลชุมชนละแวกบ้านให้มีความสมดุลในการเติบโตและพัฒนาได้อย่างยั่งยืนแบบองค์รวม

ข้อค้นพบเพื่อตอบโจทย์วิจัย จากการทดสอบคู่มือโพเอ็มในโครงการที่เลือกมาเป็นกรณีศึกษา โดยวิเคราะห์จากความเห็นของผู้มีส่วนได้ส่วนเสีย ผลการประเมินจาก GBI-TAC และ SND ไม่ได้ตอบสนองประสิทธิภาพหลังการใช้งานและระดับความยั่งยืนตามคุณสมบัติ SDP และสำหรับข้อสมมุติฐานที่ 1 และ 2 ผลการศึกษาชี้ให้เห็นว่า มีช่องว่างSDP ในเกณฑ์การประเมินระหว่างระยะที่ 2 และระยะที่ 3 (ก่อนการใช้งาน) และการประเมินสำหรับระดับความยั่งยืนของชุมชนละแวกบ้านก่อนและหลังการใช้งาน มีความแตกต่างกันตามข้อสังเกตจากผู้ใช้หรือครัวเรือนสุดท้าย จึงสรุปได้ว่าเกณฑ์และทฤษฎีของการประเมินก่อนการใช้งานชุมชนละแวกบ้านไม่ได้อยู่บนฐานSDP ซึ่งแตกต่างจากโพเอ็ม ดังนั้นการประเมินหลังการใช้งานจึงทำให้เห็นแนวทางสำหรับการปรับปรุงชุมชนละแวกบ้านโดยวิธี SDP สู่การพัฒนาเมืองที่ยั่งยืนเป็นไปตามข้อสมมุติฐานที่ตั้งไว้ ผลลัพธ์ของการศึกษาชี้ให้เห็นด้วยว่ายังมีช่องว่างในมิติของการพัฒนาอย่างยั่งยืนของชุมชน จึงสมควรที่ผู้มีส่วนได้ส่วนเสียจะต้องตระหนักและปฏิบัติอย่างต่อเนื่องตลอดช่วงเวลาที่ใช้งานอยู่อาศัยในการแก้ไขและป้องกันปัญหาตามผลที่ได้จากตัวชี้วัดของแบบจำลองโพเอ็ม กล่าวได้ว่าการประยุกต์ใช้แบบจำลองการประเมินหลังการใช้งานเพื่อประเมินชุมชนละแวกบ้านจะอำนวยความสะดวกและทำให้เกิดการพัฒนาเมืองอย่างยั่งยืนทั้งปัจจุบันและอนาคต ผลผลิตที่คาดหวังจากงานวิจัยเรื่องนี้คือคู่มือโพเอ็มสำหรับใช้งานเพื่อการพัฒนาชุมชนละแวกบ้านอย่างยั่งยืนในประเทศมาเลเซีย รวมถึงชุมชนในปรากฏการณ์ เดียวกันในประเทศของภูมิภาคอาเซียนและที่อื่นๆทั่วโลก โพเอ็มยังอาจเป็นแบบจำลองอ้างอิงสำหรับการทบทวนดัชนีชี้วัดอาคารเขียวในอนาคต และสำหรับผู้บริหารในองค์กรปกครองท้องถิ่นและกระทรวงต่างๆ ที่เกี่ยวข้องกับการกำหนดนโยบายอาคารเขียวต่อไป

สาขาวิชา สิ่งแวดล้อม การพัฒนา และความยั่งยืน ลายมือชื่อนิสิต .....

ปีการศึกษา 2559 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

ลายมือชื่อ อ.ที่ปรึกษาร่วม .....

ลายมือชื่อ อ.ที่ปรึกษาร่วม .....

5787799220 : MAJOR ENVIRONMENT DEVELOPMENT AND SUSTAINABILITY
KEYWORDS: POST OCCUPANCY EVALUATION MODEL / SUSTAINABLE NEIGHBORHOOD DEVELOPMENT / STAKEHOLDERS-INCLUSION APPROACH / STRUCTURAL EQUATION MODELING

ROSTAM YAMAN: A Post Occupancy Evaluation Model for Sustainable Urban Neighborhood Assessment in Malaysia. ADVISOR: ASSOC. PROF. SUWATTANA THADANITI, Ph.D., CO-ADVISOR: BHARAT DAHIYA, Ph.D., ASSOC. PROF. JAMALUNLAILI BIN ABDULLAH, Ph.D., 409 pp.

Urbanized areas are typically the significant sources of environmental degradation, thus, urban assessment criteria tool aiming at equally adapted sustainability dimensions need to be firmly embedded in benchmarking planning and design framework and upon occupancy. In this study, Post-Occupancy Evaluation Model (POEM) will be develop based on sustainability holistic pillar in order to assess and redefine the current sustainability assessment criteria for future sustainable development. Urban sustainable rating system in Malaysian is rather new. Even though Green Building Index Township Assessment Criteria (GBI-TAC) has been developed and implemented but there is lack of post-occupancy evaluation being conducted in assessing the sustainability level of the certified development. Thus, embarking on the research problem whether urban neighborhood assessment criteria and certified project fulfilled the sustainability concept according to sustainability dimension pillars (SDP). The research objective is to identify and formulate POEM based on SDP towards sustainable neighborhood development (SND). The scope of the study focus on GBI-TAC and three (3) certified GBI neighborhood projects in Malaysia which were occupied for more than one year. The stakeholder-inclusion approach is used in this research in order to gather experts' opinion, professional's stakeholders' views and end-users experiences regarding the proposed POEM. The research design will be formulated into six key stages, which are; 1. Content analysis, 2. Expert's surveys and semi-structure interviews, 3. Building's professional surveys, 4. Development of POEM handbook, 5. On-site Household Surveys and 6. Revision and Finalizing of POEM. The collected data are analyzed using qualitative and quantitative analysis method and structural equation modelling. The findings have indicates that a comprehensive Stakeholder-Inclusion Approach method in developing POEM for SND, supported by key issues of SDP understanding in SND and guided by clear and comprehensive POEM Handbook procedures, can oversee and foster the neighborhood and it's communities towards an enhanced, balanced and holistic sustainable development. The findings for research problem based on POEM Handbook on-site testing from selected case studies through end-users/households' opinions, the study concluded that the existing GBI-TAC and certified SND DO NOT FULFILL the post-occupancy effectiveness and sustainability level according to SDP. For research hypothesis 1 and 2: Stakeholders-Inclusion Approach Analysis, SEM modeling and POEM Handbook on-site implementation findings suggested that there is a SDP gap in evaluation criteria between Phase 2 (Pre-Occupancy) and Phase 3 (Pre-Occupancy), and pre-occupancy assessment for SND sustainability level differs from post-occupancy evaluation sustainability level perceived by the end-users/households concluded that POEM evaluation criteria and theory would differ from the pre-occupied assessment criteria and theory; therefore, there is a room for improvement and enhancement upon post-occupancy within the community's neighborhood context. Hence, SDP method will improve sustainability and in supporting this hypothesis. The study outcome suggested there is still a sustainable dimensions gap that need to be addressed in maintaining the continuity neighborhood community sustainable practices and management upon occupancy. Thus, this study claims that the adoption and implementation of POEM for SND will facilitate to enhance the current and future sustainable condition of urban development. The expected output of this research is the POEM Handbook for future SND in Malaysia and similar development phenomenon in the ASEAN region and country throughout the world. The POEM is also expected to be a reference model for future review and revision of GBI-TAC, Local Authorities and Ministries related sustainable and green policies.

Field of Study: Environment Development and Sustainability Student's Signature .....
Academic Year: 2016 Advisor's Signature .....
Co-Advisor's Signature .....
Co-Advisor's Signature .....

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List of Abbreviations

ACEM: Association of Consulting Engineers Malaysia
AGFI: Adjusted Goodness-of-Fit Index
ANOVA: Analysis of Variance
ASEAN: Association of Southeast Asian Nations
BCA Green Mark: Singapore Environmental Assessment and Classification System
BDR: Building & Resources
BPE: Building Performance Evaluation
BREEAM: Building Research Establishment Environmental Assessment Method
BSI: Business & Innovation
BUS: Building Use Studies
CASBEE: Comprehensive Assessment System for Building Environmental Efficiency
CEW: Climate, Energy and Water
CFA: Confirmatory Factor Analysis
CFI: Comparative Fit Index
CGN: Certified Green Neighborhood
CIB: Conseil International du Bâtiment/International Council for Building
CIBSE: Chartered Institution of Building Services Engineers
CPD: Community Planning & Design
CPTED: Crime Prevention Through environmental Design
CNU: Congress for the New Urbanism
CSD: Commission of Sustainable Development
CSIRO: Commonwealth Scientific and Industrial Research Organisation
DESA-UNDP: Department of Economic and Social Affairs – United Nations Development Program
DGNB: Deutsche Gesellschaft für Nachhaltiges Bauen/German Sustainable Building Council
DOE: Department of Environment
DQI: Design Quality Indicators
ECC: EarthCraft Communities
EcP: Economic Dimension
EDS: Environment, Development & Sustainability
EEC: Ecology & Environment
EnP: Environment Dimension
GBAT: Green Building Assessment Techniques
GBC: Green Building Council
GBDL: China Green Building Labels
GBI: Green Building Index
GBL: China Green Labeling
GBI-TAC: Green Building Index Township Assessment Criteria
GDP: Gross Domestic Product
GFI: Goodness-of-Fit Index:
GHG: Greenhouse Gas

GOBAS:	China Green Building Assessment Method
Green Globes:	Canada Environmental Assessment and Classification System
Green Stars:	Australia Environmental Assessment and Classification System
GSA:	General Services Administration's
GTP:	Government Transformation Programme
HEDQF:	Higher Design Quality Forum
HK BEAM:	Hong Kong – Building Environment Assessment Method
HQE:	Haute Qualité Environnementale/ High Quality Environment
HQE2R:	Haute Qualité Environnementale et Economique Réhabilitation/High Quality Environment and Economy in Regeneration
IBS:	Industrialized Building System
ICSU:	International Council for Science
ICT:	Information and Communication Technology
IEA:	International Energy Agency
IFRCRC:	International Federation of Red Cross and Red Crescent Societies
IPCC:	Intergovernmental Panel on Climate Change
IUCN:	International Union for Conservation of Nature
KeTTHA:	Kementerian Tenaga, Teknologi Hijau dan Air/Ministry of Energy, Green Technology and Water
KLIA:	Kuala Lumpur International Airport
LCC:	Low Carbon City
LCCF:	Low Carbon City Framework
LCS:	Low Carbon Society
LEED:	Leadership in Energy and Environmental Design
LEED-ND:	Leadership in Energy and Environmental Design for Neighborhood Development
MGBC:	Malaysia Green Building Confederation
MQLI:	Malaysian Quality of Life Index
NEPA:	National Environmental Policy Act of 1969
NFI:	Normed Fit Index
NPP:	National Physical Plan
NPPC:	National Physical Planning Council
OECD:	Organization of Economic Cooperation and Development
OLS:	Overall Liking Score
OLS:	Ordinary Least Squares
PAM:	Persatuan Arkitek Malaysia/Malaysian Institute of Architects
POE:	Post-Occupancy Evaluation
POEM:	Post-Occupancy Evaluation Model
Probe:	Post-occupancy Review of Building and Engineering
PromisE:	Finland Environmental Assessment and Classification System
PWD:	Public Works Department
RMSEA:	Root mean square error of approximation
SAM:	Sustainability Assessment Method
SEM:	Structural Equation Modeling
SCR:	Sustainable Community Rating
SDG:	Sustainable Development Goals
SND:	Sustainable Neighborhood Development

SoP:	Social Dimension
SPeAR:	Sustainable Project Appraisal Routine
SPSS:	Statistical Package for Social Sciences
SUPD:	Sustainable Urban Planning Development
TLI:	Tucker-Lewis Index
TRC:	Transportation & Connectivity
TST:	Technical Support Team
UDE:	Universal Design Evaluation
UN:	United Nations
UNCED:	United Nations Conference on Environment and Development
UN-DESA:	United Nations Department of Economic and Social Affairs
UNEP:	United Nations Environment Programme
WCED:	World Commission on Environment and Development
WGBC:	World Green Building Council

CHAPTER 1:

GENERAL INTRODUCTION

1.1 Introduction

The earth is experiencing the prevalent upsurge of urban sprawl in its growth history and this phenomenon mainly took place in developing nations. With 7.5 billion population in year 2017 (Worldometers, 2017), above than half of the planet population inhabiting in the metropolises. Therefore, these cities have become the center of concentration for human routines and activities, and also immense consumption of energy. Urban conurbation areas turn out to be the basis cause of acclimating urban societies and cultures towards mass-production, mass-consumption and mass-dumping of generated waste (Gorski and Yantovsky 2011). As stated in the previous United Nations reports (Kraas 2007), over 600 million population will be inhabiting in approximately 60 mega- metropolises throughout the world by the year 2015. Thus, the need for sustainable township as a center of sustainable development and economy is vital.

The discourse towards sustainable development was increasingly being developed chronologically throughout the World Conservation Strategy in 1980, the Brundtland Report in 1987, and the United Nations Conference on Environment and Development in Rio de Janeiro at 1992. The aim of the World Conservation Strategy is to support the progression and the realization of sustainable development by the means of conservation of natural resources and offer guiding principle direction on how sustainable development can be implemented at all levels (IUCN 1980). The discourse followed with Millennium Development Goal crafted at Millennium Summit in September 2000 and ended on 2015 (Sachs 2012). It was then followed by Sustainable Development Goals which the agreement was reached in 2015 at COP21 Paris Climate Conference. (Bhattacharya, Oppenheim et al. 2015). The concept of 'Sustainable Neighborhood/Township' are habitable areas that fulfill the various requirements of reside dwellers, either at present or forthcoming future. 'Sustainable

Neighborhood/Township' are habitations that are properly proposed and envisioned, safely and securely protected, and improve the encompassing surroundings, thus delivering a quality value of living for the inhabitants who reside, work and recreate there (Poston, Emmanuel et al. , GBI 2010).

The magnitude of sustainable development in the built environment sector, particularly in urban vicinities was established for quite a long time (Un 2004, Presidency 2007). Urban development play an important function in pursuing sustainability via socio-economic growth and technological innovation (Wu 2014). Sustainable development at urban level suggest a well-balanced and broader specific requirement of its inhabitant which include earnings equity, job opportunities, accommodation, basic amenities, public infrastructure, accessibility connectivity and also protection to the environment (Hiremath, Balachandra et al. 2013). Sustainable environment can be achieved at different steps and level in the urban development from the inside out of the interiors and the buildings, neighborhoods/township and cities. Neighborhoods are the part areas and systems of cities, which made up by their own built environment, social and financial (Schnur 2005). Neighborhoods are perimeter to a allocated boundary, and a communal acquaintance exists between their occupants (Berg and Nycander 1997). To enhance neighborhood/township sustainability, an understanding of its buildings, communal spaces, public infrastructure (Mattarozzi and Antonini 2011), the promotion of a managing principles (Luederitz, Lang et al. 2013), and collaboration amid its components is essential.

Since the 90s, sustainability evaluation methods for an architecture which generally recognized as green building index have been utilized to incorporate sustainability within the building industry sectors, and its vision presently at worldwide level. Neighborhood/township are as imperative as any component in the growth of urban development (Choguill 2008), nevertheless the development and application of sustainable neighborhood/township evaluation criteria principles just recently started to spread (Singh, Murty et al. 2009), and in this region, particularly in the emerging nation as Malaysia it's are however comparatively new. It is important to assess the current neighborhood/township evaluation methods at this juncture of its development, in order to verify its strong point and limitations and the means to further enhance its. There are an intensifying concentration and requirement on the evaluation and

endorsement of sustainable neighborhood/township, but research on sustainable neighborhood evaluation tools and certified green project are still lacking and insufficient. Current studies evaluate sustainable neighborhood assessment criteria based on its construct, the procedures of its implementation, its execution on circumstance studies (Garde 2009, Kyrkou and Karthaus 2011, Sharifi and Murayama 2014) the elements its measure, (Sharifi and Murayama 2013), its evaluation measures (Berardi 2013) and its common features (Haapio 2012). These reviews offer a general explanation of sustainable neighborhood evaluation tools, yet their extent does not completely encompass the particulars of the evaluation structures, and there is no approach by which benchmarking structures can be accurately assessed (Garde 2009). Sustainable evaluation criteria structures comprise of indicators that acquired from a comprehensive content and literature review. Several analyses on evaluation indicators suggest the intent designations and characteristic (Harger and Meyer 1996, Valentin and Spangenberg 2000), development means of a recent indicator categorizes (Repetti and Desthieux 2006, Niemeijer and de Groot 2008, Alkan Olsson, Bockstaller et al. 2009, Dahl 2012, Mori and Christodoulou 2012), indicator significances threshold (Niemeijer 2002) and indicators framework (Nations 2007). Presently, there are numerous rating method approaches are accessible, consequently, it is rather challenging for stakeholders to actually judge the most across-the-board one. Diverse sets of requirement, significances threshold, physical factors and locale guidelines renders distinction. Currently, sustainable city development growth are mainly encouraged by governmental institution related agendas, strategies, outlines, policies, plans, programs and incentives (Shen, Jorge Ochoa et al. 2011). On the other hand, collaboration by third party establishment such as building industry related professional body and institutions efforts, the development of urban sustainability evaluation systems which are based on market approach driven by has achieved significance and progressively implemented by the development project commissioners and developers. Sustainability evaluation criteria approaches and indicator have set an apparent impact on efforts towards sustainable urban development, mostly on sustainable strategy and policy enhancement. Sustainability evaluation criteria approaches and indicators offer guidelines, material and support to urban development policy constituting (Reed, Fraser et al. 2006). Moreover, sustainability evaluation criteria also effect policy making

unequivocally whereby its concern the anticipation of incentives, financial aids and award grants (Walton, El-Haram et al. 2005), for the implementation of evaluation criteria approaches, or its application procedure can be adequately shortened (Council 2009). In certain towns, conurbations, provinces or even countries, sustainable evaluation criteria approaches have even turn out to be obligatory for recent urban development projects (Lee 2013). Nevertheless, for non- obligatory or market driven sustainable township/neighborhood evaluation criteria approaches might also augment the possibility of applying the most least sustainable, as an alternative to the utmost cost effective indicators for urban development projects (Garde 2009).

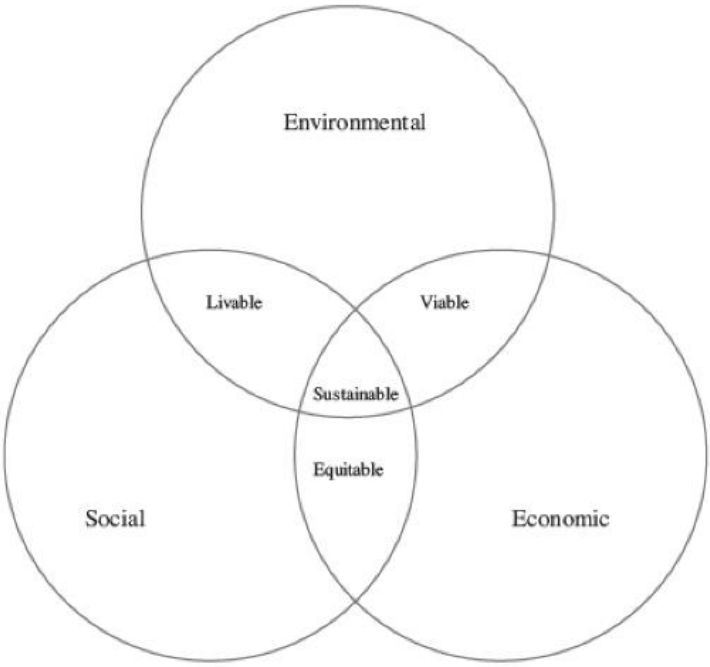


Figure1: Pillars of Sustainability.
Source: Tanguay et al. 2009

The constraint for complete systematic evaluation systems is established in order to assess the implementation of sustainable conurbation and to encourage the overall sustainable urban growth. However, the current available sustainability assessment criteria systems is normally based on low carbon city framework (LCCF). The future of sustainable township development should be beyond the current LCCF; not only heavily weighted on reducing carbon related issues but towards a well-balanced

sustainable pillars which addressed thoroughly economic pillar, environment pillar and social pillar (Figure 1). The Post-Occupancy Evaluation (POE) model developed on holistic pillar of sustainability is to assess and redefine the current sustainability assessment criteria systems, it is a way to the future sustainable urban development. In later years, it is expected to see an increase of urban redevelopment and regeneration schemes concentrated on the healthiness and wellbeing of urban inhabitants and the urban structure, which is the 'inner-urban environment' (Girardet and Australia 2004). While major sources of environmental degradation, deterioration, and depletion on Earth are irrefutably embedded in urban areas, there appears to be an unjustifiable absence of research and development aiming for the comprehensive sustainable criteria of assessment framework through improved urban planning, management and development.

1.2 Research Background

1.2.1 Post-Occupancy Evaluation (POE)

Post-Occupancy Evaluation studies is relatively complexed and rigorous. This is due to dynamic and multidimensional layer of end user needs, demands and behaviors are variable, the end user level of satisfaction and performance is also different from one to another, subjectivity and objectivity components of all this requirement is highly complicated. Measured factors for example user behaviors, the level of certain activities taken place, user psychological needs, cultural experience, economic and education standards have direct and indirect influence to the building's (or built environment) energy performance (Yu, Shen et al. 2007). The degree of some indicator which is measurable and some is intangible, is depending on subjectivity and less dependable assessments, for example on measuring aesthetic beauty or visual compositions. For the last 50 years, professionals and researchers of post-occupancy evaluation tried to denote and comprehend user requirements in making the best factors for evaluation.

Besides the complexity of the user's nature, post occupancy evaluation concepts and characteristic may also varies. Post-occupancy evaluation itself is defined into several interpretations depending on proposed study. For an example, post occupancy

assessment can be described as a procedure of organized information gathering, investigation, and appraisal with clearly specified functioning criteria relating to inhabited built circumstances (Wolfgang 1995). United States of America Federal Facilities Council outlined post occupancy evaluation as a procedure of methodically assessing the functioning of built structures upon its have been constructed and inhabited for certain period of time (Wolfgang and Ulrich 2002). Other definition may include an anthropological element in defining post occupancy evaluation as; “an appraisal of the degree to which a designed setting satisfies and supports explicit and implicitly human needs and values of those for whom a building is designed” (Karim and Carl 2009). Another definition which is more anthropocentric strengthened and elementary in perspective suggest post occupancy evaluation as; “assessments of the efficiency for person-users of inhabited built environments” (Zimring and Reizenstein 1980).

From built environment standpoint, the Royal Institute of British Architects (RIBA) Research Steering Group defined post occupancy evaluation as; “a systematic study of buildings in use to provide architects with information about the performance of their designs and building owners and users with guidelines to achieve the best out of what they already have” (Duffy and Hutton 2004). RIBA also suggest post-occupancy evaluation functions as an analytical instrument for the evaluating building function (Wolfgang 1995). In the 1970s and 1980s, post-occupancy evaluation was carried out to assess the aimed function of designed building or built environment. The current developments post-occupancy evaluation have been highlighted on universal design evaluation (UDE) and building performance evaluation (BPE), concentrating on an additional all-inclusive and procedure-oriented assessment (Wolfgang and Ulrich 2002). This implied that post-occupancy evaluation not only evaluating technical aspect of a buildings but also consider non-technical factors influencing the design and building provisions.

In further explaining definition of post-occupancy evaluation, it can be derived to that there is no mutual definition, understanding, or standards in defining it. From definition examples, where it concerns building or built environment it is obvious that post occupancy evaluation is a method that engages a thorough methodology either for evaluation of tangible (technological) or intangible (psychological) factors function of

a building. Post-occupancy evaluation is a systematic research process that assessed human requirements, building performances and management. It is not merely a technical evaluation of building performances, but a studies that evaluate the dynamic relationship of human user interacting with their built environment. In the context or urban development of neighborhood/township; post-occupancy evaluation is a broad studies that may explored the realms of community psychology and sociology; aspect/impact of environmental and economic realms; and; beyond interactive technological innovations.

1.2.2 Sustainable Township/Neighborhood Assessment Criteria.

Sustainable township/neighborhood assessment criteria is an instrument that assesses the sustainable functions of designated neighborhood versus sets of benchmarking criteria (Sharifi and Murayama 2013). (Sharifi and Murayama 2013) stated that there are two categories of urban sustainable evaluation approaches:

- The embedded decision making instrument into township scale development such as EcoDistricts, EcoDistricts Performance and Assessment Toolkit, Ecocity, HQE2R, One Planet Living, SCR, SPeAR, Cascadia Scorecard; and
- The present third-party developed sustainable evaluation approaches and systems such as BREEAM Communities, LEED-ND, CASBEE, ECC, Qatar Sustainability Assessment System, (QSAS) Neighborhoods, Green Star Communities, Green Neighborhood Index (GNI), Green Mark for Districts, and GBI Township.

These sustainable township/neighborhood assessment criteria are typically developed by a building's related professional institute (which normally not a government related agencies) or an independent third party institution. The common aims of third-party sustainable township/neighborhood assessment criteria are driven by an objective and accessible environmentally-aware system in cooperation with market participants, without limiting the freedom of built environment design, the mitigation of the impacts of development on the environment, creation of a sustainable, responsible local community. (Council 2006, Garde 2009, Hamedani and Huber 2012).

Sustainability by definition, as (Wced 1987) recommended that in an urban

development context, is to consider holistic approach where the well balanced sustainability dimensions of environment, economic and social pillars. The simplest indicators are considered only single dimension: either the environmental, or the social, or the economic pillars. Indicators measuring in two dimensions, for example: the first viable two measures where concerns environmental dimension and economical dimension. The second two measures is livability where concerning environmental dimension and social dimensions, and the last of two measures are equitability where concerns social dimension and economic dimension. Sustainable urban indicator that concerns all three measure dimensions is considered as well, to measure sustainability (Munda 2005, Tanguay, Rajaonson et al. 2010). The measurement of sustainable indicators is grounded on the implementation of the above-mentioned notion. A sustainable urban development should satisfy the entire sustainable pillar of dimension in order to perform sustainability to the utmost (Figure 2).

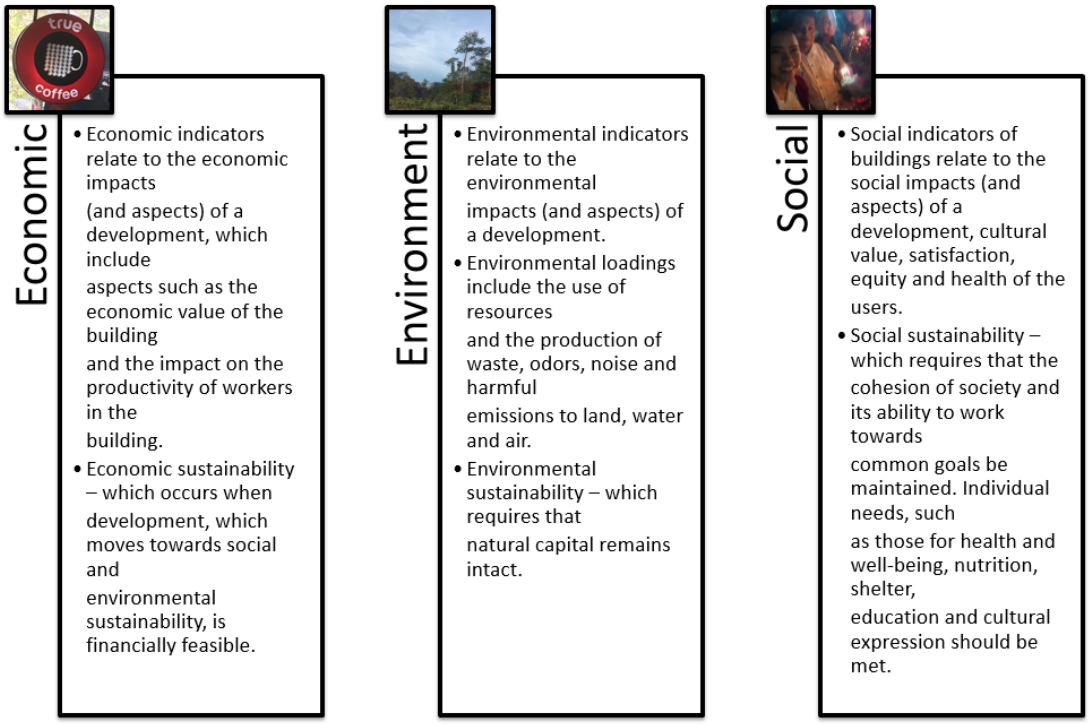


Figure2: Indicators definition of Pillars of Sustainability.
Source: Author (based on Tanguay et al. 2009)

1.2.3 GBI Township Assessment Criteria in Malaysia

GBI Township Assessment Criteria were established by Malaysia Institute of Architects (PAM) and Association of Consulting Engineers Malaysia (ACEM) as an intents for Malaysia's primary sustainable urban rating instrument which progressively will be updated and reviewed towards sustainable future. This joint initiatives between Malaysia Institute of Architects (PAM) and Association of Consulting Engineers Malaysia (ACEM) in green building indexing aims to support the construction development industry with regard to its sustainable development progression. GBI Township Assessment Criteria environmental rating approach is established to:

1. Distinguish sustainable township criteria by instituting a generic nomenclatures and standard evaluations;
2. Promote integration, holistic design; acknowledge and remunerate environmental leadership effort;
3. regenerate built environment by reducing the environmental vulnerability of the development; and
4. Assure new township development continually significant in the forthcoming future and existing township development are rejuvenate and subsequently well sustained in remaining the relevancy.

Sustainable township rating criteria are perceived as a guidelines in assisting urban planners, architects, engineers, builders, building owners, government agencies, housing developers and finally the end users in understanding the effect of each design project option and problem-solution with regard to being a more sustainable-responsive. The Malaysian indexing in green building was established to deliver a generic and verifiable means in sustainable benchmarking within the building industry of local context. GBI Township Assessment Criteria and its designed framework sets sustainability to additional level and lay out a vision for coherent approach in built environment paradigm. Its provide direction that will support all involved stakeholders in delivering sustainable urban developments.

Sustainable development is key to the strategic sustainability within a society. Sustainable neighborhoods are a fundamental element of a sustainable community, however the development of sustainable neighborhood as it selves will certainly not permit all stakeholders to efficiently address projected current or future issues that sit

beyond of the extent of physical development scope. Holistic sustainable development of the built environment is concerning relationship full cycle among the environmental, social and economic dimension factors, and by what means it is thenceforth utilized by the society concerned. GBI Township Assessment Criteria will permit related stakeholders to presume a cohesive method in adopting the environmental dimension, social dimension, and economic dimension together with design aspects linked with the provision of a sustainable township. It offers a possibility for the implementation of collaboration centered approach during the course of the development progression and assist major stakeholders in planning, designing, building, managing and operating sustainable neighborhood development.

Over more than 15 years in Malaysia, an attention to ‘green’, ‘sustainable’ or environmentally-friendly is preferred, building and township indexed in sustainable rating has intensified considerably. The Malaysia Green Building Confederation (MGBC) thru its Green Building Index (GBI) sustainable certification agenda reported that upon its inception of May in 2009, an overwhelming total of 50 million SqFt. of built area were certified ‘green’ as of May in 2013. As of in the first year (May 2009), the total registration of green project gradually increased, from 55 registered project to 91 registered project in Year 2; then to 121 registered project in Year 3 and Year 4. The Certified Green Project also grew from a single certified project in the first year to 15 certified project in the second year. On the following third year 42 projects were and fourth year 68 projects were certified. Still, in succession for this progressive trend to persist, these certified green projects should be evaluated in order to verify the actual performance is consistent towards the projected outcome. Such assessments supposed not merely limited to technical and economic performance on, but should also incorporate the sustainable experiences of the end-users or occupants.

GBI Projects	Registered Projects	Certified Projects		Registered Projects	Certified Projects		Registered Projects	Certified Projects		Registered Projects	Certified Projects
2009 Q2	17	0	2010 Q2	14	6	2011 /Q2	27	10	2012 /Q2	27	15
2009 Q3	5	1	2010 Q3	23	1	2011 /Q3	25	13	2012 /Q3	45	22
2009 Q4	12	0	2010 Q4	20	5	2011 /Q4	39	7	2012 /Q4	27	13
2010 Q1	21	0	2011 Q1	34	3	2012 /Q1	30	12	2013 /Q1	22	18
Y1 Total	55 4.5/m	1 0.08/m	Y2 Total	91 7.5/m)	15 (1.25/m	Y3 Total	121 10.1/m	42 3.5/m	Y4 Total	121 10.08/m	68 5.67/m

Figure3: GBI Project Statistic, May 2009-May 2013.
Source: Boon, 2013

Thus, in evaluating these sustainability questions, the method to study is via post occupancy evaluation (POE). Post occupancy evaluation is described as; "a systematic study of buildings in use to provide architects with information about the performance of their designs and building owners and users with guidelines to achieve the best out of what they already have" (Duffy and Hutton 2004).

1.3 Problem Statement and Hypotheses

The Malaysian construction and development sector has been over the years emerged and thrived in the direction of a more progressive sustainable urban agendas. The subject of sustainable neighborhood/township benchmarking approach in the field of urban development in Malaysia is relatively new. Although GBI Township Assessment Criteria has been developed and implemented but **there is no post-occupancy evaluation being conducted in assessing the performance, effectiveness and sustainability level on the certified development?** There has been lack of study done

to measure the greenness' of the tools and the post certified township development. Even though there is study conducted on environment dimension, however fewer so are conducted on what really signifies socially or/and economically, and/or its application in the sustainable urban development context. Do sustainable neighborhood or township evaluation criteria and frameworks in common signify sustainable holistically? (Sullivan, Rydin et al. 2014). Therefore, proficiency and comprehension on urban sustainability benchmarking criteria could strengthen neighborhood sustainable indicators, effectiveness and sustainability level among the Malaysian sustainable urban development actors are vastly still low. Studies has indicated one of the main obstacles that hinder sustainable township/neighborhood development in ASEAN nations is the deficiency of knowledge in sustainable concerns subjects in relation to the involved building profession (Yahya and Hashim 2011).

Past study done on sustainable building rating system potential in Malaysia also shows that Malaysia construction and development sector key stakeholders have insufficient understanding on sustainability development evaluation, benchmarking & indexing approach (Shari, Jaafar et al. 2008). Due to this many green certified urban development project in Malaysia claim sustainability merely for label advertisement, marketing tools and higher premiums instead of fully addressing the sustainable pillars. Certified GBI township projects normally a high-end urban development projects, study has indicated that sustainable certification do improve leasing and selling rate of developed properties, but this outcome is further substantial for end-users who are more innately concerned with sustainability, or pushing their 'green' appearance (Sullivan, Rydin et al. 2014). Even though the noble foundation for sustainable township/neighborhood is to promote and applied sustainable development, but there is no study was undertaken to address and gauge this issues. Thus, embark the **problem of the research:**

- **whether the existing GBI Township Assessment Criteria and certified urban development project fulfilled the post-occupancy performances, effectiveness and sustainability level according to dimensions Pillars of Sustainability.**
-

The research also intended to find out the theoretical aspect of the study. Besides the practical study, this research is also to prove study hypotheses listed below;

- **Hypothesis 1. Sustainable pillar dimensions method will improve the sustainability within the community's neighborhood context,**
- **Hypothesis 2. Post-occupancy evaluation model (POEM) assessment criteria and theory would differ from the pre-occupancy assessment criteria and theory**.

1.4 Research Conceptual Framework

The conceptual framework of research is design to address the Research Problem Statement and Hypotheses. The conceptual framework is basically to narrate how the research will be execute and done.

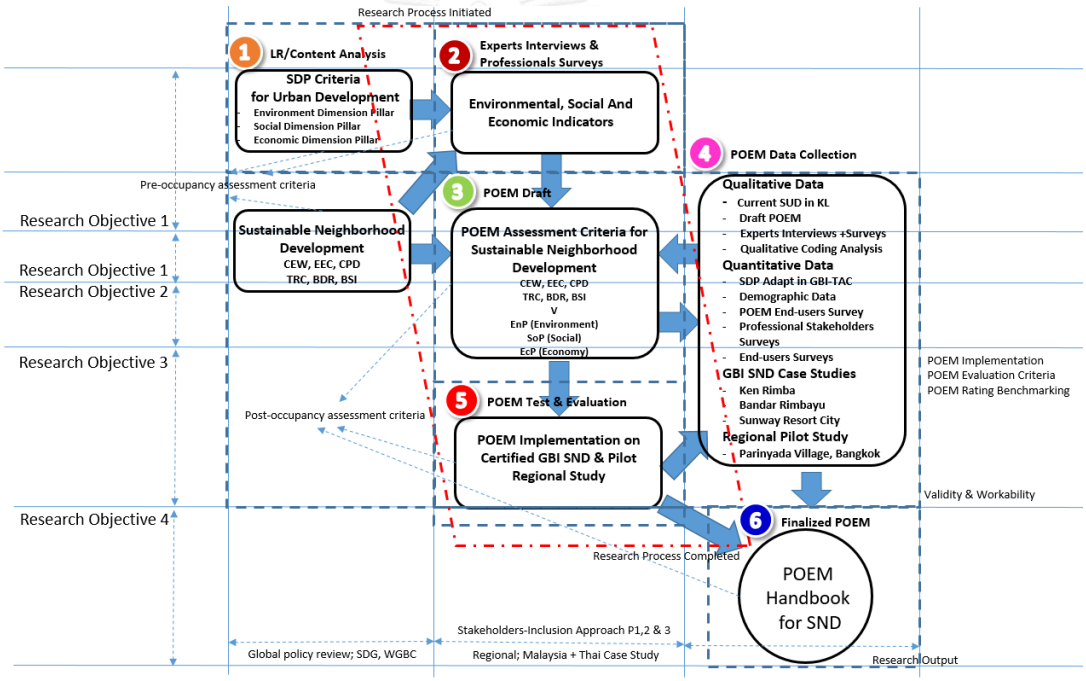


Figure 4: Research Conceptual Framework.
Source: Author

Based on figure 4, the research is will be executed in 6 stages:

1. Literature review and content analysis
2. Experts semi-structured interview and professional survey
3. POEM draft
4. POEM data collection
5. POEM test and evaluation
6. Finalized POEM

Throughout these execution stages, the research will addressed all the research objectives and answered all the research questions. The research objectives and questions is discussed further in the following sub-chapter and detailed description of the research conceptual framework is discussed in Chapter 3: Research Methodology.

1.5 Research Objectives and Research Questions

Hence, this research aimed to investigate the outcome of;

- **Post-Occupancy Evaluation Model** (POEM) on **Sustainability Dimension Pillars** in evaluating **GBI Township Assessment Criteria and certified GBI township project in Malaysia.**

GBI Township Assessment Criteria in Malaysia has list out the criteria for green indexing, however, there are no post-occupancy evaluation to address the effectiveness and explanation on specific holistic pillars of sustainability framework neither on the core criteria nor the certified urban development project using the tool itself. Thus, embark the problem of the research is to assess the effective performances of GBI Township Assessment Criteria six core criteria using pillars of sustainability framework by conducting post occupancy evaluation on certified Green Township projects. The objective of the research proposal is;

1. **To identify and formulate post-occupancy evaluation model based on sustainable pillars towards sustainable neighborhood development for Malaysia.**
2. **To implement post-occupancy evaluation model in assessing & evaluate GBI certified neighborhood towards sustainable urban development for Malaysia.**
3. **To evaluate similarity and discrepancy of Post-occupancy evaluation theory and variables are differ from pre-occupancy assessment theory and variables.**
4. **To recommend the adaptation of POEM findings to similar development phenomenon in the region and country throughout the world.**

To answer the objectives, this research is motivated by several driving **questions:**

1. **What** are most significant sustainable urban framework criteria and **how** can the POEM framework be successfully developed?
2. **How** can the POEM framework be implemented and measured?
3. **Would and Why** theory of post-occupancy differ from pre-occupancy?
4. **How** can these criteria be tested on the workability through urban development project?

This research is to develop model (POEM) and redefined an urban framework based on holistic sustainable pillars criteria (Figure 4), which is intended to stimulate public policy as well as private implementation toward urban regenerative at varying scales of community development and urban redevelopment. The POEM principles and strategies that shape the Sustainable Urban Assessment Framework hold great potentials to provide feedback in public and private processes of policy- and decision-making based on scientific analyses. Perhaps more importantly, these principles and strategies aim to incrementally bring neighborhoods-scale redevelopments that will culminate in large-scale transformations of urbanized areas.

1.6 Operational Definitions

1. This research is center upon GBI Neighborhood Assessment Criteria and three (3) certified GBI neighborhood project in Malaysia
2. The focus on GBI Neighborhood Assessment Criteria is the six (6) core criteria, which comprises of CEW (Climate, Energy & Water); EEC (Environment Ecology); CPD (Community Planning & Design); TRC (Transportation & Connectivity); BDR (Building & Resources) and BSI (Business & Innovation) (GBI, 2010).
3. Certified GBI neighborhood project is an indexed and certified project which under GBI rating or classification of Platinum, Gold, Silver or Certified.
4. The certified GBI neighborhood project is a completed project and was in operation or occupied within or more than one (1) year.
5. Data will be collected through thorough literature studies, expert semi-structured interviews and surveys, stakeholder survey and household surveys.

6. Data collected from literature studies will be analyzed using comparative analysis method; data from semi-structured interview and surveys, and data from stakeholder survey will be analyzed using stakeholder-inclusion approach.
7. The Post Occupancy Evaluation Model (POEM) will be developed from these analyzed data and based on Sustainable Dimension Pillar (SDP) of Environment Pillar (EnP), Social Pillar (SoP) and Economic Pillar (EcP).
8. The Post Occupancy Evaluation Model (POEM) will be tested on-site using end-user/household surveys at selected GBI neighborhood project to measure the sustainability level and appraise the workability. The selected certified urban neighborhood as a case study for on-site household surveys will be based on criteria described in operational definition.

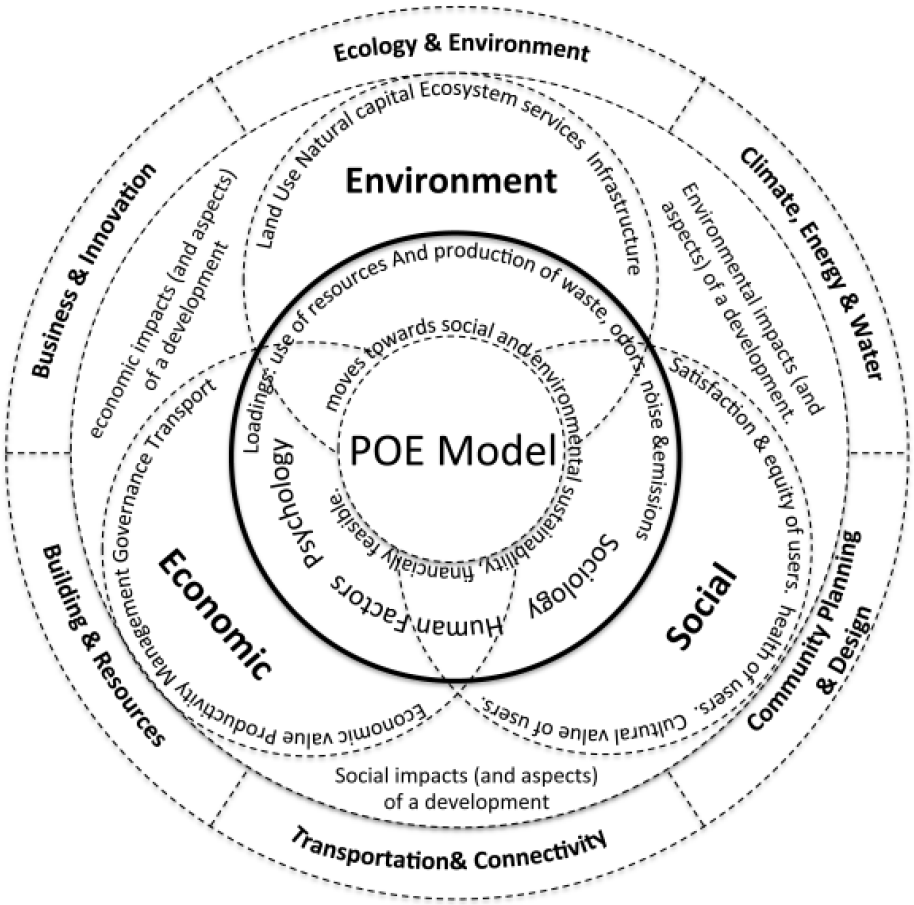


Figure5: Preliminary Conceptual Framework of POEM.
Source: Author

Operational definitions for this research is within the specific terms meanings as followed;

1.6.1 GBI Township Assessment Criteria

Green Township Assessment Criteria in this research is referring to Malaysian Green Building Confederation (MGBC) sustainable township or neighborhood tool which was developed by its subsidiary entity Green Building Index Malaysia Sdn. Bhd. (GBI). The sustainable township assessment criteria is called GBI Township Assessment Criteria (GBI-TAC) and was launched in March 2011. GBI Township Assessment Criteria is perceived as a guide to assist related stakeholders in the building industry. It serves as planning and design reference to urban planners, architects, engineers and designers, built blueprint for builders, contractors and trade specialist, enforcement policy for local authority and government agencies, development direction for developers and project commissioners and finally as continuing sustainable agendas for end-user and neighborhood communities GBI-TAC is vital in understanding the impact of each development choices and problem-solutions towards a more keen environmental friendly development. The GBI Township Assessment Criteria was initiated to deliver urban development industry a standard and verifiable systems in benchmarking green rating for sustainable property development. GBI-TAC takes neighborhood development to higher level and lay a vision towards sustainability in the built environment and offer assistance to all stakeholders in delivering sustainable neighborhoods/Townships. Currently there are three Certified Urban Neighborhood projects which been pre-occupied for more than one year in Malaysia; Ken Rimba Development, Bandar Rimbayu Township and Sunway Resort City.

1.6.2 Sustainable Township

The definition of Sustainable Townships as suggested by MGBC is habitable dwelling spaces which meet various necessities of its community both at present and also in the forthcoming future. Sustainable Townships are to be well considered in term of planning and design. They should be secure and safe, and also improving the natural

surroundings, hence offering a quality value of living to the residences who are living, working and playing there. Reasons for sustainable township development resulting from global warming impacts and climate change. This has pushed the governments and private sectors in building industry to shift and change the way they used to operate and perform. The conventional way of 'business as usual' proverb is not suitable or accepted in the current dilemma (MGBC 2010).

1.6.3 Post-Occupancy Evaluation Model (POEM)

Post occupancy evaluation model is a structured review of the functional, operational and strategic performance of the building during occupation (Galvin, 2012). POEM is about the collecting and analyzing of sustainable neighborhood development data, area operation and also inhabitant behavioral. These gathered data are significant in ensuring the developed neighborhoods, to maximize community needs and lifestyle and at the same time in conserving the surrounding environments. In this research proposal, POEM framework is a development of a methodology to formulate a comprehensive sustainable system with the aim to evaluate performance, effectiveness and end user satisfaction based on Sustainability Dimensions Pillars, leading towards an enhanced sustainable neighborhood and urban development as a whole. This POEM framework is to assess the 'greenness' of existing GBI Township Assessment Criteria and certified GBI selected urban development project in Malaysia. POE model will assess and evaluate the core criteria in green township assessment criteria, factoring in and indicating the triple bottom line of sustainable dimension pillars which consist of environment dimension, social dimension and economic dimension. The overall intent of this POEM framework is to assess and gauge GBI Township Assessment Criteria in Malaysia.

Neighborhood Definitions

The following definition will be referred in this study;

(Varga and Vercseg 1992) stated that a neighborhoods are the part areas and systems of cities, which made up by its distinct architectural features, cultural practices and

economic level. The core intend of neighborhood planning and design can be described using the listed components below (Steuteville 2004);

1. Neighborhood commonly designed with a visible focal point. This center is frequently a communal square or designated green spaces and occasionally depict as a high-street or notable public spot. A public transit hub normally sited at or within this center.

2. Main housing area located inside an approximate 5 minutes walkable distance radius from the neighborhood center, averagely of about 600 meters.

3. Neighborhood are made up of mixed residence types which include single houses, terrace houses and high-rises dwelling such as flats or apartments. This diverse inhabitants backgrounds such as age, numbers of the household, marital status and income group are part of neighborhood diversified component.

4. By the neighborhood perimeter there are commercial and working area which adequately varied in types in order to provide the essential needs of a community.

5. Residence unit are permitted to build small ancillary structure in the backyard which may be used as a rented unit, storage or working area

6. Public amenities such as primary school is within walking proximity for most children to walk from their residence unit.

7. Provision of small play area or green field which is accessible for every residences where the distance is less than 160 meter away.

8. Provision of connected trunk street and road network within the neighborhood that disperses flow of traffic via a diverse pedestrian walkway and vehicular paths to every destination in the neighborhood.

9. The roads are rather narrow and covered by rows of tree shades. This basically to slow traffics and initiating a cooler environment appropriate for walking pedestrians and cyclists.

10. Center of the neighborhood are planned with buildings that adjacent to the street whereby it will form an indoor-out space.

11. Car porch lots or garage entrances are seldom located at the street front. Car park is relegated building's rear or sideways, normally accessible via side alleys.

12. Specific prominent locations of street termination or vista within the centers of neighborhood are allocated for community buildings. These provision are for

community thrust where gatherings, religious, cultural, educational or recreational activities is conducted.

13. Neighborhood is established as self-governing organization. A formal residence association meet and debates for decision making regarding policy of neighborhood security, safety, maintenance, or any physical change. Sizeable community is accountable for taxation and other related fees.

1.7 Research Method in brief

1.7.1 Methodology: Mixed Method

The post-occupancy evaluation model (POEM) of sustainability for sustainable urban development in Malaysia will be developed using Stakeholders-Inclusion Approach. It will employs a mixed method research methodology which consist of both qualitative and quantitative data that has been inspired by the GBI Township Assessment Criteria development (GBI 2010) based on content analysis (literature review), expert semi-structured interviews and surveys, professionals stakeholder's survey, end-users/household surveys and POEM handbook on-site validation. (See Figure 5).

1.7.2 Research Process

The research is about conducting comprehensive studies on current GBI township assessment criteria versus sustainability pillar dimension (SPD) elements and community/human satisfaction aspects within urban development project. This study novelty will look on adaptation a well-balanced sustainability pillar dimension (SPD) which addressed economic, environment, and social impacts/aspect and loading factors that combines content analysis, semi-structure interview and survey, stakeholder survey, end-users / household on-site survey and POEM handbook validation (Figure 5).

Due to inadequacy of current information and lack of POEM study on GBI Township Assessment Criteria and certified GBI township project the studies is broadened to other region. The extended research to other region is to gather a more universal

building rating methods to determine the suitability of adapting, modifying and assimilating post-occupancy evaluation model (POEM) for Malaysian context.

Then, study will be carried out through semi-structure interviews and surveys of qualified GBI experts and technical team in Malaysia. Targeted qualified GBI experts and technical team are the Board members of MGBC (Malaysia), and GBI Facilitator + Assessor in Malaysia, Department Urban and Regional Planning Malaysia and Academicians. The study is also expanded using a survey questionnaires to further interrelated experts and technical team in MGBC, including Interior Architects/Designers and other similar professionals involved in urban development projects.

Upon the completion of POEM, it will be tested on selected certified GBI township project in order to assess the performances and end user satisfaction of the above said project. To validate and appraise applicability of POEM, a handbook will be used for these purposes. The POEM will be a set of reference for MGBC future review of GBI Township Assessment Criteria in Malaysia.

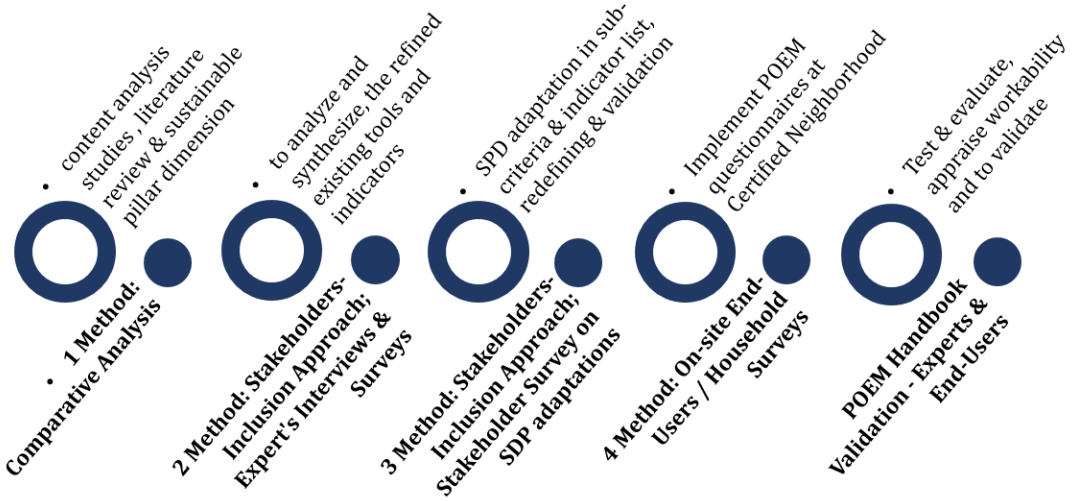


Figure6: Final deliverables of Mix Method Research Process.

Source: Author

Content Analysis in this research is based on data gathered for POEM of sustainable pillar dimension against standard criteria in GBI Township Assessment Criteria.

Expert's Semi-structured Interviews & Surveys, data from experts or Professionals from building backgrounds will be gathered to discuss whether the POEM framework can be implemented. This will be accomplished through semi-structured interviews and surveys of GBI Malaysia expert groups. The purpose of semi-structured interviews and surveys is mainly to find-out the opinion from the expert on current sustainable development indication in Malaysia and to identify the main criteria, assessment tools, weight indicators and model application.

Professionals Stakeholders Survey, the quantitative approach will be conducted in order to know POEM modeled parallel with sustainability dimension pillar (SPD). The main objective is find out SPD adaptation in GBI Township Assessment Criteria. This will be used to elicit information in consensus the targeted group (professional) and focus group (local authority and stakeholders).

End-Users / Household Survey

This method appraised the end-users/household opinion on the expected POEM in GBI Township Assessment Criteria within existing GBI core criteria standards i.e. CEW (Climate, Energy & Water); EEC (Environment Ecology); CPD (Community Planning & Design); TRC (Transportation & Connectivity); BDR (Building & Resources) and BSI (Business & Innovation). While this method summarizes the demographic data and overall SPD indexing and ranking, it is also instrumental in estimating the corrections to be expected from the performances and user satisfaction measures of POEM.

POEM Handbook: Validation & Appraised Applicability

POEM Handbook is summary of all the process and served as a tools in validating and appraising the applicability of POEM in GBI Certified Neighborhood.

1.8 Research Significance

Over the years, building and construction industry in Malaysian has been evolving and developing into a more green and sustainable development. The subjects on sustainable urban benchmarking system and approach in urban neighborhood development in Malaysian are relatively new. GBI Township Assessment Criteria has been developed to fill in the gap. In keeping abreast with the green development, POEM will be used

to measure the greenness of the tools and the certified GBI township development. POEM is set to measure the sustainable 'pillar' by addressing what is really signified environmentally, socially and economically, and how to be implemented? Does green township assessment criteria in general fully represent sustainability?

The role of professionals in building industries has changed. It is only not to design linearly physical development but to incorporate a functional, operational and strategic performance concepts into overall life-cycle of urbanizations. This study established the POEM via pillars of sustainability dimensions on a selected certified GBI township development project in Malaysia. This research will **set new green urban development paradigm in Malaysia sustainable township assessment criteria,** and going beyond merely green label, marketing tool or higher premium development tags where city can fully embrace pillars of sustainable development. Moreover, hopefully, this research will **contribute to the government authorities, building professionals and urban communities.**

1.9 Expected Outcome.

The **expected outcome** (Figure 6) upon the completion of the research is the **POEM for future sustainable town township development in Malaysia.** The POE model is expected to be a reference model for future MGBC review and revision of GBI Township Assessment Criteria, Local Authorities and Ministries related sustainable and green policies. The expected outcome deliverable through the research is as in the followings;

1. The **expected output** upon the completion of the research is the **POEM Handbook for future sustainable neighborhood development for Malaysia.**
2. POEM Model for future sustainable neighborhood development is not only for Malaysia but similar development phenomenon in the region of ASEAN nations and country throughout the world.
3. The POEM model is expected to be a reference model for future MGBC review and revision of GBI Neighborhood Assessment Criteria, Local Authorities and Ministries related sustainable and green policies. POEM model is also expected to be a reference guide to any urban neighborhood development and influence

planning, design and construction process as whole.

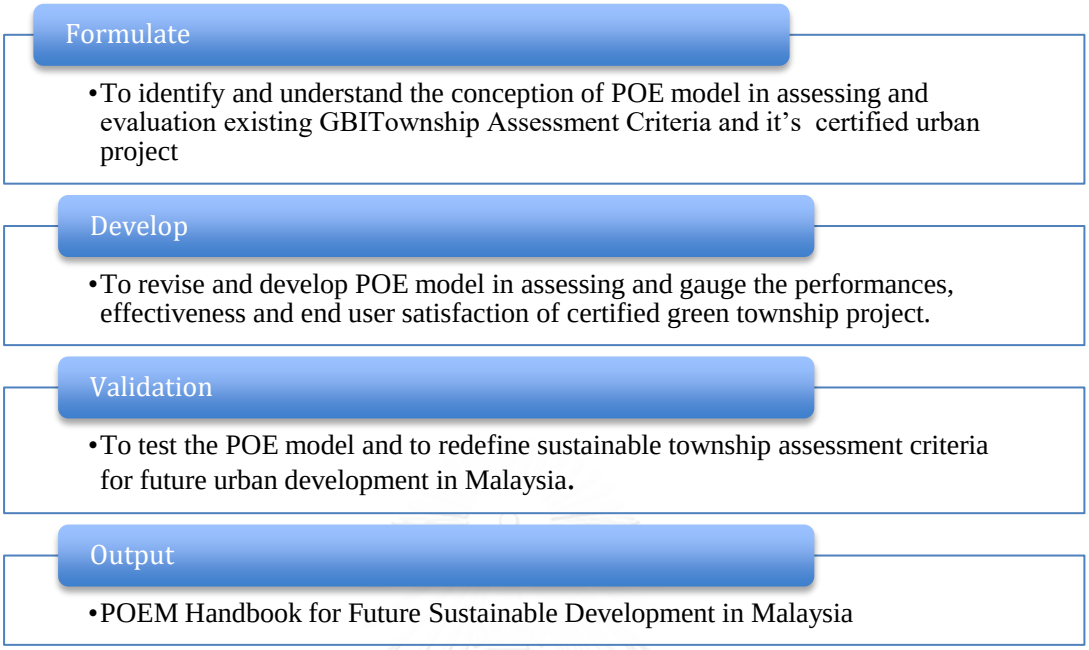


Figure7: Expected outcome of the research.
Source: Author

CHAPTER 2:

LITERATURE REVIEW

2.1 Introduction of Urban Growth and Environment

Modernizations relate to rapid urban development and sprawling. It is inevitable and desirable. Whether under developed, developing or developed nations, all are striving for modernizations. It is about enhancing the standards of living, economics and lifestyles. Modernization touches upon every aspect of life, from human affluence to the built environment that we are dwelling and carrying out our daily routines. The rising world population together with economic growth have effectuated various environmental issues, ranging from climate change, atmosphere pollution and many other hazardous natural environment degradation phenomenon.

United Nations Environment Program (UNEP) stated that urban development is responsible for massive energy consumption and the contributor of greenhouse gases emission (40%), natural resources use and generated wastes (30%) and consumption of water (20%) (Lowe and Ponce 2010). US-EPA (Environmental Protection Agency) implied that construction and building sector is the cheapest and easiest sector can be aimed for reducing generated wastes and greenhouses gases emission (refer to Figure 7: (IPCC 2007). Sustainable urban development is a way of innovating and implementing better resource-efficient frameworks for demolition, refurbishment and renovation, construction, maintenance or operation, and it has turn out to be an accepted aim in the building industry, property sector and also market for end user throughout the globe (Truitt 2009).

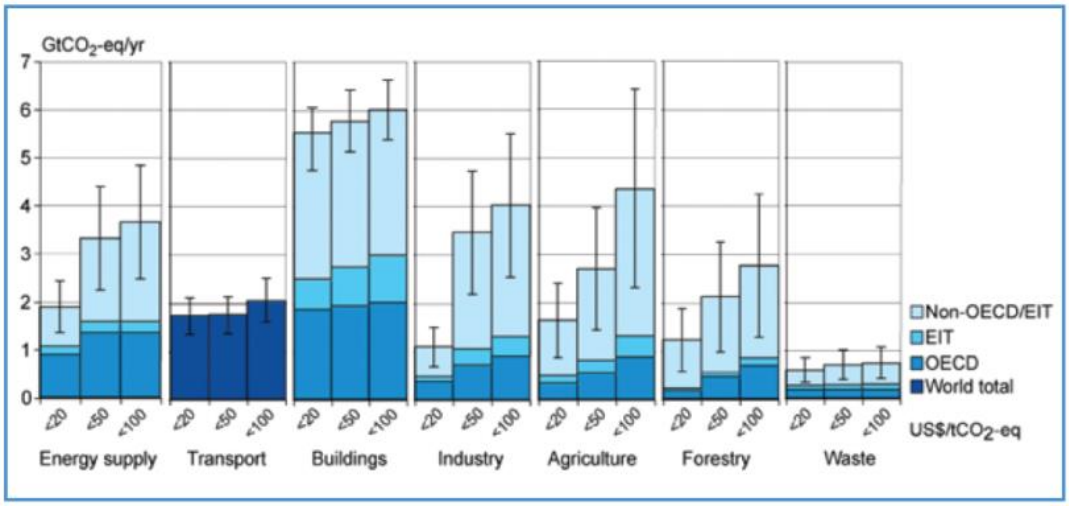


Figure8: Estimated economic mitigation potential by sector and region using technologies and practices expected to be available in 2030.

Source: IPCC, 2007a.

Urban development is the human collective phenomenon together with physical alteration of natural surroundings, it is the utmost influential, irretrievable, and obvious anthropogenic forces towards the planet (Grimm, Grove et al. 2000). Manmade urbanization is the main cause resultant in the most significant and major changes impacting the environment either at the urban areas itself or the hinterland in supplying resources. Currently, above 50 percent of the planet inhabitants are dwelling in the metropolitan areas and the projected future population growth more than 90 percent will live in the urban metropolises especially in poor nations (Cohen 2006). Rapid population growth and urban development suggest imperative declined implications towards humanity continuing to endure. Loaded with undesirable impact of growth in urban area, whether the development itself, people and the environment are subjected to an increase vulnerability (McMichael 2000).

The rapid urban growth imbalance especially in developing and poor country couple with economic and financial crisis effectuates great social gap within the societies. This impact has substantial role in factoring city development and world ecological degradation. These adverse social loadings in the urban areas are sources of environmental degradation, simultaneously also further contributing to negative effects in urbanizations. This mutual complementary relationship of adverse effect keeps continuing; hence it needs to be rectified.

2.1.1 Global Urbanization and Environmental Change

An open secret, by looking at the current trend of world population by 2050, a massive escalation of urban population will pose crucial setback to the environment, health and infrastructure of major metropolis. The current global population is at 7.4 billion (as of August 2016), and anticipated to escalate to 8.1 billion in the year 2025 and projected to touch 9.6 billion in the year 2050 (McMichael 2000, UN-DESA 2013, Steffen, Broadgate et al. 2015). Newly developed country's city centers will be highly dense, polluted and inefficient. This will lead to metropolitan development grew to staggering unprecedented areas. Resource depletion and climate change adaptability will create new breed of building and infrastructure based on changing new social structure and the needs of the environment.

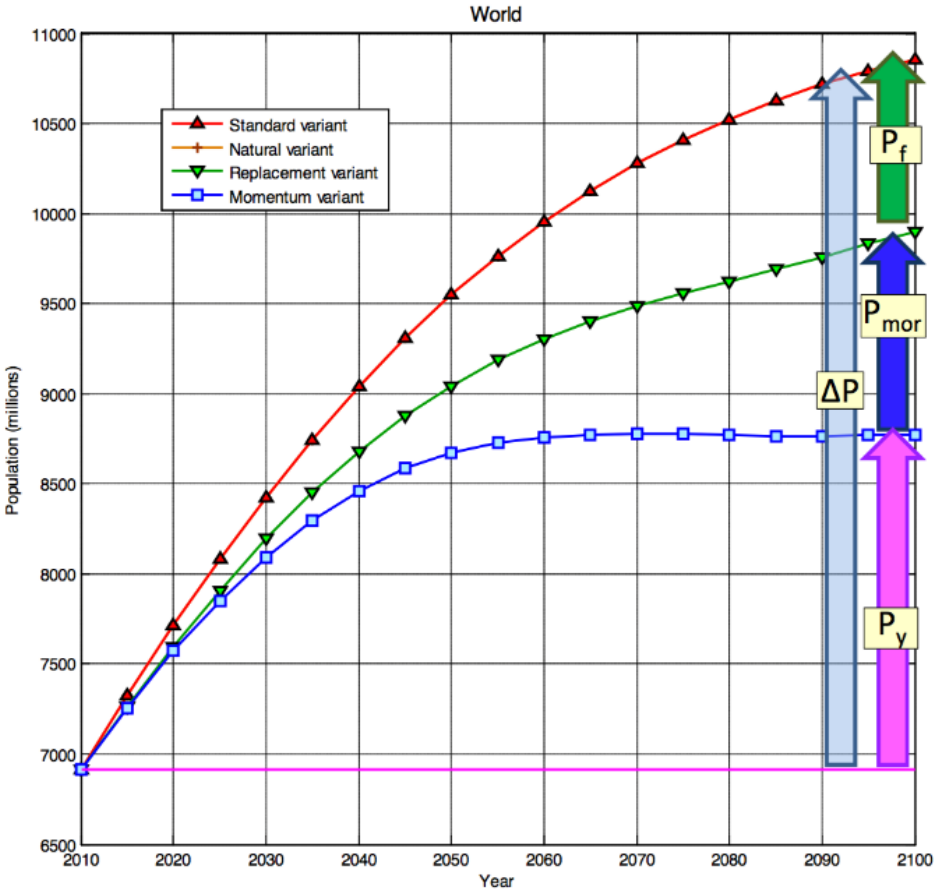


Figure9: Population projection variants to future population growth, 2010-2100.

Source: UN-DESA, 2013

The future trends of mid-21st. Century urban development must be ‘self-sufficient’, an urbanization that able to fulfill the needs and requirement of its’ citizen to live comfortably and sustainably and not dependents to other isolated supporting infrastructures. Looking at current scenarios of human consumption either physically or spiritually till 2050, we can assure of apparent and huge degradation of resources and environment. The sustainability of the built environment concerns the capacity of an intervention to enhance the livability of buildings and urban infrastructures for ‘all’ city dwellers without damaging or disrupting the urban region environment (Allen 2009). It also includes a concern for the efficiency of the built environment to support the local economy.

This wider view of urban sustainability calls for re-embedding our understanding of cities and their multiple and diverse impacts on society and the environment within the contemporary process of urbanization. This is because cities cannot be expected to become ‘islands of reform’ in isolation from the wider global political economy in which they are produced. Thus, the question of how to promote sustainable cities and indeed sustainable urbanization cannot be dissociated from the uneven geographies of development (Potter 2004) produced by the globalization process and the way this changes the relationships between people, environment and places, both through time and space.

The human center perspective between Global Environmental Change and Urbanization is the key element in establishing transformation and efficient Sustainable Development Goals (SDG) after the year 2015. Environmental change at global scale includes climate change, global warming, deforestation, desertification , land degradation, diminishing ecosystem services, deficiency of biodiversity, alteration of hydrological natural systems which are amid others is driven and as an outcome of physical, economic, social, cultural and political course of actions in urbanized areas (ICSU 2014). Based on this, urbanization is the regarded as the internal and external caused factors for environmental change. As at current time the world are breathing in Epoch of the Conurbation (Peirce, Johnson et al. 2008), careful considerations in built and rebuilt sustainable development in this context is imperative. Defining cities merely as localities or static entities is sustainably ignorance instead emphasize should be the importance of cities as an ongoing process of urbanization.

Key principles in global environmental change and urbanization in sustainable development should adhere to the SDG's Goal no. 11, Make cities and human settlements inclusive, safe, resilient and sustainable; and TST (Technical Support team) Issues Brief: Sustainable Cities and Human Settlements' (Tyler and Moench 2012, DESA-UNDP 2013);

> '*promot[ing] cities that are environmentally sustainable, socially inclusive, economically productive and resilient*'; and '*[e]mpower[ing] inclusive, productive and resilient cities*, by addressing their social, economic and environmental dimensions',
> (DESA-UNDP, 2013).

Comparatively, at not more than lifespan of human itself, the surface of our Planet has been malformed rapidly. During 1950s, merely 29% of world population inhabited the metropolises, currently the number has leapt to 50.5% and projected to grow by 70% in 2050. Global urban dwellers in Asia region is increasing very rapidly as compared to any other region, ongoing trend and escalating since the turn of the century. According to Butler (2010), urban inhabitants is at 234 million in the 50's, stretched to 1 billion inhabitants in the 90's, and projected to touch 11.2 billion inhabitants coming 2025. Based on Figure 9, Asia will have the most mega metropolises throughout the planet. This developmental progress towards urbanizations since 1950's in Asia suggests immense growth in India, China, Bangladesh, Pakistan and some ASEAN countries. City of Jakarta in Indonesia, and Manila in the Philippines is projected to grow more than double in 2025 as compared from 1950s.

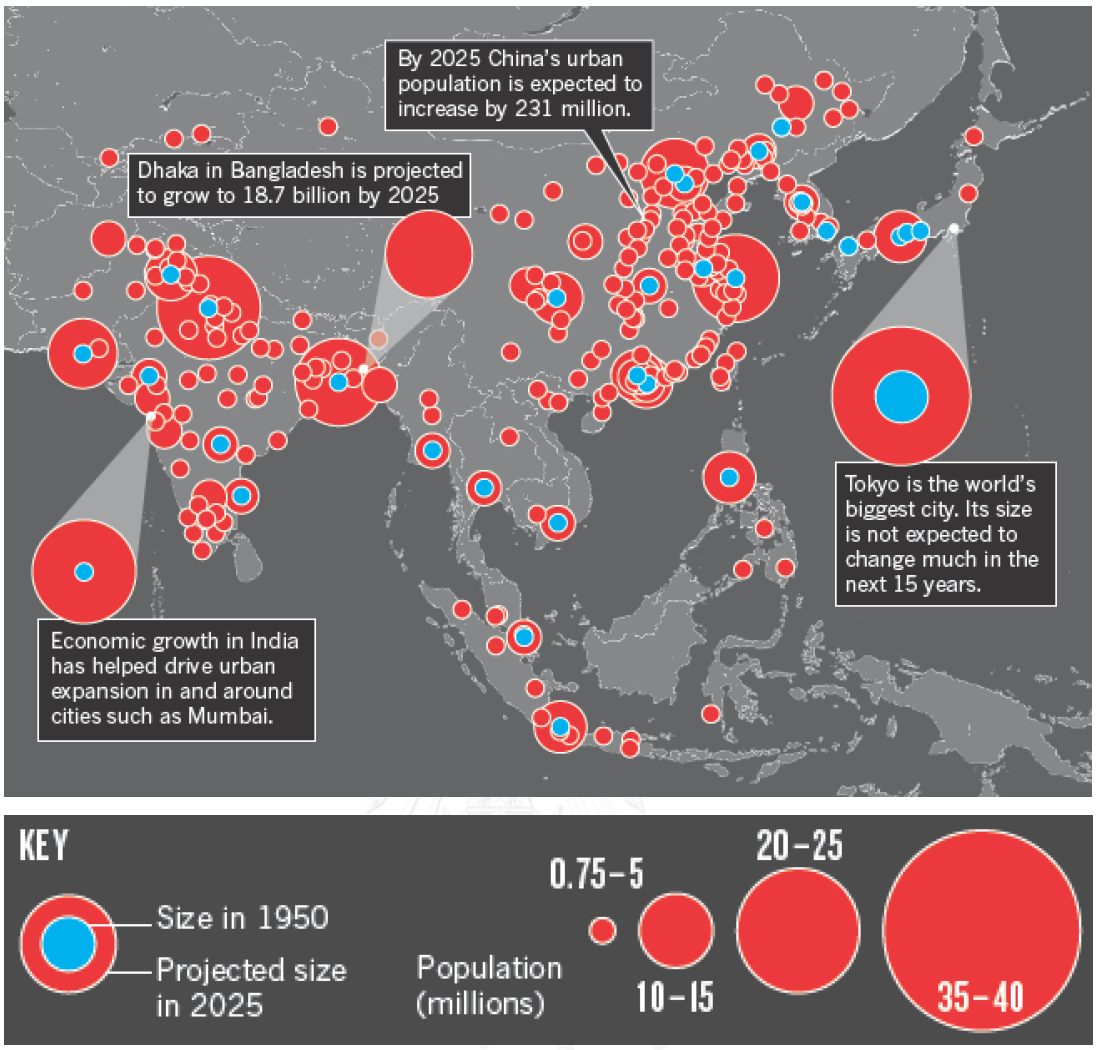


Figure10: Asia's urban population growth projection by 2025.

Source: Butler, 2010

The common growth population in urban metropolis is the cause of expected upsurge, countryside to city migration besides the upgrading of previously rural regions to urban areas. This basis is also primarily happening in urban conurbations of developing nations, mainly in the Asia and Africa continent (2010). These development tendencies are highly noticeable at cities of small to intermediary -sized range, whereby the methodological and economical capability are the lowest and infrastructural insufficiency is often the highest (2012).

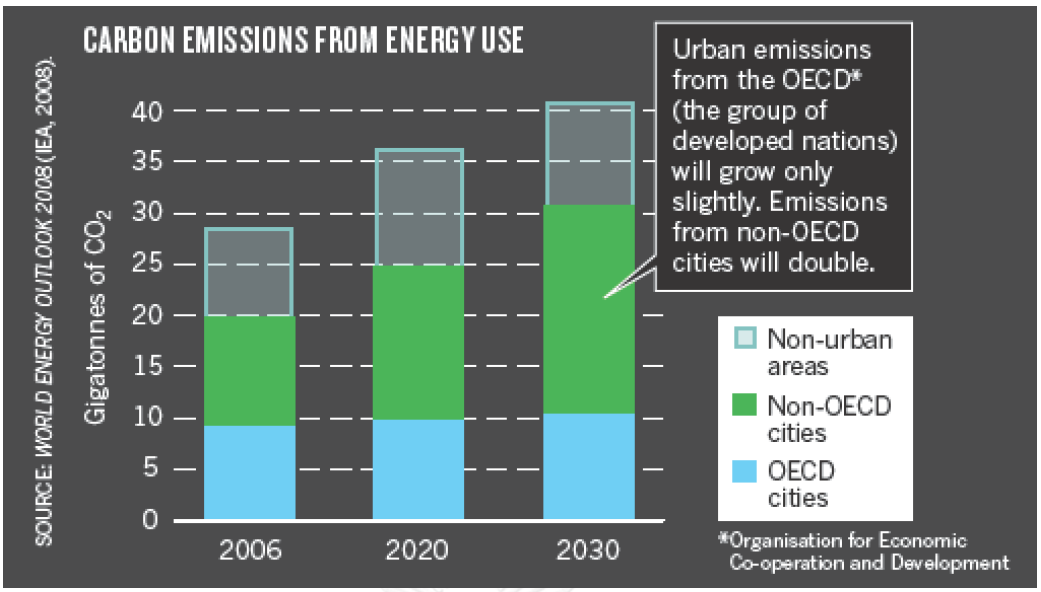


Figure11: Where the problems are: CO2 emissions from energy use.

Source: IEA, 2008

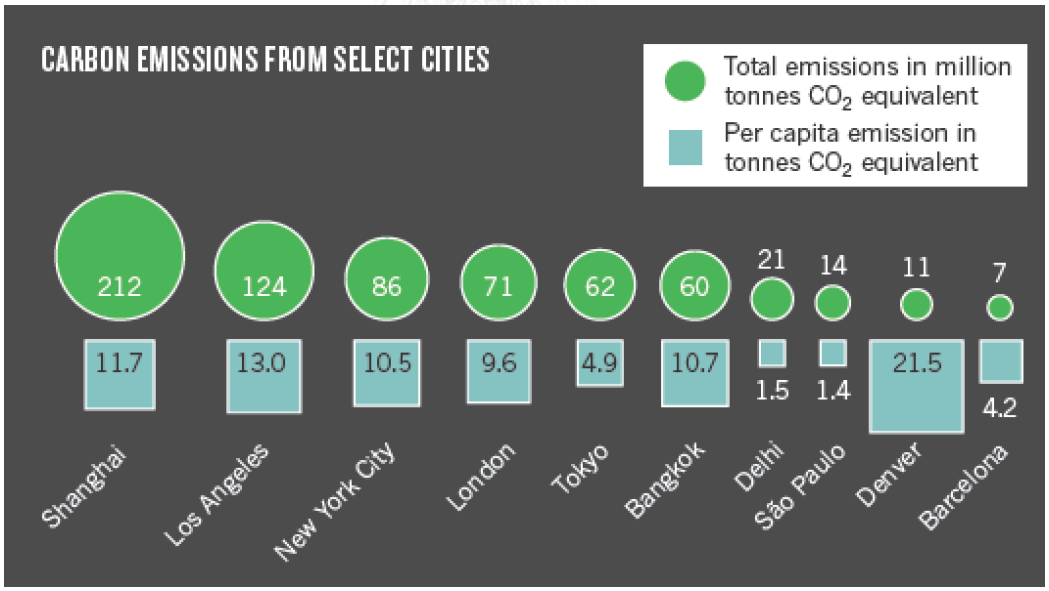


Figure12: Carbon emissions from selected cities.

Source: IEA, 2008

The biggest global environmental change due to urbanization is greenhouse gas emission from energy consumption in the urban area. Figure 10 suggest projected CO2 emission from developing nations (non-OECD) doubled from developed nations

(OECD) by 2030. Urban conurbations are the major cause contributor of energy and natural capitals consumption. Approximately more than half of global populace are urban inhabitants, however they used up 2/3 of over-all world energy utilization, moreover they released a massive 70% and above energy related carbon dioxide emission to the atmosphere (Stuckenschneider 2004, IEA 2008). Figure 11 show CO2 equivalent emission per-capita and total emission in million tones equivalent in selected cities. Shanghai emits almost double compared to Los Angeles, which the earlier is the city in developing nation and the latter is the city in developed nation. Asia is the largest region in the world with 30 per cent of the land mass and 60 per cent of the population. Given its vast geographical expanse, Asia and the Pacific is perhaps also the most diverse region in terms of economy, society, culture, environment and human settlements (Dahiya 2012).

Another major problem related global environmental change is land use due to urban sprawling and improper development planning and management. During the year 1990 to the year 2000 or within a decade urban development across the globe sprawling rapider instead its populations grew, this is as a result of urbanized sprawl in the developing nations which developed faster by 20% or so (Seto, Fragkias et al. 2011). Whereas cities lack its density due to urban sprawling, it's incarcerating itself into untenable land used guides where working area and residential area are distant to each other, transport expenses as well as massive traffic jam, longer infrastructure operations including higher cost, socioeconomic division separation and types of land use are further proclaimed and as a consequences resultant to vaster environmental impacts. Figure 12 below suggest urban sprawling in Bangkok in less than 10 years:1994-2002 (Angel, Parent et al. 2007); urban main core of Bangkok has increased more than 24 kilometers in radius wise from Central Business District to any direction (Hara, Takeuchi et al. 2005). It also suggest the urban secondary core in 1994 also has be reclassified and upgraded as urban main core in 2002 particularly at the areas of downstream of Chao Phraya river (Angel, Parent et al. 2007).

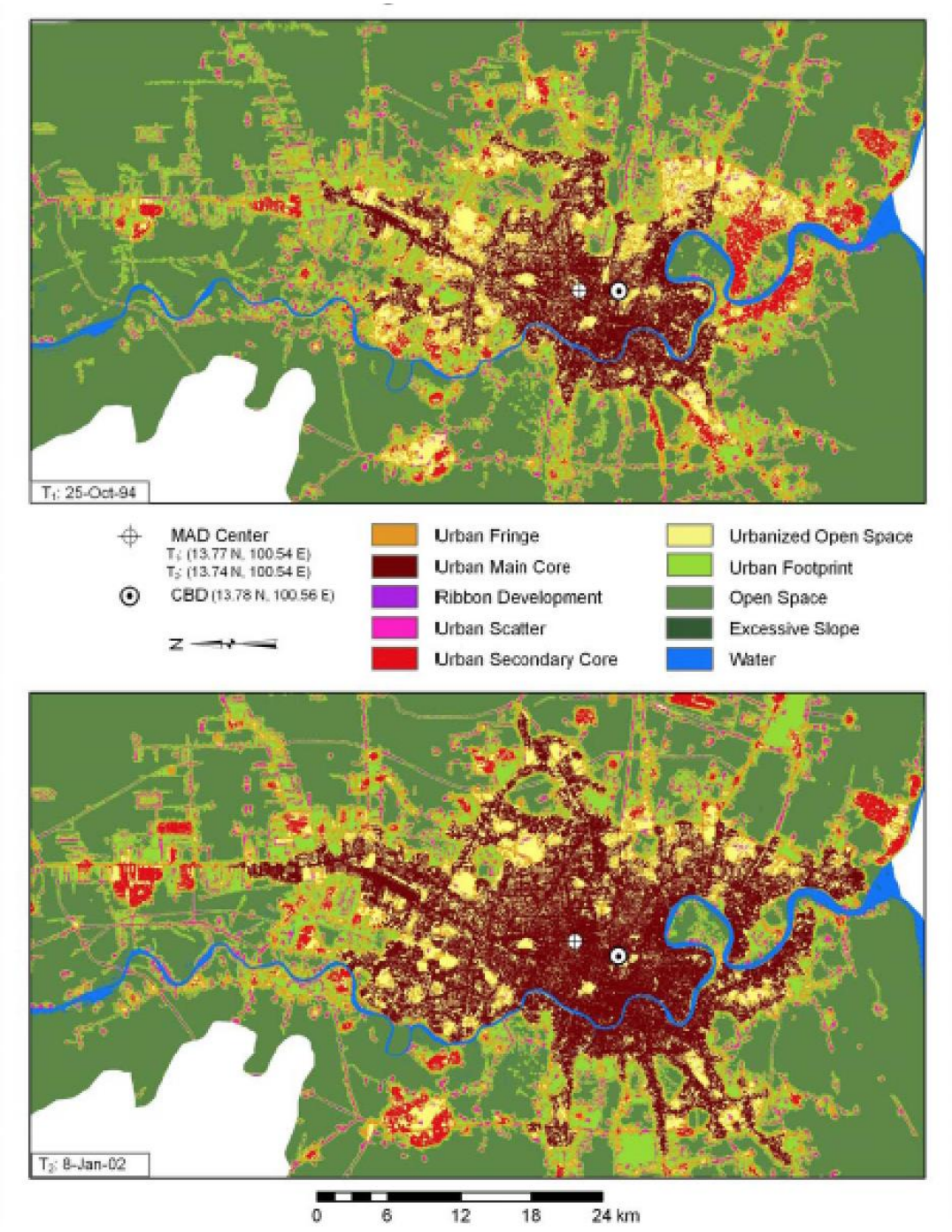


Figure13: Urban sprawling landscape in Bangkok 1994 – 2002.

Source: Angel, Parent et al. 2007

2.1.2 UN Urban Sustainable Developments Policies

A sustainable urban framework is developed basically parallel to UN Sustainable Development policy, criteria, goals and declaration. As a devised assessment criteria's and rating tools for holistic design and construction approaches, Sustainable Urban Institutions worldwide is constantly revised and updated according to current economic, social and environment needs with the aim of meet towards the future that we want (GBI 2010).

The common sustainable urban development adopted evaluation measures is climate-energy-water efficacy, environment-ecology conservation, community planning and design, transport-connectivity efficacy, building-resources efficacy, and design innovations. Generally, all UN protocol, policies, principles, declarations, outcomes and goals are somehow related to GBI as both are developed upon human-centered. Listed is some of the directly related policy, principles, declaration or goals from UN and agencies pertaining urban development sustainability.

Report of the World Commission on Environment and Development: Our Common Future is one of the earliest reports that discuss the needs for sustainable development. It was mention in Article no. 3 point no 27 where it is deliberated to adopt sustainable development in meeting basic needs for all without compromising the future. It basically consists of three main pillars, which was known three overlapping rings of environment, social and economic. The Brundlant Report suggests sustainable development does not imply limits except limitations on; current technology and social organizations towards natural resources (Brundtland, Khalid et al. 1987). It also mention on combating poverty in order to sustain the environment as poverty may lead ecological and other natural disasters.

> *Sustainable Development*
>
> *27. Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs. The concept of sustainable development does imply limits - not absolute limits but limitations imposed by the present state of technology and social organization on environmental resources and by the ability of the biosphere to absorb the effects of human activities. But technology and social organization can be both managed and improved to make way for a new era of economic growth. The Commission believes that widespread poverty is no longer inevitable. Poverty is not only an evil in itself, but sustainable development requires meeting the basic needs of all and extending to all the*

> *opportunity to fulfil their aspirations for a better life. A world in which poverty is endemic will always be prone to ecological and other catastrophes.*
>
> **WCED (1987) Our Common Future [The Brundlant Report**].

The meaning of sustainability taken from the U.S. National Environmental Policy Act of 1969 (NEPA, 1969), is to, "create and maintain conditions, under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic, and other requirements of present and future generations (Congress 1969)." The sustainable policy is a structured-grounded method which pursues to recognize dimensional relationship that transpires between pillars economic, social and environment concerning an attempt for higher understanding of the outcomes from human acts. Idyllically, a balanced pillars of sustainability dimension are the answers for protecting the natural surroundings, hence, its strengthen the community and also foster the economic prosperity (Murphy 2012, Sands and Peel 2012). The Brundlant Report and Three Pillars of Sustainability is the basis of sustainable urban framework as it laid the foundation on the needs to ensure the currents needs without compromising the future resources. It served, as key principles in sustainability, all sustainable urban assessment criteria and ratings are means of reducing the environmental and social impact but yet at the same time improving economic sufficiency. The assessment criteria which are climate-energy-water efficacy, environment-ecology conservation, community planning and design, transport-connectivity efficacy, building-resources efficacy and design innovations is the total concentrated effort in meeting currents needs and preserving the future.

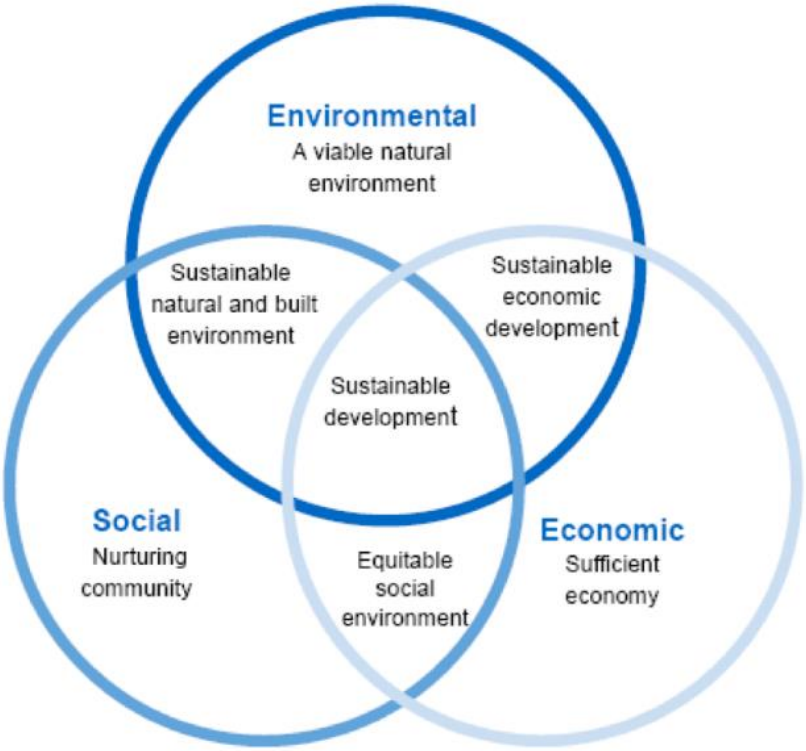


Figure14: The Three Pillars of Sustainability.

Source: Sands & Peel, 2012

Earth Summit is an international conference which officially known as United Nations Conference on Environment & Development (Meakin 1992, Summit 1992). The conference took placed in Rio de Janeiro, Brazil on 3rd. to 14th. June 1992. The outcome of the conference is Agenda 21 Agenda 21 is a comprehended document, which covers every aspect of human impacts on the environment (Robinson 1993). It served as action plan to be adopted at every tier of s globally, nationally and locally participations by UN, Nations Government and Major Groups involved. Agenda 21 were adopted by 178 Governments at the conference.

> *Agenda 21 – Chapter 7*
> *PROMOTING SUSTAINABLE HUMAN SETTLEMENT DEVELOPMENT*
> *7.1. In industrialized countries, the consumption patterns of cities are severely stressing the global ecosystem, while settlements in the developing world need more raw material, energy, and economic development simply to overcome basic economic and social problems. Human settlement conditions in many parts of the world, particularly the developing countries, are deteriorating mainly as a result of the low levels of investment in the sector attributable to the overall resource constraints in these countries. In the low-income countries for which recent data are available, an*

> *average of only 5.6 percent of central government expenditure went to housing, amenities, social security and welfare.*
> **AGENDA 21,**
> **United Nations Conference on Environment & Development,**
> **Rio de Janeiro, Brazil, 3 to 14 June 1992**

Prior to Agenda 21, The Commission of Sustainable Development (CSD) was established in December 1992. It acts as an effective measure of UNCED, to track and report on execution of agreements at every level and it was reviewed within 5 years at special session in UN General Assembly. Related Agenda 21 agenda to sustainable urban framework is Chapter 7: Promoting Sustainable Human Settlement Development, it very much suggest the imbalance consumption in the cities, which affect the other counterpart in the world. It is addressed in the Energy Efficiency, Water Efficiency and Material Resources in sustainable urban assessment criteria. The sustainable urban frameworks is designed in such ways as all the over consumed energy; water and material resources can be reduced at minimum level.

Rio Declaration on Environment and Development consist of 27 Principles (Declaration 1992). Out of those principles four principles directly related to sustainable development and GBI. The first principle is Principle 1 where it suggests human being should be center of sustainable development, where it similar to sustainable urban framework, which prioritize human well-being, is the key consideration in the frameworks. The second principles is Principle 8 where it promote government intervention in reducing and eliminating unsustainable consumption and production which are similar to sustainable urban framework on reducing energy, water and material resources. The third principle is Principle 9 where it promote usage of technology in sustainable development where it equivalent sustainable urban framework criteria in Innovation of design, technology and operations. Finally, Principle 11 where it suggest environmental legislation, which applicable to all sustainable urban framework criteria in adapting national standards and management systems as point of reference guide

> *Principle 1*
> *Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.*
> *Principle 8*

> *To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies.*
> *Principle 9*
> *States should cooperate to strengthen endogenous capacity-building for sustainable development by improving scientific understanding through exchanges of scientific and technological knowledge, and by enhancing the development, adaptation, diffusion and transfer of technologies, including new and innovative technologies.*
> *Principle 11*
> *States shall enact effective environmental legislation. Environmental standards, management objectives and priorities should reflect the environmental and development context to which they apply. Standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries.*
> **Rio Declaration on Environment and Development**
> **Rio de Janeiro from 3 to 14 June 1992,**

Sustainable Development Goals is one of significant outcome following outcome from Rio+20 Conference. The motion was consensus approved by UN Member States, it is to establish the procedure in developing a Sustainable Development Goals (SDG). SDG was created based on Millennium Development Goals in order to continue sustainable development agenda beyond 2015 (Sachs 2012). The main gist is to determine "*inclusive and transparent intergovernmental process open to all stakeholders, with a view to developing global sustainable development goals to be agreed by the General Assembly*" (Miyazawa 2012, OWG-UN. 2014).

SDGs agenda that link towards sustainable urban framework criteria is GOAL 11. Make cities and human settlements inclusive, safe, resilient and sustainable. It's corresponding to urban sustainable framework criteria on Sustainable Site Planning and Management, which concern site selection, universal design, transportation and green space operation and maintenance. It's also touched on Water Efficiency and Environment Quality where it suggests on air quality and waste management.

> *GOAL 11*
> *Make cities and human settlements inclusive, safe, resilient and sustainable*
> *11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons*
> *11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory,*
> *Integrated and sustainable human settlement planning and management in all countries*
> *11.6 By 2030, reduce the adverse per capita environmental impact of cities, including*

> *by paying special attention to air quality and municipal and other waste management*
> *11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities*
> *11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning*
>
> **Open Working Group Proposal for Sustainable Development Goals**
> **Full report of the Open Working Group of the General Assembly**
> **On Sustainable Development Goals is issued as document A/68/970,**
> **Available at http://undocs.org/A/68/970**

UN-HABITAT report in State of World's Cities 2012/2013 mentioned a prosperous city of economic progress consist of equally balance infrastructure, conditions of living and environment (Habitat 2013). These three pillars are not new in sustainable development and is the core component in achieving those prosperity. The three pillars is the basis of sustainable urban framework criteria and it meets all the measures of climate-energy-water efficacy, environment-ecology conservation, community planning and design, transport-connectivity efficacy, building-resources efficacy and Innovations.

> *A prosperous city according to UN HABITAT's new definition contributes productivity leading to economic growth (further called 'productivity'); provides adequate infrastructure ('infrastructure deployment'); offers 'quality of life' through public space etc.; ensures the equitable distribution of the benefits of a prosperous city ('equity and social inclusion'); and values the protection of the environment ('environmental sustainability'). All in all, a balance between these indicators is seen as crucial in achieving (urban) prosperity.*
> ***United Nations Human Settlement Programme (UNHABITAT), (2012), State of World's Cities 2012/2013 p. 14.***

UNEP Sustainable Building & Climate Initiative. Promoting Policies and Practices in Sustainability, June 2012 in its publication of Building Design and Construction under the theme Forging Resource Efficiency and Sustainable Development is to strengthen the movement of Green Building Councils worldwide. It was a call to sustainable development strategies through the frameworks criteria adapted by all sustainable urban rating system. It addressed all the needs of sustainable built environment with an added approaches based on climatic conditions and environmental pressures. Global climate change is trans-boundary but criteria need to be localized based on geographic region as it addressed different strategies.

> *Building Design and Construction: Forging Resource Efficiency and Sustainable Development*
> *.. rating system encourages green building through a suite of sustainability strategies which promote energy efficiency, water conservation, indoor air quality, and more……. promotes sustainability in the areas of Sustainable Sites Selection, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, Locations and Linkages, Awareness and Education, Innovation in Design, and Regional Priorities based on climatic conditions and environmental pressures*
> ***Sustainable Consumption and Production, UNEP-DTIE. (Clark 2007)***

CIB & UNEP-IETC, 2002. Agenda 21 for Sustainable Construction in Developing Countries discussed on different approaches in inducing sustainable development at developing countries. It depends on the priorities of the development and capacity of the nations. Besides, the cultural and climatic differences in developing countries compared to developed countries may require different consideration and execution in sustainable construction and development. Thus, it is also similar to sustainable urban framework criteria adopted in developing countries, where the climatic conditions, requirements and standards are differing from other counterpart.

> *Creating a sustainable built environment in the developing world requires a different approach from that taken by the developed world, and this is not often clearly understood and discussed. The problems and their scale, the development priorities, the capacity of the local industry and governments, as well as the skills levels found in developing countries are often radically different from those found in developed countries. There are also certain cultural and worldview differences between the developed and developing world countries that impact on the understanding and implementation of sustainable development and construction.*
> ***Agenda 21 for Sustainable Construction in Developing Countries***
> ***A discussion document. WSSD edition.***
> ***Published by the CSIR Building and Construction Technology***
> ***P O Box 395, Pretoria, 0001© 2002, CIB & UNEP-IETC***
> ***Boutek Report No Bou/E0204. ISBN 0-7988-5540-1***

Similar to the figure below, whereby CIB-UNEP A21 derived from by tiers of CIB A21, The Habitat Agenda and from Agenda 21, the sustainable urban framework criteria of developing nations is establish tier upon framework of developed countries and from World GBCs (Du Plessis, Laul et al. 2001).

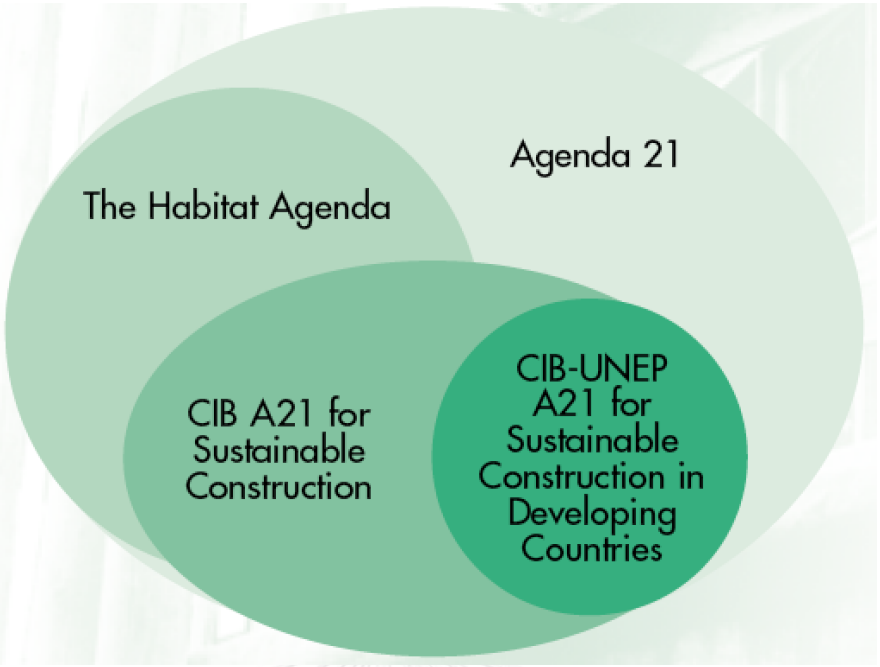


Figure15: From Agenda 21 to CIB-UNEP A21.
Source: CIB & UNEP-IETC, 2002

2.2 Sustainability and Urban Development.

The world is rapidly changing. UN-Habitat (2013) in Prosperity of Cities proposes a new attempt for prosperous urbanization instead merely stressing on economic dimension, other fundamental measurements includes life quality, infrastructures adequacy, impartiality and also ecological sustainability (Habitat 2013). The development and urbanization has significantly changed its landscape and the environment. The ever growth of population and longevity demanded a provision of an adequate and affordable spaces to live and make a living. It has become a main priority of any government in any nations. In the development strive of today, the urbanization and spatial concept of housing and working spaces requires a comprehensive new understanding of addressing those needs. It ranges from demanding subjects related slums preventive measures, the urban divide, the economic and social development, and climate change (Habitat 2012). The urging issues of climate change has led to the foundation of sustainable development beside the pressing issues on the economic and social factors.

From Urban Planners, architects and designers perspective, housing or spatial circumference and envelope is not simply as creating a roof to shade one's head, it is beyond that (Chansomsak and Vale 2009). It addressed vital forms and functions in achieving a holistic sustainable development or envisaged conception of sustainable green buildings. Sustainable buildings has gained and grasped importance in urban development of developed nations but yet still lacking prominence in developing nations generally. Sustainable development of housing and others types of spaces which encompassed an efficiency criteria's in energy, resources, social, cultural and economic yet to be an integrated policy in developing countries (Lutzenhiser 1993).

Generally, in most of the developing nations, adhocly and instant urban planning and architectural development has led to unsustainable developments. Inconsideration future projections of population density, infrastructure and amenities, uncontrolled urban sprawling and poor maintenance accumulate an amplified carbon footprint and growing negative impacts to the environments (Pauchard, Aguayo et al. 2006). Rapidly low cost housing developments programs in remote locations resulting poor standard accommodations, parking and traffic congestions, and less considerations to end users lifestyle and livelihood strategies further adding the problems. In developing urban city settings, the majority of the populations still dreaming of a safe, decent and reliable housing as most of the state governments or developers view it as a social liability instead of sustainable responsibilities. A more profitable upper cost and medium cost development is favorable as it generate higher revenue margin instead of low cost housing for the mass which most of the time subsidized using states funds.

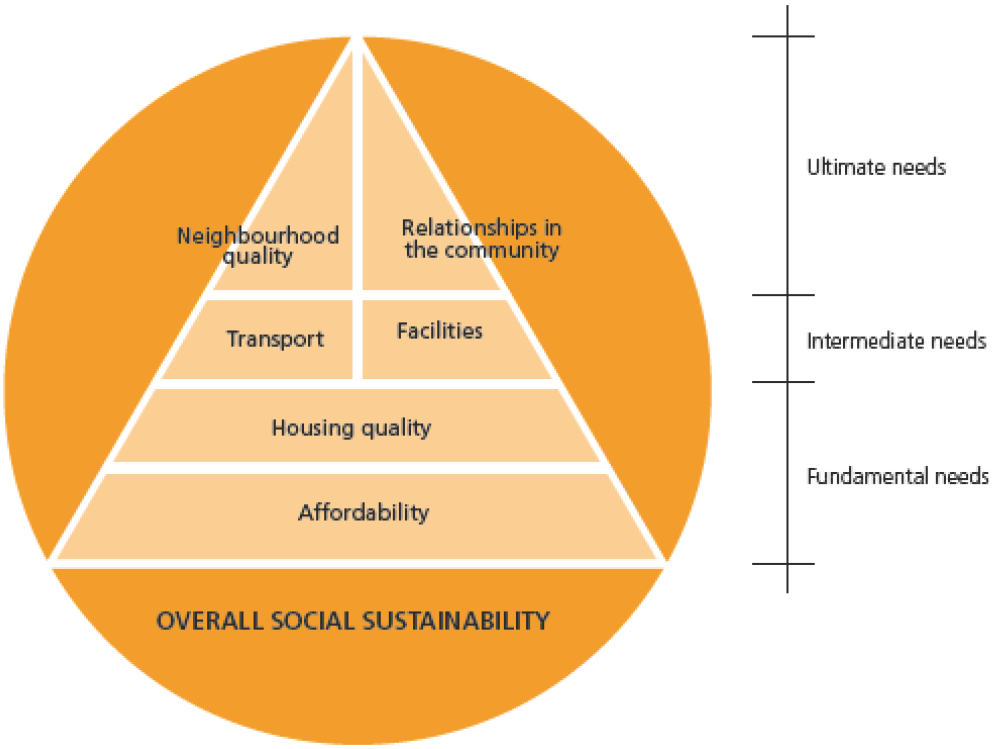


Figure16: A Conceptual Representation of the Social Sustainability of Housing.
Source: Ancell and Thompson, 2008: 432

Sustainable architecture development towards justifiable urban conurbations suggested key consideration together with conceptions to support the notions of living sustainably (Brain 2005). It's underpin a broad framework criteria for designing a sustainable dwelling spaces and rational operations. From designers perspective, sustainable dwelling is commonly considered as a predominantly the 'green' forms of the envelope and services (resource efficiency, GHG emission reduction, design innovations), it normally sought the physical and operable structure as the main ideation. The 'greenness' of a building or housing is often assessed or rated based on the performance of the building itself but lack of occupants' psychological or emotional feel (user experience), the social connotation to sustainable development.

This study will advocates to more holistic sustainable approach, not merely on the classical design thoughts of green building. A holistic sustainable development recognized beyond the multiple function of architectural space or housing, its renders both of physical and social systems, the physical forms of the buildings and the user experience. Spaces mold the behavioral and emotions of users (Freundschuh and

Egenhofer 1997), green buildings are to augment and harmonize the environment, social and economic dimensions of the sustainable building development. Hence, the holistic sustainable development parallel with solutions for the built environment – energy and resource efficiency, environmental, ecology and health reliability, resilience to natural risk (Omer 2008). Is also to deal with immaterial sustainable policies of affordable living, societal impartiality, impacts on economic and social, and in promoting a healthy contextual neighborhoods and sustainable metropolis.

Sustainable development via green building conceptions disentangle the tensions concerning climate change, urban growth, urban poverty, scheme for affordable housing and key solution reliable residential services, cleaner energy and mitigating from environmental conditions, thus, further elevated the possibility of enhanced social and economic growth (Kohler 1999). A well planned and conceived, comprehensive and participative sustainable framework guidelines and schemes have a large amount of benefit offered towards its completion. Green Building Index (GBI) has gaining recognition in developing nations. Most of sustainable assessment criteria and rating system framework is developed by building related professional institutions such as the institute or association of planners, architect, engineers or designers (Wu and Low 2010). Even though it is not fully or directly related to governments or its agency, the framework normally was well adopted and accepted as part of planning and designing policies of the urban and spatial development.

2.2.1 Sustainable Urban Development and World Green Building Councils

Developing an economically productive urban set-up and at the same time sustainable and equally livable is a world's issues. Future projections by 2030 suggest the planet earth is will be a global city and not regarded as global village as previously presumed (UNEP-WGBC 2012). Cities and metropolis will be the hub of economic activity and productivity, a center for human livelihoods and economy development. Cities or urban development should be planned at district or micro level with requiring measurement and benchmark for it performances, it should be both viable economically and sustainable dwelling place, also socially satisfying. Throughout the world, the movement of green building framework was used to measured sustainability of existing and newly developed building using building-by-building approach (WGBC

2012/2013). Newly build city or urban area also adopting green city planning framework as measure to sustainable development. The model of green building council (GBC) was set up all over the world to encourage all sectors of built industry ranging from developers, designers, financiers, product suppliers and manufacturers, builder and contractors in working together with the government in improvising the economic, social and environmental performance of building developments. The GBC is a very successful story and currently there are 90 GBCs' are operating in the respective nations (WGBC 2012/2013).

Green Building Council's framework is universal language adapted for green building. It has been steadily grown via peer-to-peer education especially in tertiary education, shared practical knowledge through on-site case studies and conveyance the green building importance to the government. The importance of building envelope and services performance within the cities and communities is not the total part of holistic sustainable developments equations (Kumar, Sarraf et al. 2010). Many of GBCs are realizing the importance of building context and surroundings – the green lungs and play area, bicycle and pedestrian lane networks, distribution or energy generation and water saving systems, and streets built for people not only for vehicular (Tiwari 1999). The others often left in measuring the holistic sustainable development is the welfare of the occupants of the internal spaces. The measurement should not only limited to the physical indoor environmental quality of spaces itself but yet extended to psychological and emotions of user experiences. Many GBCs has acknowledged the importance of the spatial context surrounding the building and internal space impact to end user psychology & emotions.

The concept of greening the neighborhoods, districts and finally the cities has become projected momentous challenge. Understanding the criteria's and frameworks that learned from greening the buildings is rightly essential. The ideal green district prototype should emphasize on putting the pedestrian as center of planning and designed considerations, while vehicular is regarded as secondary factors in it (Pucher and Dijkstra 2000). Emphasizing the communal within walking and cycling distance to access their daily need and socially interact is sustainable, the usage of energy is reduced, thus, no greenhouse gas emitted to the atmosphere or surrounding. Community can be connected to nature by accessing to green lungs, such as parks,

gardens or playfields. The social well-being of the communities is increased through employment and education opportunities within local vicinity, civics engagement and other local amenities (Woodcraft, Hackett et al. 2011). Assessment criteria may comprise a community car-pool initiatives, provision of bicycle parking rack and shower stations

Table 1: Supporting Community Socialization
Source: Young Foundation 2011

BUILT ENVIRONMENT	COMMUNITY PRACTICES
Socially mixed housing areas	Joint community projects to encourage inter-generational and inter-group mixing
Community centres	Local community governance
People-friendly layouts (e.g. car-free areas, well-lit areas)	Voluntary security and neighbourhood watch
Distinctive architecture or landscaping to create sense of local identity	Community cultural events and celebrations
Religious facilities	Neighbourhood networks (e.g. women's groups, special interest clubs, babysitting circles)
Local libraries and museums	Local oral history collection and depositories
Public and congregational spaces (e.g. open spaces, parks, benches)	Community betterment events (e.g. fundraising litter picking, planting,)
Shopping and entertainment facilities (including markets, cafes, pubs)	Collective services (e.g. credit unions, childcare co-ops)
Affordable sporting facilities, playgrounds and play spaces, community gardening areas	Community sporting competitions and gardening activities

.

On the micro side; beside concerning on the performance or indoor environment quality by measuring the physical form of the building, sustainable buildings also means assessing the well-being of the user experience inside interior space (Vischer 2008). How great the performance of the internal spaces of the buildings is null if the well-being of the end user of the space is not satisfying. The psychological and emotions of occupants will determined the productivity and social interaction inside a space. Logically a saving in energy is good in measuring building performances, but does it give the same impact to the occupants of the space. Gloomy under lite room or thermally not comfortable building definitely will defeat the purposed of greening the building. Savings on less ergonomic furniture's and compromised building materials

will affect the user experience and performances. Considerations should be taken into account by assessing occupants demographic, cultural, climatic conditions, regions and the nature of behavioral and activities in the spaces. It needs to be tailored made accordingly to optimized both the spaces and the experiences.

Throughout the world, governments, local authority, project developers and communities have realized the importance and value of sustainable development, effort need to be consolidated into actions as holistic approach in green building is rather complex (Ding 2008). GBCs have recognized the needs of frameworks and guidelines for sustainable communities, various rating assessment criteria's and tools for sustainable development is developed and constantly revised. These frameworks and guidelines have been developed to give a clear and consistent direction on constituting the green or sustainable communities. It also acts as a reference support to local authorities with a policy framework, project's planning and approval, and for ultimate sustainable development outcomes (Hezri 2004).

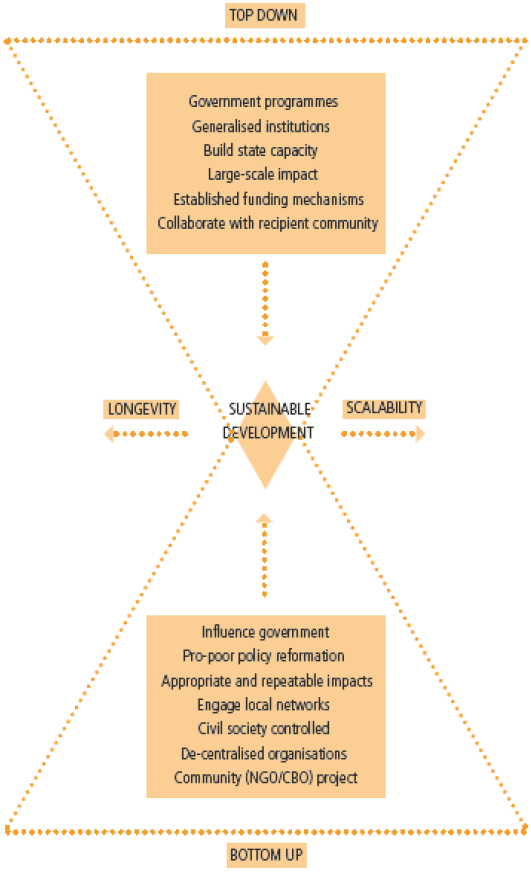


Figure17: Top-Down and Bottom-Up Routes to Sustainable Development.

Source: Cronin and Guthrie, 2011

2.2.2 Urbanization Risk, Vulnerability, Adaptation and Resilience

Projected populace of the world is anticipated to surpass 9 billion inhabitants in the mid of this century and future growth is presumed to dwell in an urban settlements. Excessive density of people and building development will resultant cities prone to disaster risk. Environmental and climate change will further challenge urban area by diverse and more severe disaster risk compared to existing urban disaster related environmental problems. Furthermore, cities are major contributor to greenhouse gas emission due to non-stop, 24/7 human activities in highly dense populated urban area.

Unsustainable urban development due to improper planning in highly populated and dense building development resulted of two common problems, slums of urban poor and urban temperature change factor such like urban heat island (will be discussed in next sub-chapter). Thus, making urban area more prone to risk of disasters and unhealthy. Urban poor is estimated about a billion people and live in slums or illegal settlement, which are lack of basic essential services and infrastructure. The urban illegal settlements are typically located within negligible urban parts for instance sharp hillsides, prone floodplains, coastline areas or proximate to hazardous zones. This will put urban poor on greater possibility of landslides, flash floods and intense precipitations and further environmental change and hazards impacts (Baker 2012). Urbanized zones are predominantly susceptible to impacts of environment change because of the concentrated inhabitants and resources in relatively small area (Carmin, Anguelovski et al. 2012). Whereas entire urban surroundings are in jeopardize, “urban areas in the global south are likely to experience some of the most immediate and severe impacts” (Carmin, Anguelovski et al. 2012). Mitigating disaster risk and environmental problems within urban development is a key tasks and challenges.

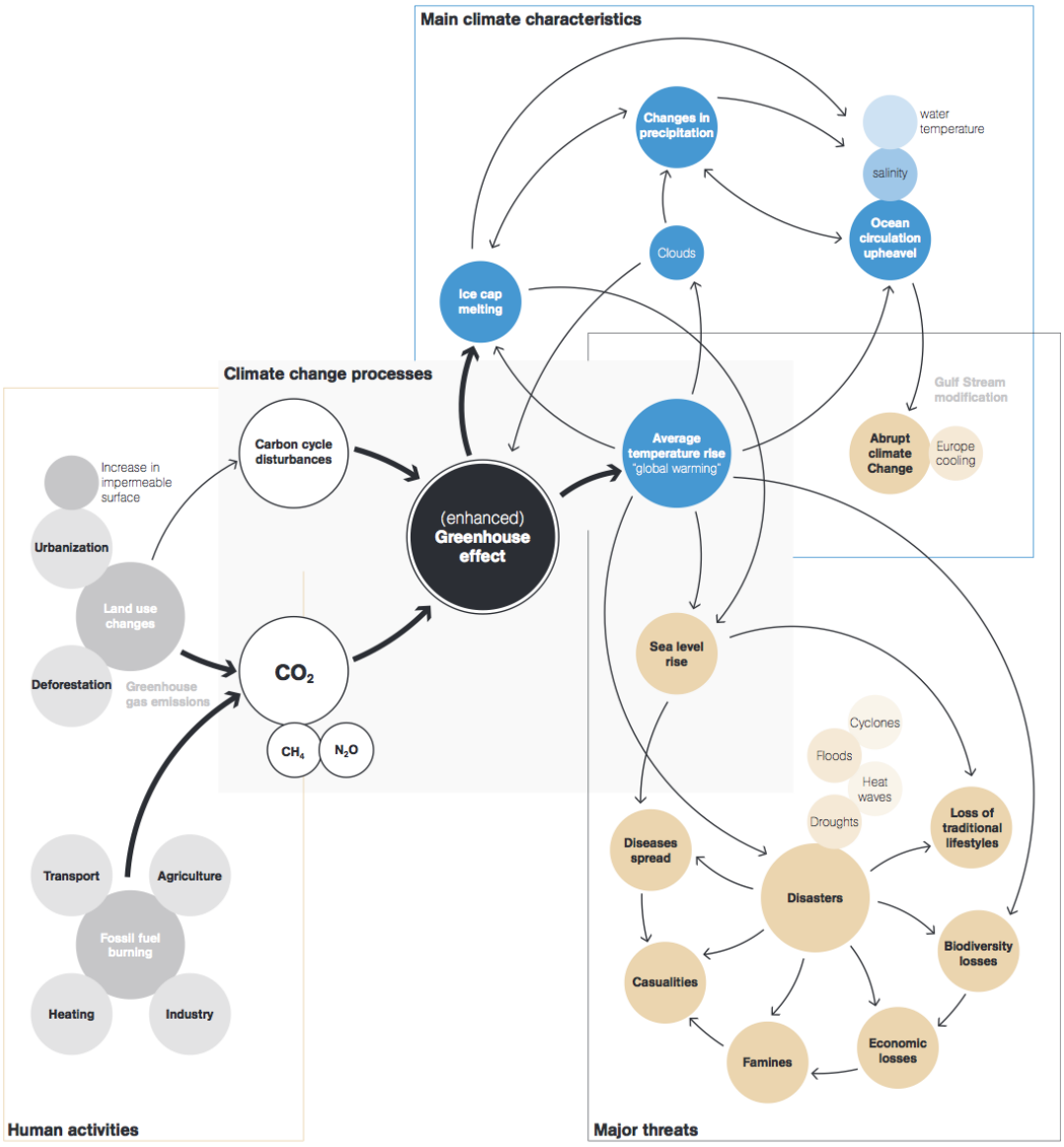


Figure18: Climate change: processes, characteristics and threats.
Source: UNEP/GRID–Arendal, 'Climate change: processes, characteristics and threats', designed by Philippe Rekacewicz, UNEP/GRID–Arendal Maps and Graphics Library, 2005

While urban settlements are always prone to disaster occurrences, environmental change sets an added further and systematic challenges to sustainable urban development (IFRCRC 2010). The impact of environmental change able to heighten the amount and occurrence of catastrophes related to hydro meteorological and, will be more severe especially in urban area at coastal lines. Asian mega-deltas and low coastline urban zones which also include mega metropolises are remarkably susceptible to submerging due to sea level rise (IFRCRC 2010). This is important to mention that

the siting of urban development concentrates are at the low-lying areas whereby 35 out of 40 megacities of the developed nations together with 18 out of 20 major Asia's urban conurbations either located at the coastline, or on the river bank or within a delta, both are risky from flooding due to sea level rise and strong thunderstorms (Habitat 2008). Table 2 below show how climate change impact urban areas possible risk and increased risk.

Table 2: Climate Change Impact in Urban Areas
Source: Wilbanks et al., 2007

Change in climate	Possible impact on urban areas
Changes in means	
Temperature	■ Increased energy demands for heating/cooling ■ Worsening of air quality ■ Exaggerated by urban heat islands
Precipitation	■ Increased risk of flooding ■ Increased risk of landslides ■ Distress migration from rural areas as a result of crop failures ■ Interruption of food supply networks
Sea-level rise	■ Coastal flooding ■ Reduced income from agriculture and tourism ■ Salinization of water sources
Changes in extremes	
Extreme rainfall/tropical cyclones	■ More intense flooding ■ Higher risk of landslides ■ Disruption to livelihoods and city economies ■ Damage to homes and businesses
Drought	■ Water shortages ■ Higher food prices ■ Disruption of hydroelectricity ■ Distress migration from rural areas
Heat- or cold-waves	■ Short-term increase in energy demands for heating/cooling
Abrupt climate change	■ Possible significant impacts from rapid and extreme sea-level rise
Changes in exposure	
Population movements	■ Movements from stressed rural habitats
Biological changes	■ Extended vector habitats

2.3 Sustainable Urban Development in Malaysia

Over the years, the world have witnessed a more prolific effort towards urban redevelopment schemes that concentrated on the condition and well-being of urban inhabitants and the urban structure or the 'urban-inner-environment' especially in the developed nations. This schemes have obtained considerable financial aids and coverage by media, and it is believed have enhanced millions of inhabitant's lives. In several nations urban redevelopment have been founded in order to tackle issues for instance, deindustrialization, abandonment, overcrowding, old infrastructure, dilapidated sink developments and other related issues.

Sustainable urbanization notions are not only limited within the urban boundaries but beyond, it's also a pursuit to contend with the correlation concerning urban area and its vicinity, and past that where the further far-off areas which provide it with energy, food, water and additional essential means. The concept is to re-enrich the environments which urban areas depend on, and this to include determines to boost its capacity to absorb carbon emissions. Initiating a sustainable connection between urban areas, its surrounding vicinity and the realm beyond, requires channeling new prospects in economy, practice policy and technology. Creating sustainable urban areas thus principally signifies a single factor; initiating all-embracing financial, political and high-tech approaches towards sustainability boosting, curative connection link up of urban areas and the ecosystem services from which its obtain the essential means for its sustenance.

The global carbon emission is tallying at 18.3 billion tons in 1980 and the growth exceeded 28.19 billion tons or 28% growth in emission from 1995-2005 (Figure 20) (Vidal and Adam 2007). The current greenhouse gases emission is keep on escalating till to date. With rapid developments worldwide the figures will keep on climbing higher. The need to reduced carbon emission is the key to delay the key to reduced impact of the climate change. Since carbon emission is the main greenhouse gas emitted to the atmosphere due to rapid development of urbanizations and changes of lifestyles, the effort to delayed emissions has coined the terms Low Carbon City (LCC) and Low Carbon Society (LCS).

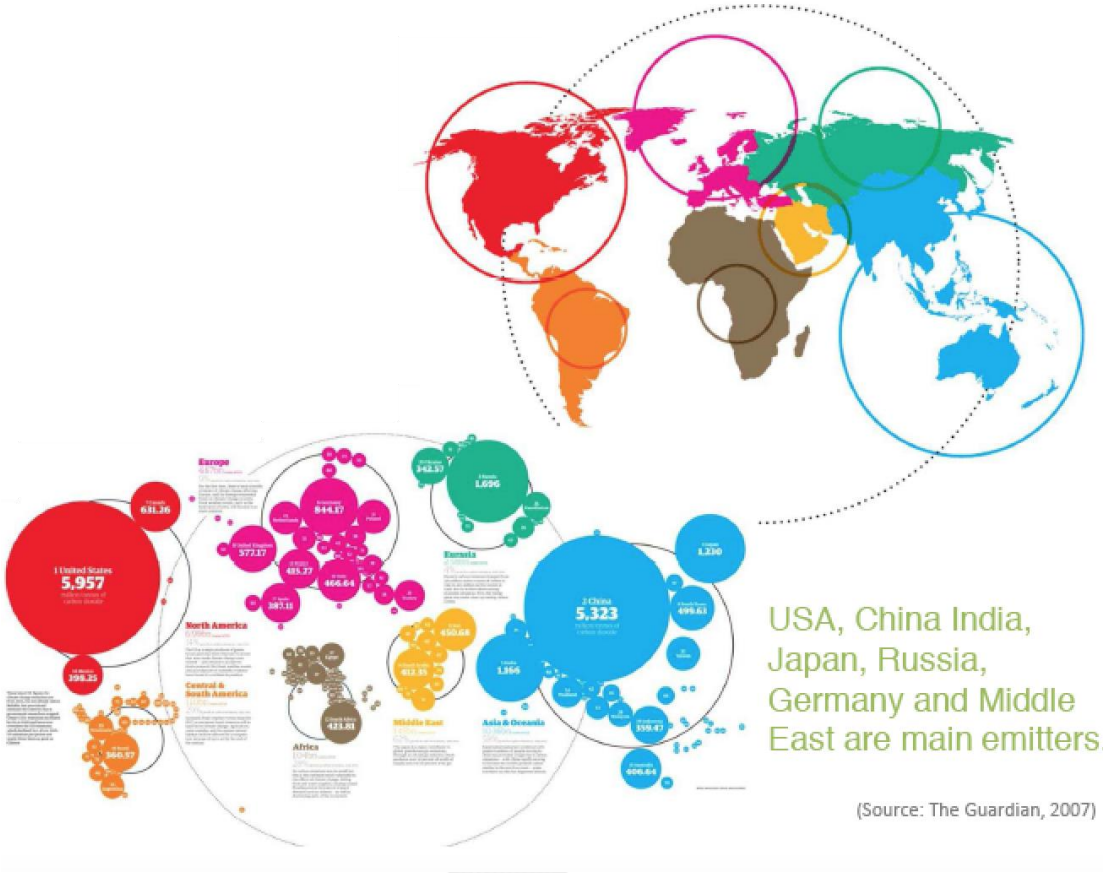


Figure19: World greenhouse gas emission.
Source: The Guardian, 2007

Since the 50's, ASEAN Region has experienced tremendous levels of urbanization with more than 1000% rise till 2014 (Dahiya 2014). The expansion of city-based economic activities draws human and natural resources, consequently, expanding demand for more human and natural resources. Thus, the urbanization process in the ASEAN region is inextricably linked to economic growth through (rapidly) rising consumption (Dahiya 2016). This striking rise in the "urban power of consumption" will have impacts at multiple levels.

- It will raise the city-based **demand for consumable** goods and services.
- It will enhance the **demand for developed land** for residential, commercial, institutional, and other public uses (e.g. transport), along with a plethora of urban infrastructure and basic services.

- The **demand for city expansion** at the urban periphery will cause an irreversible change in land-use – from agriculture and forests to urban built-up areas – with consequential concerns related to food in-security.
- Finally, it is quite likely that such a **staggering expansion of a "consuming class"** will spur **demand for private vehicles** which create an enormous increase in greenhouse gas emissions, with the potential of further exacerbating climate change and its worldwide impacts.

The global greenhouse gas emission by sectors suggest the main emitted gas is carbon dioxide which made up 70% of total emission (Figure 20). The main sectors of carbon emission which come from Energy and Land Use manifest the urban development and urban lifestyle (Baumert, Herzog et al. 2005). Hence, the need to remodeled the way of urbanizations either development or lifestyle towards reducing greenhouse gas emission to the atmosphere which is the main cause of global climate changes. The overall concept of LCC + LCS is to reduce the carbon emission in controlling climate change (Ho, Matsuoka et al. 2013).

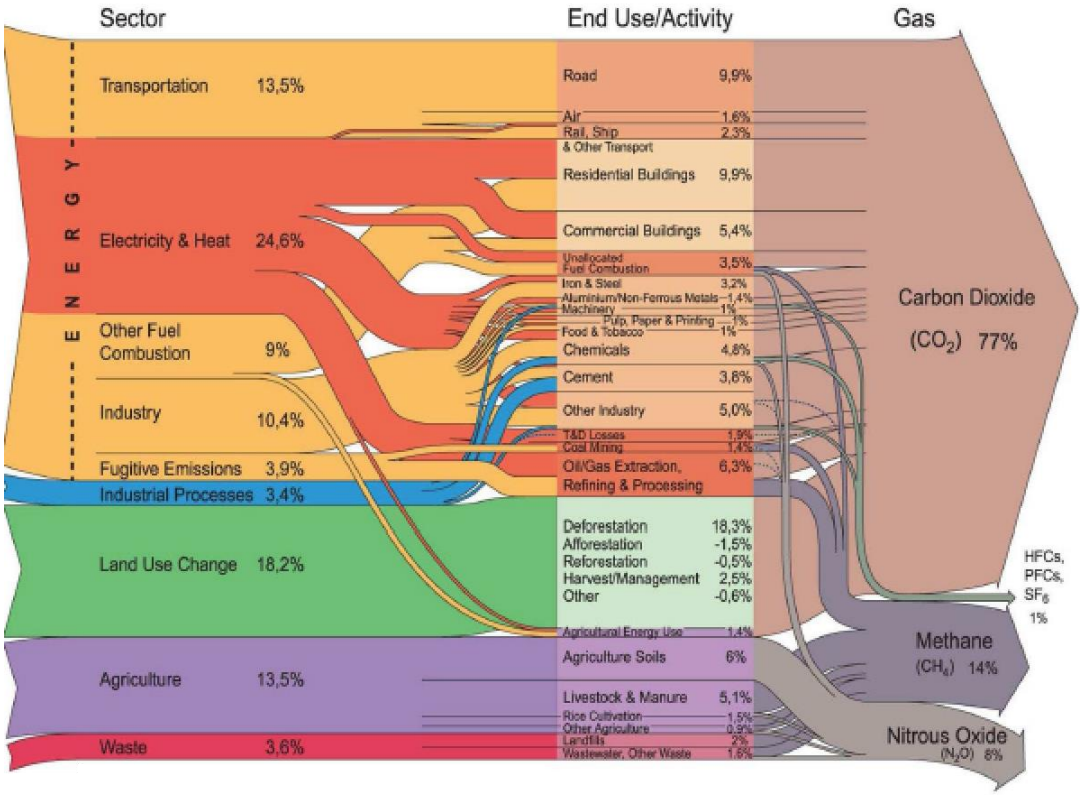


Figure20: Global Greenhouse Gas Emission by Sectors.

Source: World Resource Institute, 2005

The current sustainable township assessment criteria system in Malaysia (Figure 21) is a birth from Low Carbon City Framework & Assessment Systems (Figure 22) (KeTTHA 2011). The overall ideas is to create a sustainable cities (LCC) and societies (LCS) in reducing the greenhouse gases emission to the atmosphere. The attempt is somehow not sufficient as the term 'reduce' itself is not the solutions to the growing global temperature and climate change.

Figure21: Low Carbon Framework.

Source: GreenTech Malaysia, 2014

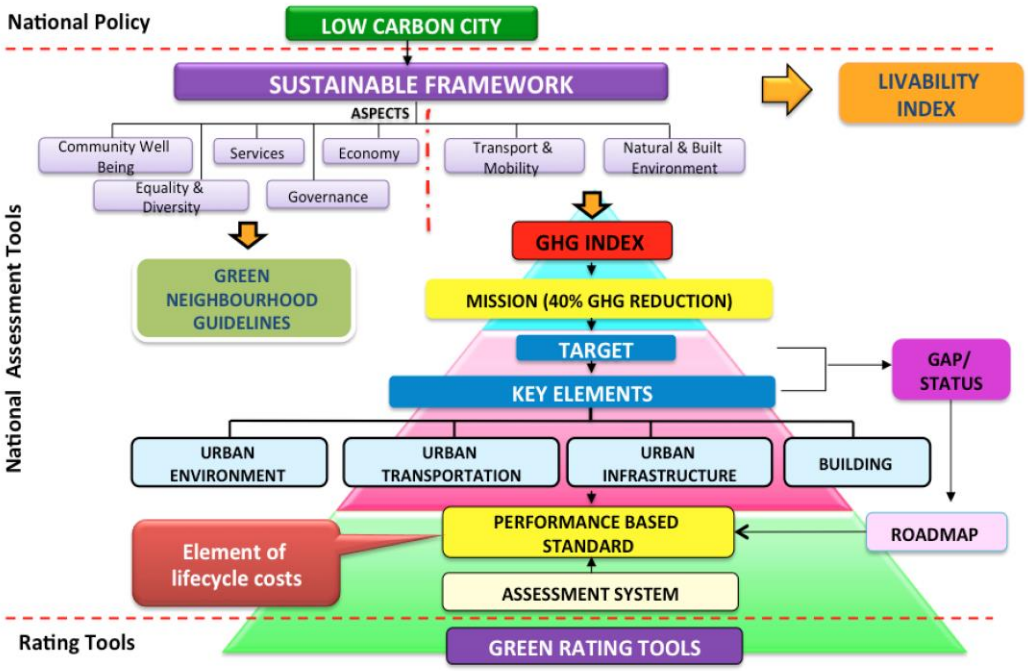


Figure22: LCC Framework & Assessment Systems.

Source: GreenTech Malaysia, 2014

Even though the Low Carbon City Framework And Assessment Systems was introduced and applied as early in the 1990's (Geels 2012), global carbon emission which is resultant from energy and land used sectors continued to rise up. According to Global Report Commission (2014) the total carbon emission for 2014 is recorded at 37 giga-tons (GtCO2), the figures seems suggesting the current LCC + LCS framework is not sufficient (Figure 23) (CSIRO 2014). Hence, the new frameworks is required, the one that improvised the current and existing LCC + LCS framework; the next or beyond 'Regenerative Future Cities'.

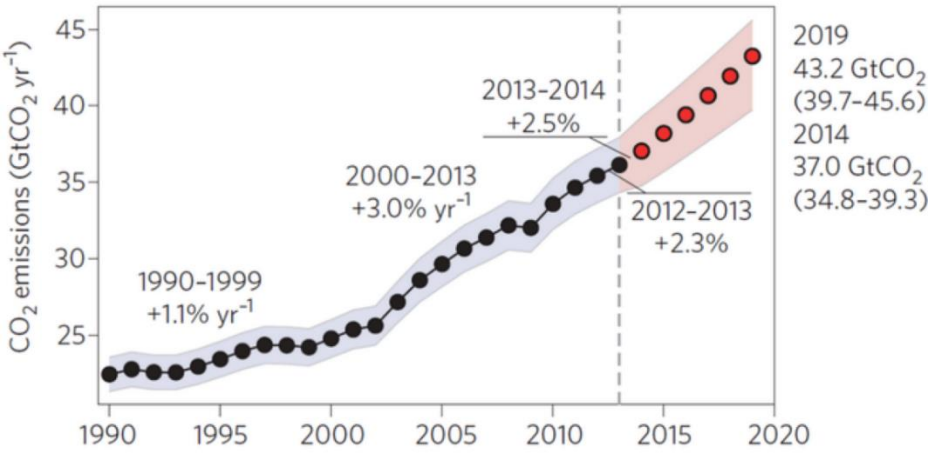


Figure23: World CO2 Emission 2014.

Source: CSIRO, 2014.

Malaysia is a faction of the United Nations Framework on Climate Change and has endorsed the Kyoto Protocol on September 4th. 2004 (KeTTHA 2011). Hence, Malaysia has moved towards a developed nations by the year 2020 and it demands to deliver the obligations of becoming a developed nations not limited to economic and technological positions but furthermore towards variables element of sustainable development. Malaysia Government support the campaign towards green building and technology as announced in 2010 Budget which comprehended: the fund of not less than 1.5 billion Malaysian Ringgit (MYR) to be disburse as soft loans, tax exemption to building proprietors who acquire the new GBI certification, purchasers of buildings with GBI certification will also exempted from stamp duty which valid between Oct. 2009 until Dec 31st. 2014 (Hamid and Embi 2012).

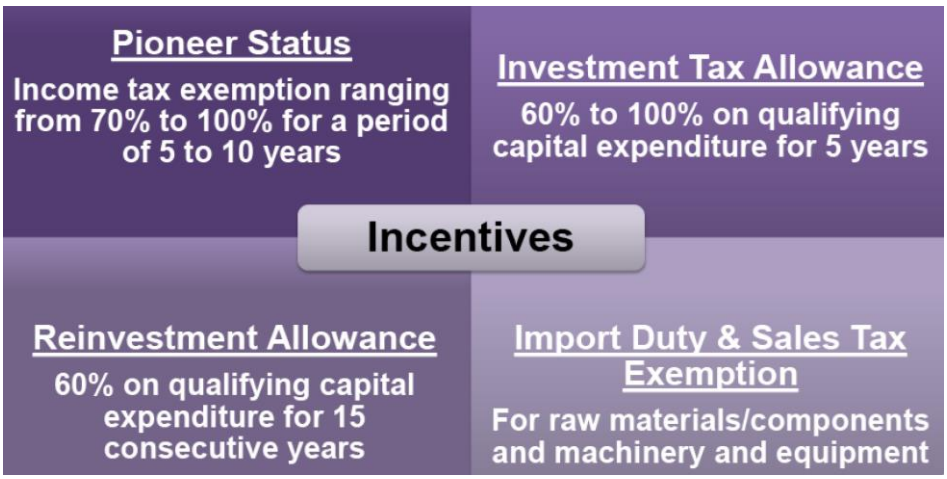


Figure24: Tax Incentives in Relation to Building Industry.
Source: MIDA, 2014

As developing country, the concept of green or sustainable building is relatively new in Malaysia. From Malaysian development and economic context, the Return of Investment (ROI) factors in investment such as capital appreciation, higher rental income and cost saving based on projected demand in the future. Grounded upon the findings of the study, investment in green office building will open a new dimension in building development and real estate industry in Malaysia. The relevancy of this study on my essay is very much on the main stakeholders in green building industries, which are the developer who initiated the development and governments who encourage sustainable developments (Isa, Rahman et al. 2013).

The role of Public Works Department (PWD) which is an agency under Ministry of Works Malaysia progressive steps in formulating; adapting and applying sustainable project management towards achieving Malaysia government aspirations of green nations by 2020. It focused on energy efficiency and savings to reduce carbon emissions. PWD's has taken step forward by taking a collective approach with other related government agencies and professional bodies (Rashid, Sulaiman et al. 2011). Parallel with the Malaysian Plan, PWD's has come out with sustainable development plans that aim to increase life quality and environment. Government interventions and supports in promoting sustainable development are very important. It creates synergies and drives in the efforts of rapid modernization without compromising the environment. Ministry of Public Works Malaysia suggests the Green Building Design (GBD) and

Universal Design (UD) as an aim in achieving sustainability in the field of built environment. The introduction of Green Building Index in Malaysia served as reinforcement method in strengthening the Green Building Design agenda even though it was not compulsory to comply. However, the government discourse in assimilating GBI framework criteria through Persons With Disabilities Act 2008 (Public Work Department Act) in promoting universal design, which is one of the criteria's in GBI is a step forward in legalizing the effort. Both of the GBI and PWD Act is a catalyst and support for Sustainable Development in environmental protection and social equity and equality (Yiing, Yaacob et al. 2013). The support for GBI development in Malaysia also landed by Prime Minister Najib Tun Razak in his letter to Malaysia Green Building Confederation by stating GBI Malaysia is a good example of how private sectors, professionals and NGOs can work together to established an internationally accepted standard for Green Building in the tropic region like Malaysia (MGBC 2010). It suggests the government efforts in sustainable urban development in Malaysia.

Modernization and urban development hastily change the landscape of major cities in Malaysia. The capital of Kuala Lumpur and the main city of Penang in the north and Johor Bharu in the south is flourish with new building development, infrastructures and amenities project. Rapid urban development and economic activities attract mass migration from rural area to the city led to contribution greenhouse gas emission due to high consumption of energy. Over demand for residential and commercial buildings may result to adhoc and under-control development; - key problem in developing countries in South East Asia like Malaysia. Holistic effort in proper urban planning, design, constructions, operations and maintenance is the solution for sustainable development. Implementing GBI assessment criteria as guidelines and indicator in building development will reduced the greenhouse gas emissions and impact to the environment. GBI framework inaugurates all sustainable urban and building development conceptions, from the inception of the project until the end of building life cycle.

2.3.1 GBI Township Assessment Tools

Throughout the world, various evaluation systems have been established encompassing ecological and energy impacts of buildings and neighborhood. Hypothetically a sustainable urban development assessment criteria demands an all-inclusive concern of healthiness and well-being of stakeholders and end users in every facets of the build development, not limited to sub-unit of plot but the whole township/neighborhood, within the broader view and context of the surrounding and population contained by it. Hence, it may possibly be a very complicated system which might demand cohesive analyzing by urban planners, engineers, builders, government agencies, local authorities and property developers accountable for the communal development (Plass and Kaltenegger 2007). While sustainable urban development assessment criteria is comparatively newfangled, emerging sustainable urban development is currently a recognized conception with an escalated expanding need in most parts of the world. It's keenly encouraged by the Green Building Councils of the corresponding nations and adopted by nearly all respective governing countries in the America, Europe, Asia and Asia-Pacific. Vulnerable due to environmental change, it resulting to an ever-increasing requirement towards energy and resource efficient built developments, and also a necessity to develop dwellings which are healthful and pleasant, not perturbed by unwarranted hazardous emissions substances, over-reflective or deficient illumination, excessive noises, cold and hot temperature (Singh, Yu et al. 2010, Yu and Jeong Tai 2011); where end users feeling safe, be able to interact one to another and can develop aspiration of better time ahead. In commercialized urban projects, there are reported proofs that sustainably verified projects with better regulated of daylighting, thermal comfort, air quality and noise reduction can increase personnel working productivity and company function (Lee and Guerin 2009).

To boost the growth of sustainable township/neighborhood, numerous sustainable building evaluation approaches at national level were initiated upon endorsed score credits award. These sustainable township/neighborhood includes BREEAM in the United Kingdom, LEED in the USA, CASBEE in Japan, China Green Building Labels such as GBDL, GBL, GOBAS, DGNB in Germany, HQE in France, Green Globes in Canada, PromisE in Finland, HK BEAM in Hong Kong, Green Stars in Australia, BCA-Green Mark in Singapore and GBI Malaysia. The pioneer of sustainability assessment

approach was initiated in the United Kingdom at the year 1990, The Building Research Environmental Assessment Method or BREEAM in abbreviation. Following that, on the year 1998 the US Leadership in Energy and Environmental Design or LEED sustainable building benchmarking method was launched built rather substantively upon the UK BREEAM approach. Meanwhile, in 2005, the Canadian adaptation of UK BREEAM named as the Green Globes was introduced in 2005 by Green Building Initiative (GBI) of Canada and it was also distributed to the US building sectors. These developed nations began to initiate their sustainable built environment systems since the last two decade. In Malaysia, the launching of the Green Building Index (GBI) in 2009 open a new discourse in rating the green building and later on in 2011 is the launched of GBI Township Assessment Criteria which focus on wider sustainability concept.

GBI Township Assessment Criteria (GBI-TAC) was launched nearly a decade and half ago as the pioneer of sustainable built environment assessment criteria in Malaysia. GBI-TAC is jointly developed by two professional bodies, the Malaysian Institute of Architect (PAM) and the Association of Consulting Engineers Malaysia (ACEM) (Hamid and Embi 2012). The recognized indexing assessment tool for green urban development is Malaysia's industry is GBI Township Assessment Criteria (GBI-TAC). Developed differently compared to other urban development assessment approach such as CASBEE-UD of Japan, GBI-TAC Malaysia assessment criteria is devised particularly towards humid tropical environment and integrate present condition of social, economic and infrastructure growth of Malaysia (MGBC 2010). Thus, a latest outline for acquiring GBI-TAC rating systems and approaches is required to warrant that sustainable and justifiable urban development shall reduce ecological impacts whereas becoming socially responsive and functionally effective.

GBI Township Assessment Criteria programs is targeted to prepare the stakeholders in urban development sectors in theirs progression towards sustainable intensification in built environment and city development as a holistic system. The targets is to establish a mutual recognized criteria which is to promote cohesive urban scheme with base-building from beginning of each development, commended and remunerate sustainable projects, and significances of urban development envisages of the coming future. From social point of view, GBI Township Assessment Criteria encourage a more sustainable

lifestyle, educating green practice and promoting social interaction of the end user. Sustainable development is not only to measure building performances, but also should include the experiences, performances and level of composure of user inside the spaces. Human is the most valuable assets of a nation; a high development human index will foster the nations growth and prosperity.

The GBI Township Assessment Criteria establishes a concept of sustainability embedded in the urban development. Its offer assistance that will help to deliver sustainable urban development in the context of Malaysia. Currently in Malaysia, there are five derivatives of the GBI Assessments tools. One of the assessment tools is Green Township Tool Framework. Key core criteria in GBI Green Township Tool Framework are;

Climate, Energy & Water (CEW): Sustainable Urban Development are supposed to balanced term of their continuing produced and consumed energy and water. CEW is targeted for zero carbon emission via maximizing principles of passive design, minimizing the effect of heat island, minimizing utilization of energy, implementing energy generation on-site, and utilizing energy from renewable supplies such as micro-generation or co-generation. CEW dedicated for water neutral whereby it suggests for mains water consumption reduction, harvesting of rainwater and recycling of greywater.

There are six (6) Key Issues and Assessment Criteria under Climate, Energy & Water (CEE). The total score able credits in this core criteria is 20 credits. The weightage scoring are:

- Heat Island Design Principles 4 credits
- Efficient Streetscape & Greenspace Lighting 2 credits
- On Site Energy Generation 2 credits
- Renewable Energy 4 credits
- Reduction in Waste Water 4 credits
- Reduced Water Use 4 credits

Environment & Ecology (EEC): Sustainable Urban Development value their enveloping surroundings and local environmental structures. EEC are perceptive towards the native biodiversity and ecological needs, and intents to conserve and preserve the environmental surrounding and the ecosystem values. EEC aims for stabilizing the land-subsidence through decreasing the impact from erosion and flooding.

There are eleven (11) Key Issues and Assessment Criteria under Ecology & Environment (EEC). The total score able credits in this core criteria is 15 credits. The weightage scoring are:

- Biodiversity Reserve 2 credits
- Land Reuse 1 credit
- Ecology 3 credits
- Flood Management & Avoidance 1 credit
- Wetland & Water Body Conservation 1 credit
- Agricultural Land Preserve 1 credit
- Hill Slope Development 1 credit
- Sustainable Storm water Design & Management 2 credits
- Proximity to Existing Infrastructure Services 1 credit
- Services Infrastructure Provision 1 credit
- Light Pollution 1 credit

Community Planning & Design (CPD): Sustainable Urban Development are benefited to its community through justifiable plan and design. CPD emphasized people-centered and greenspaces via best practice of community design in urban development principles and integrated master planning approach. These sustainable goals in CPD facilitate to create a highly sensible place for communities inhabitation, thus, resultant of more diverse, viable and livable neighborhoods.

There are eleven (11) Key Issues and Assessment Criteria under Community, Planning & Design (CPD). The total score able credits in this core criteria is 26 credits. The weightage scoring are:

- Greenspaces 3 credits
- Compact Development 1 credit
- Amenities for Communities 3 credits
- Provision for Universal Accessibility 3 credits
- Secure Design 2 credits
- Health in Design 2 credits
- Recycling Facilities 2 credits
- Community Diversity 1 credit
- Affordable Housing 1 credit
- Community Thrust 4 credits
- Governance 4 credits

Transportation & Connectivity (TRC): Sustainable Urban Development means a well- linked areas which facilitate a wide range of transportation connectivity choices. TRC criteria suggest for brilliant transportations accessibility, transits connectivity and are properly connected to adjoining localities. TRC criteria promotes for making a good use of current transportation connections and create precedence and anticipation for future facilities for example rapid rail systems, bus lanes and cycling networks.

There are six (6) Key Issues and Assessment Criteria under Transportation & Connectivity (TRC). The total score able credits in this core criteria is 14 credits. The weightage scoring are:

- Green Transport Masterplan 8 credits
- Availability and Frequency of Public Transport 1 credit
- Facilities for Public Transportation 1 credit
- Pedestrian Networks 1 credit
- Cycling Networks 2 credits
- Alternative Transport Options 1 credit

Building & Resources (BDR): Sustainable Urban Development is to have a low down impact towards resources in its development, for instance by practicing the ‘more is less’ tenet. BDR criteria stressed on minimizing the demand for using high impact

materials by employing a life-cycle method and promotes regional material for development. Hence, BDR make valuable utilization of localized resources and supplies for the development of newly developed neighborhoods.

There are eight (8) Key Issues and Assessment Criteria under Building & Resources (BDR). The total score able credits in this core criteria is 15 credits. The weightage scoring are:

- Low Impact Material (Infrastructure) 1 credit
- Low Impact Material (Building & Structures) 1 credit
- Regional Material 1 credit
- Quality in Construction 2 credit
- Construction Waste Management 1 credit
- Site Sedimentation and Pollution Control 1 credit
- Sustainable Construction Practice 2 credits
- GBI Certified Building 6 credits

Business & Innovation (BSI): Sustainable Urban Development are customized to react to community requirements in establishing commercial and jobs opportunity while integrating innovative planning resolutions. BSI are meant to deliver occupation prospects for its communities in order to travel nearer from their residences. BSI criteria suggest for provision of businesses avenues to develop and flourish. It exemplify finest practices via the application of innovative solutions and technologies at several diverse phases of the urban developments.

There are three (3) Key Issues and Assessment Criteria under Building & Resources (BDR). The total score able credits in this core criteria is 10 credits. The weightage scoring are:

- Business 3 credits
- Innovation 6 credits
- GBI Facilitator 1 credit

2.4 Review of Sustainability Assessment Model/Framework

Shen & Guo (2013), suggest an efficient sustainable standards need to be receptive to the community capital method. They further stressed that community capital model is established as a practical instrument to control the subject of the propositioned sustainable rating framework by fostering six categories of community capital. Benefits of community capital model is three-fold in an applied sustainability appraisal. Firstly, community capital permit for an effective integration of sustainability related measurements, criteria, significances to offer a broad comprehension of holistic communal building. Secondly, community capital model can provide clear objectives and strategies to confine the factor such as energy, cost, duration and workforce in creating a proper indicator structure. Lastly, upon strategic development standpoint, the community capital model method also provide community engagement such as non-governmental organization, occupants, proprietors, scholars, and developers for making decisions and plans to manage the issues of sustainability.

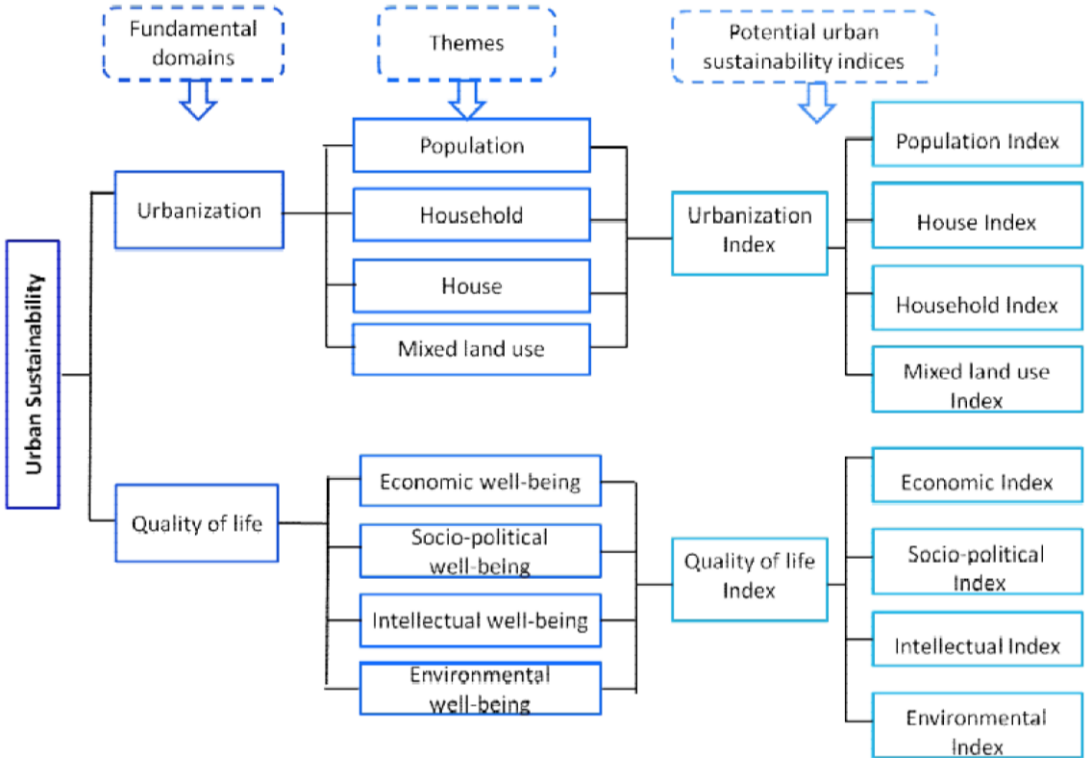


Figure25: Community Indicator Conceptual Framework.

Source: Shen & Guo, 2013.

Mawar et al. (2014) emphases on classifying the inclinations and commendations from relative findings of the Green Building Assessment Techniques (GBAT) measures and the observed outcomes of the study concerning the score weightage of the criteria for acquiring evaluation means. The study intention implements a mix-approach methodology of quantitative and qualitative method, and also ethnographic method. For this study, the research issues and gaps in terms of the holistic approaches were identified in sustainable community development.

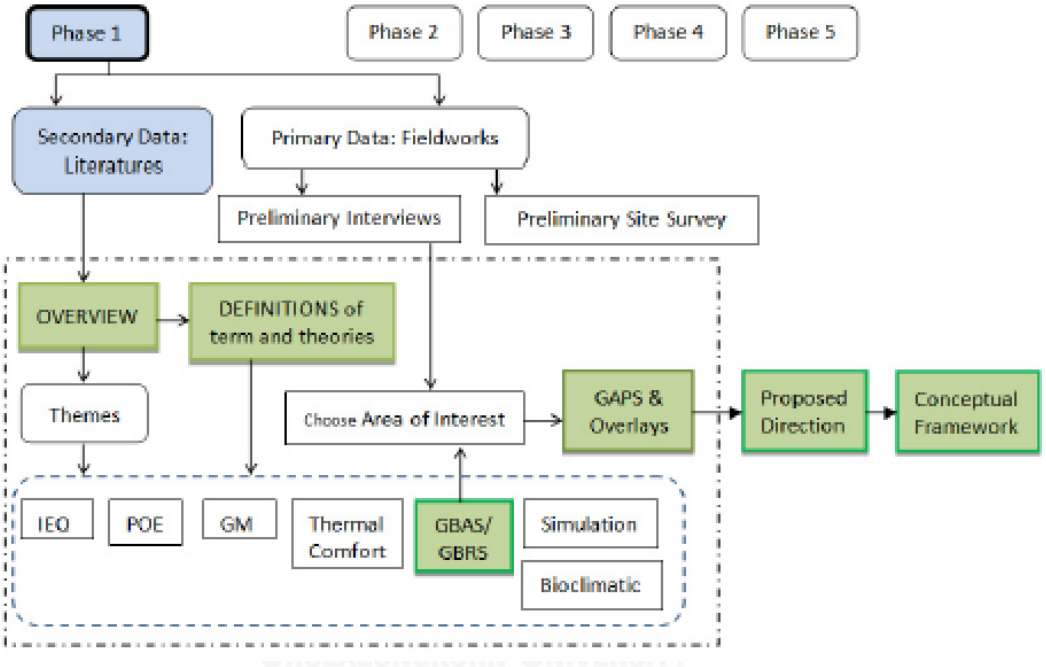


Figure26: GBAT Conceptual Framework.

Source: Mawar et. al, 2014.

Shika et al. (2012) suggest, to attain sustainable intentions in built environments, an articulate approach and accomplishment strategy is required to attend dweller's anticipations and necessities in existing developments. This very incoherent and significant subject should be link up for action in an appropriately conduct or aims shall be at imperil (Shika, Sapri et al. 2012).

Table 3: POE Strategy for Commercial Building Retrofits.
Source: Shika et. al. (2012)

Objective	Type of Data required	Data collection Approach
To critically examine the relevant criteria for assessing sustainability of existing office buildings.	Green Building system strategies. Environmental, social and economic Sustainability indicators. GBI-Rating Criteria.	Literature Review Interview with experts (Qualitative) Pilot case study
To evaluate the occupants' perception of sustainability in both GBI certified office building and conventional commercial office building.	Environmental, Social and Economic indicators	Quantitative data (Questionnaire)
To determine the variability of the occupants' perception in the two buildings	Indicators	Quantitative data (Questionnaire)
To develop a POE sustainability assessment framework for retrofitting commercial buildings.	Categories of assessment indicators and their weighting coefficient	Quantitative and Qualitative data

Abu Bakar & Cheen (2013) proposed assessment model for urban development sustainability known as Comprehensive Assessment System for Urban Development (CASSUD). CASSUD encompasses three main stages, which are the result stage, project dimension indicators stage, and sustainable measures stage. CASSUD schematic diagram is as shown below in the conceptual framework in Figure 28. The goal level depicts the final attainment of the framework. It tries to create highly sustainable development for either the new development or redevelopment in urban area.

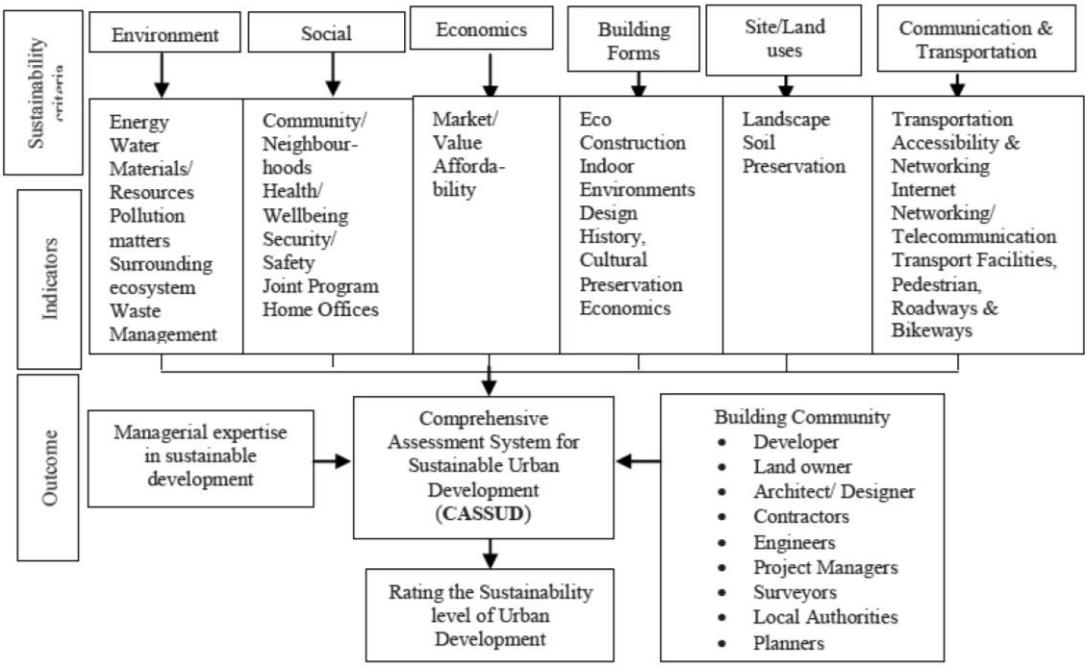


Figure27: CASSUD Conceptual Framework.

Source: Abu Bakar & Cheen, 2013.

Poston et al. (2010) established holistic framework known as Sustainability Assessment Method (SAM). It can be considered as one of the most wide-ranging approach as it is founded upon investigating various evaluation criteria systems for sustainable development from 14 different countries. SAM holistic framework is as shown in Figure 29, it is originated upon justification the constraints for forthcoming durability over investigating the significant dimensional aspects of environmental, social, and economic.

Figure28: SAM Conceptual Framework.

Source: Poston et. al, 2010.

Al Qahtany et. al. (2014) proposed a sustainable urban assessment model using consensus based approach for the city of Riyadh, Saudi Arabia. The model was called Sustainable Urban Planning Development (SUPD) and it were categorized within 5 evaluation dimensional criteria which are social, environment, economic, planning and information & communication technology dimension. Thus, SUPD framework is configured into 5 subcategories for assessment and criticism towards urban development of the city of Riyadh within adopted 5 distinguished factors.

Figure29: SUPD Conceptual Framework.

Source: Al Qahtany et. al, 2014.

2.5 Post Occupancy Evaluation

Post Occupancy Evaluation (POE) is described as an appraising practices which was done systematically on the operation of a built environment upon its completion and being inhabited for certain period of time. The occupants requirement such as issues concerning health, security, safety, function-efficacy, inner satisfaction, aesthetics traits and contentment are the main criteria of the investigations (Preiser 2001). POE also could be termed as the assessment of the efficiency for social end-users of dwelled built developments (Zimring and Reizenstein 1980). Effectiveness by this definition is in the ways of physical and organizational aspects that achieved or increased personal or

institutional targets. POE targets and indicators is used to evaluate design objectives and environment impacts, thus make it different from behavioral and environmental research or social science applied research (Zimring and Reizenstein 1980).

Another definition of POE is as a systematic tools to diagnostic aspects of a building performance and essential to facility managers (Preiser 1995). POE research can be categorized into three methods. The first method is indicative evaluation where POE studies is conducted via walkthrough evaluations and inspections using structured interviews with key target user or groups or key personnel. The second attribute is investigative POE studied, which is more in-depth evaluation. Investigative POE apply interviews and questionnaires on top of photographic or video recordings, on-site measurement as in indicative evaluation. The third methods are diagnostic POE, the most thorough and detailed POE, it may take long durations which could be month or years and strictly required a sophisticated instrument for data gathering. Diagnostic POE utilize analysis methods focused on a broader range of aspects in performance evaluation (Preiser 1995).

Approach definition suggest POE by feedback techniques, which are divided in five classifications as; i. Review, ii. Deliberation, iii. Survey, iv. Package and v. Procedure (Bordass and Leaman 2005). This approach definition somehow similar to the definition in earlier discussion. POE types by definition in indicative studies are audit, discussion and questionnaire of feedback techniques; investigative studies utilize package category of feedback techniques; and diagnostic studies is process category of feedback technique (Preiser 1995). POE could be instigated as a research, specific case-studies, or to bench the requirements via responses upon occupancy of particular built environments and behaviors relates to it. Mentioning above, POE categories can be group into many headings or designations and not exhaustive. Throughout literature reviews there are many POE methods with different headings. Few will be discussed in the next sub-chapter.

2.5.1 Reason for Post-Occupancy Evaluation

A building's performances seldom matches anticipated design aspirations of the designers who create them. POE monitoring and feedback is essential in understanding

this issues and how to improve this gap. This method of monitoring and feedback has long been distinguish as an essential phase in the building design development (Stevenson and Rijal 2010), but it has not been given the prominent considerations or funding budget in making it as effective as it can be. POE have three definite features (Bordass, Leaman et al. 2002):

1. Project performance review- encompassing project statement, plan, administration, setting and coordination, expenditure monitor and develop quality
2. Upon a year or above past project hand-over feedback, whereby facilitates are regulated to refine performance as in operation, notify the project commissioner, planning and developing panels and improve progression into maximum and efficient control
3. Comprehensive urban development function assessment for operation, with attention of end-users viewpoint.

Post Occupancy Evaluation (POE) is normally assumed as of the third feature, even though it could be included in some components of the second or first feature. Although it is undeniable to many designers or urban planners think that Post Occupancy Evaluation ought to be an important component in the planning development, acquiring from past occurrence, issues analyses, and knowledge management, but within real situation Post Occupancy Evaluation has proven tough to applied (Leaman, Stevenson et al. 2010). Among the reasons justified against POE are (CABE 2011);

1. Cost factor, preliminary studies have a tendency to be costly. Even though recently POE may be more affordable than before but there are still questions about who pays the studies.
2. Risk and threat, certain quarters are frightening that the outcome after a POE research might take the evidence to lawsuit or additional accountability. In actuality, in contradictory it is further probability towards an increase of understanding and capabilities.
3. Uncertain gains with assets values which propelled by setting, manifestation and added aspects which unnecessarily influence building performances in

operation. Even though POE is implemented, what increases means for proprietors is yet not appreciated in the property sectors, but this is currently slowly shifting.

4. Uneasily fitting scholastic fields or academic study criteria. It have a tendency to be relegated from the academic norms. This setback still persist for future implementation if no formal or standardize academic measure is imposed on POE academically.
5. Indistinguishable 'ownership' and duty of care upon and after executing POE and the outcomes. This probably related to the first reason pertaining the cost, but beyond it who will be responsible? Assumed that setbacks are revealed, who keeps what setbacks? Most opted to abandon it alone.
6. Absence of agreement towards the communal interest and cooperation deficiency between built environments professionals.

2.5.2 Post-Occupancy Evaluation Methods

There are various methods or headings for POE, different establishment or researcher might name it as how it was used in evaluating certain building or built environment projects. One of the method is Design Quality Indicators (DQI), which method is use to evaluate existing building refurbishment and also on new building design and construction. Design Quality Indicators can be applied at any stages in building's development. It also contribute significant role in improvising quality of building projects as it could be used on any phased of projects. DQI methods evaluates functionality, quality and impacts of build project using 100 questions and 6 point scale questionnaires (Alwaer and Clements-Croome 2010).

Another POE methods is developed by the collaborations in the University of Manchester Institute of Science and Technology (UMIST). This method was known as Overall Liking Score (OLS). It is an analytical approach of evaluation which measure the people perception or likeness feel towards their working environment. OLS utilize questionnaires in getting feedback from the occupants of the said case studies. The questionnaires was designed to assess all concern major factors or areas which include lighting, ventilation, thermal condition, workplace services and energy utilization in the working environment. As the name suggested, OLS evaluates the degree of likeness by

the occupants and how significant is the major listed factors translated in a simpler terms (ABS-Consulting 2009, Kamaruzzaman, Egbu et al. 2011).

Building Use Studied Ltd. Developed POE method known as Building Use Studies (BUS) Occupant Survey and Reporting Method (Gething and Bordass 2006). BUS method uses questionnaire surveys and benchmarking techniques in gaining occupants feedback and analysis. It is an occupant questionnaire survey self-completion and method of benchmarking for building or project types that require rapid and comprehensive research in finding user needs and requirements (Gething and Bordass 2006). This method of survey is essentials in formulating project's need statements and rating method of each criterion.

Learning from Experience method was devised by Higher Design Quality Forum (HEDQF). Even though it is initially devised for university building projects but it is gaining a momentum and being used widely in other type of projects (Bordass and Leaman 2005). This methods utilizes techniques by getting related people or stakeholders of the project together and discussed the foresight, insight and hindsight needs. Foresight discussed what they are going to do? Insight discussed what are they doing? And Hindsight discussed what they have done? Learning from Experience includes seminars and cross-examines, and also review of past projects.

Besides occupants' surveys, POE also measure the buildings performance such as energy use and other technical data. CIBSE TM22 techniques which include Energy Assessment & Reporting Methodology, is a method of energy surveys in an operation-able buildings (CIBSE 1999). This methods consist of a three-tier techniques for gathering and reporting yearly energy consumption, cost and CO2 emissions data. The method is used to develop design intents, to review design scheme and to verify what has been installed and commissioned at site, and this is essential in providing more clarity amid anticipations and findings. Another POE approach that related to CIBSE is Post Occupancy Review of Building and Engineering (Probe). It is used inside Building Services published series of CIBSE Periodical in year 1995 until year 2000 and financed by the Builder Group and UK Government. This POE method is a combination of energy survey method of CIBSE TM22 and BUS method of occupant surveys, observations, interviews, technical issues reviews and questionnaires (Baird 2001).

Soft Landing is a systematic POE method which normally carried out after buildings being occupied for and more of three years. The method of Soft Landing is a diagnostic POE, it closed the users and other stakeholders' gap by increasing designers and constructors involvement in the projects both at early stage and after handover. Soft Landing encourage the involvement of project supply side (designers and contractors) with the end-users of its products, hence make the building performance assessment become more vigilant. The methods in Soft Landing include personal surveys, discussions and building monitoring of it uses and energy performances in three consecutive years of first occupations create the regular precedent in implementing post occupancy evaluation (Way and Bordass 2005). The method in Soft Landing facilitates the designers to refine and improved their design based on users' feedback.

Meanwhile in the US, a web based POE was developed by Center of Built Environment at University California Berkeley. This POE method was called CBE building environment satisfaction study. CBE POE is a standardized surveys which focused on the occupants' contentment and consolation issues within internal environmental value. These subjects concern internal atmosphere value, internal flow contentment, illumination and acoustic ambience (Zagreus, Huizenga et al. 2004) Another online POE surveys in the US is the introduction of U.S General Services Administration's (GSA) Public Building Service. It is started as the GSA Workplace plan back at the year 2001. The GSA Workplace plan employ on-line studies to collect and measure occupier responds towards before-occupied and after-occupied workplace (Mallory-Hill, Preiser et al. 2012).

Besides standards heading POE as mentioned in the paragraph above, Field Measurement & User questionnaire includes individual methods driven by varies researchers' in measuring building performances upon completion and occupancy. This techniques of POE is centered on technical performance attributes of built environment systems. The feedback data is gathered from questionnaires, walkthrough observations, interviews and utilities assessment via the metering and billing of unit used and also using portable measuring instruments for environmental condition measures.

Conventional POE research are generally achieved with evaluation methods which by means of survey questionnaires, interviews and walkthrough observations. The recent POE methods remain mainly concerned with measuring and assessing the factors of

occupiers' activities which lead to utilization of energy and attentively emphasis on environment atmosphere quality. This particularly emphasized on the internal spaces quality, thermal and illumination comfort within the influence notions of sustainable ‘ness’, these are weigh up as the main and focus amongst plan plus operational significances (Inalhan, Brown et al. 2010). As anticipated, the architectural assessment tools need to be centered on incremental environmental improvements. Architectural design issues need always focused on the methodical and proper combination of technological aspect and convey viewpoints in the direction of sustainability (Cole 2004). Even though the physical building assessment of energy functioning are upon evaluation and rating, and it is comparatively properly acquired and applied (Chiu, Lowe et al. 2014), the POE assessors expressed concerns about the shortage in significant study of dwellers' responses. As an example, a critic on existing POE methods which focused predominantly on ‘environment’ dimension, as a result, the evaluation approach are limited without explicitly concerns about the impending prospect, social engagement or impartiality dogmas that reinforcing sustainable urban development (Cooper 1999).

2.5.3 Outcome of POE

POE emphasizes areas of not achieving desired intents in the built environment that develop major significant after-effects and afterward facilitates analysis and corrections. In the neighborhood, thermal discomfort statistically may related to community activities and productivity, it also could be associated with urban heat island effect due to poor landscaping or material reflectance in the development, deficient planning system configurations, deficient management or probably all the above causes. One of the main findings of poor urban development performances is due to unmanageable complexity, it is surprising that this findings not only affected to large township projects with complex service systems but also applied to ‘green’ label neighborhood scale development.

From sustainability point of view, efficient and best performing urban development were likely to be relatively smaller or clustered neighborhood, not so complex but rather a mixed development and not over developed with unnecessary features but worked better according to community needs and cultures. These neighborhood

development are also further receptive to inhabitant's apparent necessities, particularly in the way its upkeep daily routine undertakings. The further community comprehend of how the facilities and features is intended to benefited, particularly wherever common use facilities and features are at ease to access, it is much more better. Easy to access and operate should be major factor upon planning and developing sustainable elements. Neighborhood community provision must be supported with related means to function and run public facilities efficiently.

Numerous decent planning and designing intents are practically most of the time disenchanted from actuality, urban neighborhood in application incline to function less efficient compared to intended concept or blueprint. For instance, it's rather common to discover that public facilities consumed more than three times of energy instead of what being projected at schematic planning phase. Post occupancy evaluation able to assist in identifying the factors within the development that at which point the energy efficacy has been diminished. Probable drawback phases is maybe during authorizing, schematic designing, building or facilities supervising. Thus, it is an urgency to create prompt transformations in how involved stakeholders plan, build and regenerate neighborhood developments and formulate assessable enhancements in its performances in function. This are able to be done provided if regenerate or new development take lessons from achievements and setbacks of the past developments and distribute that knowledge among the related development professionals and related stakeholders.

2.6 Conclusion

Climate change and sustainable development is one of the most coined term anywhere in the world today. Both basically derived from economic development since the last industrialization dated back approximately 100 years ago. The way how the world is shaped upon industrialization and label used to classify state nations intensified development. The north-south global region and developed developing – under develop tag to certain nations has make the development race become more vigorous. Striving to be developed, intensified used of energy, change of land use and over-exploitation of natural resources has led to emission of greenhouse gas and damaging the ecosystem. Thus led to climate change or global warming, the after effect is notorious; uncertainty

weather, more frequent disasters and scarcity of natural resources.

New development approach needed to reduce the impact, under United Nations and it's agency, the solution is to developed without compromising the environment and socially justice – the term 'Sustainable Development' is established. Rapid urban development in developing countries especially the Eastern Asia region has contributed to the emission of the greenhouse gas due to high consumption in energy. Concentrated effort need to be done in proper development planning, constructions, operations and future maintenance. Using GBI framework as an indicator and guidelines in urban and building development will reduced the greenhouse gas emissions and impact to the environment. GBI framework inaugurate all sustainable urban and building development conceptions, from the inception of the project until the end of building life-cycle. Its assessment measures of Climate, Energy and Water Efficiency, Environment and Ecology Conservation, Community Planning and Design Consideration, Transportation and Connectivity Efficiency, Building and Resources Efficiency, and Business and Innovations is the manifestation of holistic sustainable development.

From existing studies and observations, POE suggest well-defined indications on function, effectiveness and satisfaction factors, in what way urban development should be enhanced? This is to propose an added expert services to be included for further sustainable means within the urban development build phases. This sustainable means should be embedded into development design statement phase, planning and design phase, construction phase, and development handover phase with strategic operation and maintenance guide so that threat is coped effectually and efficiently. Sustainable urban development is likely to perform well if these sustainable means is embedded from the preliminary stages to occupancy stages. To get this done, POE need to be executed. By learning from the past occurrence and evaluated from occupancy stage, problems can be identified.

In conclusion, POE must anticipate emissions of carbon and other GHG, efficacy of cost and time, satisfaction of end-users and adverse impact towards other sustainable means like water, energy, materials and waste. In community wellbeing, sustainable urban development place revitalized concern towards the productivity and healthiness gains of effective neighborhood. Current indication somehow strengthens that sustainable urban development from wellbeing point of view are much better in term of productivity and

healthiness compared to conventional counterpart, and yet perhaps still lesser compared to what community could conceive or expect from a neighborhood. Thus, it is very challenging for architects or urban planners to determine the constraints which influence the sustainable achievement of larger urban developments such as at city scale, therefore the examples gain from well achieving sustainable township or neighborhood are significant set model towards future sustainable development. Several present-day metropolises are very complex, particularly in the context of human and capital means which are made accessible to employ, control and support them. So to conclude, ‘don’t develop things that you unable to handle’; where the researcher believe a measurable assessment model need to be devised in addressing the current development phenomenon, a tools which measure the development after occupancies by its dwellers based on sustainable dimension pillars and ‘good neighborhood performs then satisfies its community needs’ which suggest end-users view towards a built environment is highly significant. A sustainable neighborhood is not measurable merely on green labels or property price tag but very much based on end-users opinion who experienced and affected by it.

CHAPTER 3:

RESEARCH METHODOLOGY

3.1. Introduction

The accomplishment toward a successful research depending on the proper and suitable research method adopted in the studies. Thus, the accomplished research aims and objectives required right selection of research procedure within scope parameter. Achieving research objectives based on proven outcomes only feasible if the right research method is implemented and it is highly significant during the process of studies activity (Bryman 2006). Pertaining to that, in research it is always been focused that inquiry, analysis, findings, conclusion, validity, standards and ethics of study are greatly influenced by the appropriate data collection methods (Fellows and Liu 2015). Therefore, in this study, significant research methodology literature has been considered and to be follow as research process guides.

This section provides a complete and profound descriptions in what way this study processes are implemented in order to attain the required data and information to fulfill the study questions. The research methodology will be instituted upon the discussion of six main subjects that are summarized in the following main items:

1. Study Background which intends to discuss sustainable development and criteria in general, conceptual framework/model and methodology outline.
2. Study Method: describes diverse research method which include induction and deduction method.
3. Study Approach: emphasizes diverse study approach, for example interview, survey, grounded theory, experimental, and case study approach.
4. Procedures and Approaches: an assessment towards the procedures and approaches for data/information gathering and testing.
5. Study Design: description of distinctive theoretical to practical steps which were pursued in this study design.
6. Conclusion of the chapter

3.2 Research Methodology Background

Sustainable development as defined in Our Common Future of 1987 Brundtland Commission report are the; “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Wced 1987). The meaning suggest the importance of sustainable development issue in urban policy and planning (Watson 2009). Since urban policy and planning is one of main source of environmental degradation and climate change, sustainable development should be the core of it. Hence, adapting sustainability in urban development has become a crucial agenda. Furthermore, it also due to rapid urbanization especially in developing countries including Malaysia (Muhammad 2005) and in any major capitals of the world.

The most commonly discussed and critiqued frameworks in addressing sustainable urban planning development are BREEAM Communities, LEED-ND (Neighborhood Development) and CASBEE-UD (Urban Development). These three frameworks represent three continent, BREEAM Communities was developed in the UK of European continent, LEED-ND (Neighborhood Development) was developed in the United States of North America continent, and CASBEE-UD (Urban Development) was developed in Japan of Asia continent. All the three frameworks have been analyzes in various scholastic journals in discussing the important factors which connected to sustainable urban development (Eriksson, Glaumann et al. 2005, San-José, Losada et al. 2007, Ding 2008). Basically, it is a mixed opinion whereby these three sustainable assessment criteria includes several points of advantages and disadvantages depending on which criteria and locality applied. All these three frameworks suggest mutual interests and highlight the significance of numerous concerns including energy-saving, environment-friendly resources and transportation efficacy (Haapio and Viitaniemi 2008) and at the same time, these three frameworks insufficient in term of provision and direction for variation acclimatization in different nations or trans-boundaries. Besides, these framework seem to overlook on management and financial aspect/impact; and lack of emphasis on these issues.

GBI Township Assessment Criteria which also adopted and adapted these frameworks especially BREEAM Communities. This Malaysian sustainable urban framework was localized base on regional difference, which developed to suit local policy, planning

by-laws, standards, culture, social and environmental condition including geographical and climatic factors. This urban assessment criteria which claim to integrate sustainable development attributes consist of six core criteria as discussed earlier in chapter two. However, till to date there is still lack of studies were implemented to evaluate and gauge the efficiency and the sustainability measures of holistic-ness towards this assessment criteria.

3.3 Research Conceptual Framework and Research Design

Hence, in order to evaluate this very own Malaysian sustainable neighborhood assessment criteria framework, a post occupancy evaluation studies is needed. The studies will embark on;

Research Justification: there is no post-occupancy evaluation being conducted in assessing the effectiveness and sustainability on the certified development.

Problem Statement: whether the existing GBI neighborhood assessment criteria and certified neighborhood development project fulfilled the performance and effectiveness according to sustainability dimension pillars.

Research Hypotheses:

Hypothesis 1. Sustainable pillar dimensions method will improve the sustainability within the community's neighborhood context,

Hypothesis 2. Post-occupancy evaluation model (POEM) assessment criteria and theory would differ from the pre-occupancy assessment criteria and theory.

Research Aim: Post-Occupancy Evaluation modeled on sustainability dimension pillars in evaluating GBI neighborhood assessment criteria and certified GBI neighborhood project in Malaysia.

Research Objective: To identify, formulate and implement the post-occupancy evaluation modeled on sustainability dimension pillars in assessing and evaluating GBI certified neighborhood towards sustainable urban development for Malaysia. The objective is also to evaluate similarity and discrepancy of Post-occupancy evaluation theory and variables are differ from pre-occupancy assessment theory and variables.

Research Questions:

1. **How** can the POE model be successfully developed and implemented?
2. **What** are most significant sustainable urban framework criteria?

3. **How** can these criteria be tested on the workability and implemented through neighborhood development project?
4. **Would and Why** theory of post-occupancy differ from pre-occupancy?

The significance of this intended POEM framework is to offer an evaluation measurable model for effectual sustainable urban neighborhood development which addresses the limitations and gaps of the current sustainable neighborhood assessment criteria upon occupancy. The research conceptual framework (Figure 31) discussed the overall conception of the study. From related literature and content analysis at global level on sustainable urban development in particular United Nations (UN) and World Green Building Council (WGBC) policy, the study is being narrowed to national level which look upon sustainable township development. At national level, the study cover government development policy such as Low Carbon City (LCC) and Low Carbon Society (LCS) framework aiming at sustainable township development. On the following stage, at local level, the study is narrowed towards sustainable neighborhood development aspects which concerns local authority policy, guidelines and green assessment criteria. The study is then further narrowed at institutional level, where it particularly focused in GBI-TAC pre-occupancy evaluation tool which based on six core criteria of Climate, Energy & Water; Environment & Ecology; Community Planning & Design; Transportation & Connectivity; Building & Resources; and Business & Innovation. Based on Malaysia context, there are two main derivatives of sustainable urban development criteria which are Low Carbon City (LCC) carbon calculator devised by Ministry of Energy, Water and Green Technology; and GBI Township Tools (GBI-TAC) developed by Malaysian Green Building Confederation.
At this point, the study focused on GBI Township Tools due to objectives in developing POEM and measuring certified sustainable neighborhood upon occupancy. The study justification is that GBI-TAC is implemented in Malaysia, while LCC carbon calculator was not applied hence there is no precedent case studies using this measure. Prior to certify sustainable neighborhood assessed using GBI-TAC pre-occupancy assessment criteria, the study proceeds via Stakeholders-Inclusion Approach. The GBI-TAC and selected case studies is then measures using POEM framework in addressing the study problem statements, hypotheses and questions.

In this study, POEM framework considered the fundamental dimension aspects of sustainable urban neighborhood development which was designed upon environmental, social, and economic issues. The foundation of POEM framework are based of three sustainable dimensions, by which should be assimilated cohesively in order to attain the anticipated aims of this proposal framework. Namely environmental, social, and economic dimension. The study output is POEM Handbook for Sustainable Neighborhood Development.

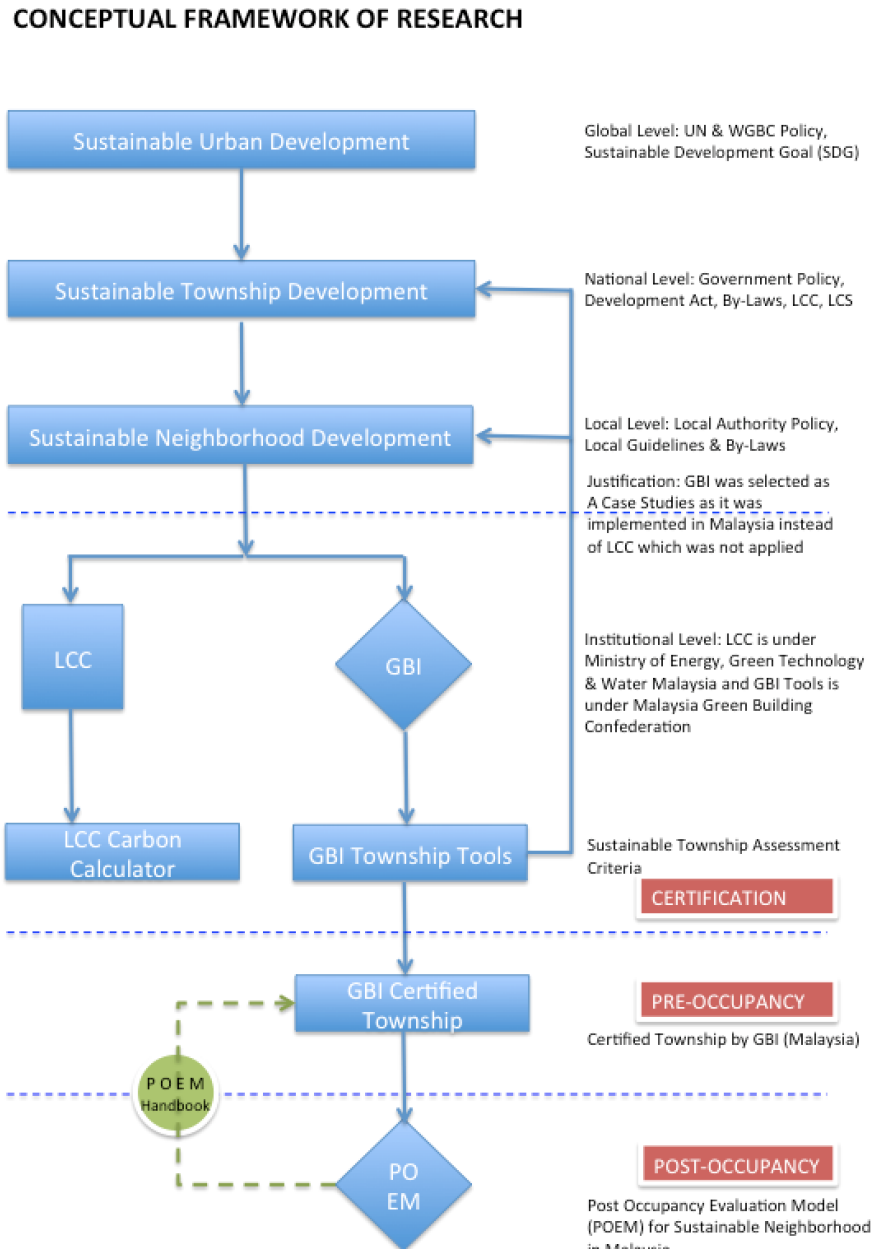


Figure30: Research Conceptual Framework.

Source: Author

Figure 32 further explained POEM study strategy framework throughout the research which cover: 1. Document/Content Analysis; 2. Expert's semi-structure interviews and surveys; 3. Professional's Surveys; 4. POEM Development; 5. POEM Handbook (end-users/households surveys) and 6. Finalized POEM Model/POEM Handbook.

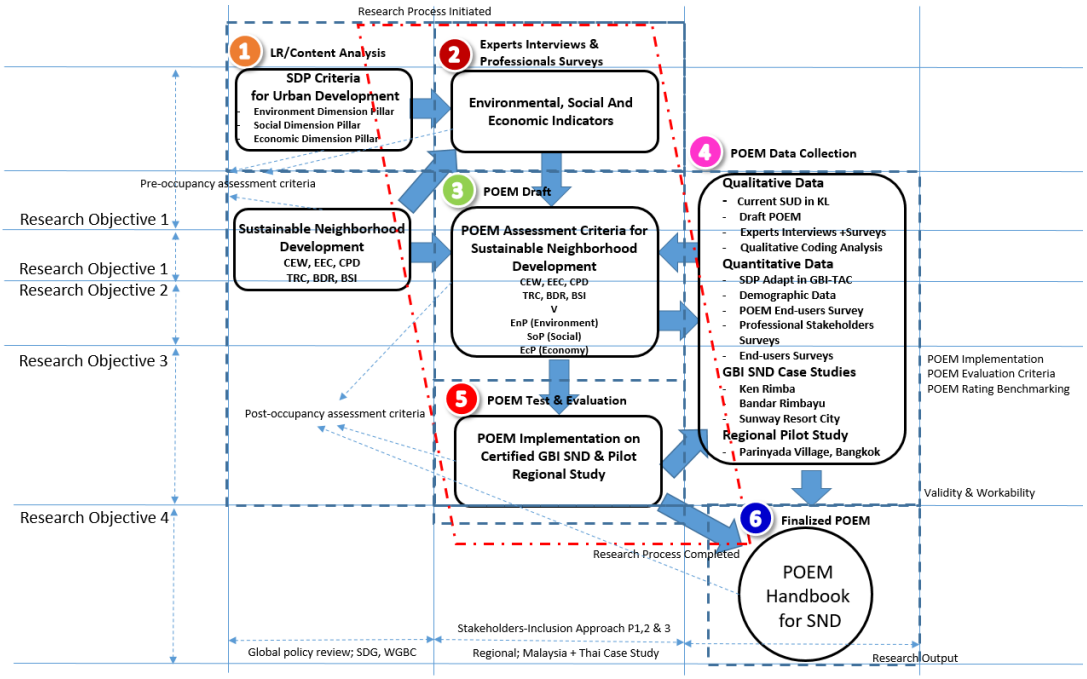


Figure31: Research strategy framework of POEM.

Source: Author

3.3.1 Research Design

Research design is the logical method which act as a blueprint of research process that explained how the research will be applied in the studies (Kochan, Bezrukova et al. 2003, Gill and Johnson 2010). The chosen research design is determined by the priority given to a number of aspects that related to the research process (Bryman 2012). It gives guidance to the researchers in gathering and examining research data in order to make sure the gathered information is appropriate to the study works and research needs (Churchill and Iacobucci 2009).

For this study, the research design will be formulated into six key stages; one stage is a theoretical stage, and the other three stages are considered as practical stages. The stages are as listed as follows;

1. The first stage, the comparative analysis or theoretical stage. It focuses on the literature review with the aim of forming a comprehensive concept of sustainable development dimensions particularly applied to urban planning. Besides, this stages also targeted to achieve one of the research objectives; to review of the different existing frameworks/models of POE for sustainable neighborhood development. The main aim of this review is to propose an effective POE model for the certified GBI neighborhood project for Malaysia
2. The second stage of this research is a practical study; the first process is to do semi-structured interviews/surveys with experts from Malaysia Green Building Confederation (MGBC) and other related professional institutions. Since this study concerns urban and certified sustainable neighborhood by GBI Malaysia, the chosen experts is professional's from building industry such as urban planners, architects, designers, engineers, engineers, surveyors and other professionals affiliated to MGBC. The data and information from stage one, the content analysis will be tabulated and discussed for an expert consensus before for more detailed and narrowing process. The second research process in this stage is to finalize the narrowed data. During this stage, a number of experts will be selected to evaluate the proposed POE model of sustainable urban development for certified GBI township projects in Malaysia. This stage aims to obtain expert opinions regarding the importance of the proposed POE model. Furthermore, it investigates expert views on the nature of sustainable urban development of certified GBI neighborhood project in Malaysia at the current time.
3. The third stage focuses on the application of professional's surveys to evaluate the adaptation of SPD in GBI Township Assessment Criteria. From broad general surveys on sustainable urban development and assessment criteria in stage 2, the professional's survey is to find out further gap in SDP adaptation. The professional in this research stage is individual or organization's representative involved in urban development project ranging from government sector, professional institution, developers, contractors, financers and academicians. Professional's surveys are employed in this research in order to get wider opinion on the SDP adaptation. It give opinion weight to each sustainable pillar dimensions based on GBI Township Assessment Criteria core-criteria, sub-criteria and scoring index.

4. The fourth stage is development of POEM questionnaires, data gathered from all the previous three step process will be analyzed and synthesized into final draft of POEM survey questionnaires for on-site End-User/Household Surveys.
5. The fifth stage is the on-site End-User/Household Surveys. The vital intent of this stage is to verify the proposed POEM of sustainable neighborhood development based on the local context of the certified GBI neighborhood project in Malaysia. The testing process is mainly built based on the result of expert's semi-structured interviews/surveys and stakeholder surveys. The objectives of this stage is to find-out end-users/household opinion on sustainable neighborhood and experiences occupying GBI certified neighborhood.
6. The final stage is Revision and Finalizing of POEM. All data from previous stages will be reviewed and refined in this stage. The output of this stage is POEM Handbook which will be validated by Experts and tested by selected End-Users for POEM applicability appraisal.

The stakeholder-inclusion approach is employed in this research in order to garner expert's view concerning the proposed POEM model for sustainable neighborhood development. It is developed for assessing the sustainable indicators of GBI certified townships project for Malaysia, which is one of the primary aims of this study work. Indeed, it aims to address the underpinning of the research question: are the current certified GBI neighborhood project in Malaysia are sustainable enough? And how to evaluate and assess sustainability through adapted sustainable dimensions of POEM model? The main reason behind the use of this approach in this study is to determine the criteria which are expected in evaluating and measuring neighborhood sustainability of certified GBI neighborhood projects in Malaysia. This is a vital issue and requires precise understanding from the very knowledgeable individuals who able recognize the different dimensions of environment, economic, and social pertaining urban development matters of sustainable neighborhood.

This study pursues to acquire an environmentally, economically and socially equilibrium and receptive method towards GBI Township Assessment Criteria. Whereby the standards and approaches of measuring and rating are placed to emphasize and support holistic sustainable dimension pillars notion across gradual developments in sustainably balanced urban development benchmarking.

The POEM is conceived to address a critical yet currently non-inclusive aspect of GBI neighborhood assessment criteria, that is, an exclusive focus on the well balanced sustainable pillars criteria through neighborhood growth and development. While the POEM framework is not the only possible venue to implement broad based and widespread sustainable criteria it does form a foundation not only for other urban research and developments to follow but also for countless other sustainable efforts to transform the current urban realities.

The research revolves around the development of a methodology to formulate a Post Occupancy Evaluation Model (POEM) with the goal to evaluate performance, effectiveness and sustainability corresponding to sustainable dimension pillars outline which heads for an enhanced sustainability in urban neighborhood development. In the course of achieving this objective, the planned study sequence to be followed;

- To carry out a comprehensive literature review and content analysis aiming at regional sustainability concept and applications for Malaysia
- To review, analyze and developed POEM model against GBI neighborhood assessment criteria
- To redefined POEM with GBI experts and professional's surveys on GBI neighborhood assessment criteria for urban neighborhood development.
- To test the validity and workability of the POEM model with on-site end-user/household surveys on certified GBI neighborhood project. POEM Handbook for further applicability instrumentation.

This research question established a case study that is positioned within the broader area of sustainable urban development and will be studied through an empirical method. The study strategy using case study can be described as performing a study which implicates an empirical studies of a particular current occurrence in its actual setting using various sources of evidence (Robson 2002). Pertaining to this definition, selected certified GBI neighborhood project in Malaysia is chosen as the specific current focus, whereby various bases of verification could be acquired from diverse approaches such as via comparative analysis, survey questionnaires and focus group discussions that will be carried out through the research process.

The case study strategy as well as the focus group discussion/interview and questionnaire strategy is chosen in this study due to its suitability in getting feedback

or answer to the research questions. It is considered the most appropriate method to apply because it offers a systematic process of collecting data, analyzing information, and discussing findings and results, hence, a clearer understanding on particular problem or situation. Moreover, these strategies help to understand a particular situation or problem profoundly.

Data Collection and Analysis

The evaluation and optimization process of the POEM model using stakeholders-inclusion approach, the difference between the estimated values of indicators in on-site project test on all core criteria help determine the necessary improvement to be made in the current assessment criteria. The comparisons and incremental improvements toward specific sustainable strategies are expected to require combination methods to be adopted for sustainable urban assessment framework as outlined in the Objective.

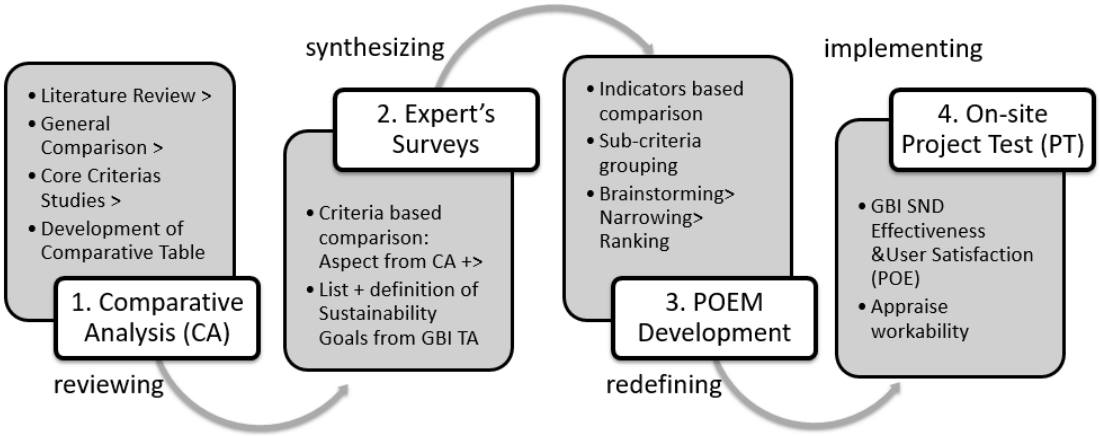


Figure32: The four simplified steps of analysis and evaluation method of POEM.

Source: Author

Mapping Research Questions & Objectives

The POEM is conceived and designed to engage six primary dimensions of green urban township indexing criteria i.e. Climate, Energy and Water (CEW), Ecology & Environment (EEC), Community Planning & Design (CPD), Transportation & Connectivity (TRC), Building & Resources (BDR) and Business & Innovation (BSI). In each dimension, sets of study inquiries and hypotheses are pointed for evaluation of intended environmental, economic and social impacts and loadings caused by

urbanization, as well as the strategies to mitigate those impacts. Few of the central questions and hypotheses guiding the POE model can be pointed out as follows:

Question 1) what are most significant sustainable urban framework criteria and **how** can the POEM be successfully developed? Assessing the extent of POEM indicators in a neighborhood or an urban district, which method of determining the current sustainable neighborhood / township development in Malaysia, GBI Township Assessment Criteria, GBI Certified Neighborhood, regional and international township assessment criteria and tools and reviews on POE model and frameworks.

Objective: The model of required impacts based on data available from content analysis, literature and archive on similar development size and types will be the most effective method because these kinds of data can be accessed conveniently and inexpensively for many conditions. The SPD adaptation in sub-criteria of neighborhood/township assessment criteria are to be compared to the opinions made using stakeholders aggregated averages from Stakeholder-Inclusions Approach analysis from professional's surveys. The main objective is to find out what is the professional's opinion on SDP adaptations in GBI Township Assessment Criteria. Professional stakeholders will nominated which SDP is highly or lowly adapted in each of the sub-criteria in assessment tool. This will give SDP adaptation indexing scores for further POEM investigation towards GBI certified neighborhood end-users / homeowners.

Data Collection and Analysis

Content analyses of specific indicators in all six core criteria dimensions against sustainability dimension pillars adaptation. Reviews on sustainability assessment framework and models give preliminary conceptions of POEM. Expert's views on current sustainable neighborhood development and assessment criteria suggest the POEM necessity indicators. The assessment and analysis process of SDP adaptation for POEM using Stakeholder-Inclusion Approach method, the difference between high and low adaptation values of SDP in sub-criteria of all core criteria help to determine the expected outcome to be made in the POEM end-user/household surveys. The data will be analyzed using SPSS software package.

Question 2) how can the POEM be successfully implemented and measured? In identifying and determining SPD adaptation for POEM development, Professional's Stakeholders Surveys strategies likely to be the most appropriate, applicable and effective interventions for study areas with especially high sustainable adaptation scores in each of neighborhood assessment sub-criteria and indexing scores. In the evaluation, validity and workability of POEM application, the End-User/Household Survey strategies likely to be the most appropriate, applicable and effective interventions for study areas within GBI certified neighborhood which were occupied for more than a year. For final appraisal on POEM validity and applicability, a POEM Handbook is instrumented for further evidence.

Objective: In optimization, a certified GBI township project with more than one year occupancy will be selected for end-user/household on-site project test within selected study sites. A balanced approach that combines a responsible mixture pillars of sustainable strategies will be adopted for real-onsite evaluation, primarily to evaluate the certified GBI township project. POEM Handbook is instrumented for further validation and to appraise applicability of the POEM and also as a reference for future development.

Data Collection and Analysis

The evaluation and optimization process of the POEM using Stakeholder-Inclusion Approach method. The End-Users/Household Surveys question will be divided into two section. The first section is on demographic and general survey on sustainable neighborhood awareness. The second section is the surveys on end-users opinion towards simplified sustainable certified neighborhood criteria based on SPD. The gathered data will be analyzed using SPSS software package. The difference between the opinions values of indicators in on-site end-user/household surveys on all criteria help determine Post Occupancy Evaluation outcome on GBI Certified Neighborhood. Hence, the outcome can be used for the future revisions of the current assessment criteria review. The POEM Handbook is instrumented as a POEM final assessment tools output for further research validity and appraisal applicability in actual context of neighborhood post occupancy evaluation assessment.

Question 3) would and why theory of post-occupancy differ from pre-occupancy? In finding out and determining pre-occupancy and post occupancy theory and variables differences, Professional's Surveys Phase 2 (pre-occupancy criteria) and Household Surveys Phase 3 (post-occupancy criteria) Structural Equation Modeling analysis are used. The outcome of good fitness indexes are used to determine this gap.

Objective: To evaluate similarity and discrepancy of Post-occupancy evaluation theory and variables are differ from pre-occupancy assessment theory and variables. The outcome is as a basis for pre-occupancy evaluation criteria review. The opinion of the end-users or each household measured from their dwelling experience will give an insight for further refinement of future sustainable neighborhood development and sustainable agenda in general.

Data Collection and Analysis

The evaluation and optimization process of the POEM using Stakeholder-Inclusion Approach method. The Professional Surveys will be used to measure SDP adaptation of pre-occupancy evaluation criteria (GBI-TAC) and End-Users/Household Surveys will be used to measure post-occupancy evaluation criteria (POEM for SND). The gathered data will be analyzed using SPSS-AMOS 22 software package. Both pre-occupancy (GBI-TAC) and post-occupancy (POEM for SND) data are examined via Cronbach Alpha Reliability Test, Confirmatory Factor Analysis and Structural Equation Modeling. The overall yielded results from full SEM will be used to evaluate the difference of pre-occupancy and post-occupancy theories and variables.

Question 4) how can these criteria be tested on the workability and implemented through neighborhood development project? Upon finalized POEM framework development, POEM Handbook implementation strategies likely to be the most appropriate, applicable and effective interventions for regional study area beyond the selected case studies in Malaysia. In the evaluation, validity and workability of POEM application, the regional case study in Bangkok, Thailand is chosen.

Objective: To recommend the adaptation of POEM findings to similar development phenomenon in the region and country throughout the world. For this objective, literature surveys was conducted in the ASEAN region to find out the availability of pre-occupancy and post-occupancy SND implementation through each country GBI /

GBC websites. For regional POEM framework implementation, Parinyada Village in Bangkok, Thailand was selected as the regional case study as it's suitable and have sustainable features comparable to selected case studies in Malaysia. The selection of Parinyada Village as a regional case study also upon discussion and deliberation of EDS experts in the SND and urban development subjects for this regional case study. A collaborator and evaluator was appointed (Ms. Kespanerai Kokchang, Energy Research Institute, Chulalongkorn University).

Data Collection and Analysis

Literature surveys and content analysis was conducted in the ASEAN region to find out the availability of pre-occupancy and post-occupancy SND implementation through each country GBI / GBC websites. The data was tabulated and analyzed using comparative analysis for finding out the gap in post-occupancy implementation in this region. The POEM evaluation implementation at regional level via an appointed collaborator and evaluator is to further appraise and validate the POEM workability beyond the selected case studies in Malaysia. The data will be collected using purposive sampling method and analyzed using POEM for SND procedures. The specific evaluation criteria achieved outcome can be used for sustainable enhancement and practice targeted at community and individual level for continuing sustainable agenda upon occupancy. Thus, POEM for SND evaluation criteria can be recommended in actual context of neighborhood development throughout.

3.3.2 Research Strategy

Established upon the study question of this research is "How can POE model be successfully developed and implemented? What are most significant sustainable urban framework criteria? And how can these criteria be tested on the workability and implemented through GBI certified neighborhood development project in Malaysia? This research question established a case study that is positioned within the broader area of sustainable urban development and will be studied through an empirical method. The study strategy using case study can be described as performing a study which implicates an empirical studies of a particular current occurrence in its actual setting using various sources of evidence (Robson 2002). Pertaining to this definition, selected certified GBI neighborhood/township project in Malaysia is chosen as the specific

current focus, whereby various bases of verification could be acquired from diverse approaches such as via survey questionnaires and semi-structured interviews that will be carried out through the application of Stakeholders-Inclusion Approach as seen in sub-chapter 3.5.

The on-site case study strategy as well as the semi-structured interviews and survey questionnaires strategy is chosen in this study due to its suitability in getting feedback or answer to the research questions. It is considered the most appropriate method to apply because it offers a systematic process of collecting data, analyzing information, and discussing findings and results, hence, a clearer understanding on particular problem or situation. Moreover, these strategies helps to understand a particular situation or problem profoundly.

3.3.3 Research Process

Research design is a logical approach and as a blueprint of research process that explained how the research will be applied in the studies (Kochan, Bezrukova et al. 2003, Gill and Johnson 2010). The chosen research design is determined by the priority given to a number of aspects that related to the research process (Bryman 2012). It gives guidance to the researchers in gathering and examining research data in order to make sure the gathered information is appropriate to the study works and research needs (Churchill and Iacobucci 2009). For this study, the research design will be formulated into four key stages; one stage is a theoretical stage, and the other three stages are considered as practical stages. The stages is as listed as follows;

- The first stage, the content analysis or theoretical stage. It focuses on the literature review with the aim of forming a comprehensive concept of sustainable development dimensions particularly applied to urban planning. Besides, this stages also targeted to achieve one of the research objectives; to review of the different existing frameworks/models of POEM for sustainable township/neighborhood development. The main aim of this review is to propose an effective POEM for the certified GBI township projects in Malaysia
- The second stage of this research is a practical study, the first process is to do

semi-structured interviews and survey questionnaires with experts from Malaysia Green Building Confederation (MGBC), Government Agency, Professional Institutions and Academicians. The data and information from stage one, the content analysis will be analyzed and summarized for an expert‘s opinion for more detailed and narrowed process using Stakeholders-Inclusion Approach (Phase 1) Expert’s Semi-structured Interviews and Surveys. During this stage, a number of experts which consist of MGBC Technical Team, Assessors, Facilitators and Government Representatives will be selected to evaluate the proposed POEM of sustainable urban development for certified GBI township projects in Malaysia. This stage aims to obtain expert opinions in regard to the importance of the proposed POEM. Furthermore, it investigates expert views about the nature of sustainable urban development in general and certified GBI Township projects in Malaysia at the current time.

- The third stage focuses on the adaptation of SDP in GBI Township Assessment Criteria. The Stakeholders-Inclusion Approach of (Phase 2) Professional Stakeholders Surveys is utilized in order to evaluate the SDP adaptation in all sub-criteria in GBI Township Assessment Criteria. This research stage will give a findings on SDP balance in GBI township/neighborhood certification. Hence, it gauged the SDP adaptations balance outcome based on the results that obtained through the employment of the (Phase 1) Expert’s Semi-structured Interviews and Surveys in the stage two. Stakeholders-Inclusion Approach is employed in this research to give SDP adaptation weight to each sustainable dimension pillars against sub-criteria and it weighing scores. The data gathered in this stage is analyzed using analytical functions of statistical software.
- The fourth stage is the on-site end-user/household test stage. The vital intent of this stage is to verify the proposed POEM of sustainable urban development based on the local context of the certified GBI township projects in Malaysia. The Stakeholders-Inclusion Approach (Phase 3) End-User/Household Surveys is mainly designed based on the findings of both Stakeholders-Inclusion Approach (Phase 1 and Phase 2) and was simplified for end-users/household surveys as the respondents is a layman. Final output of this research is POEM Handbook which it will further validate and appraised applicability of POEM

in actual context of neighborhood post-occupancy evaluation. An analysis of these theoretical and practical stages findings will be presented in the following subsection, while the full detail and main results will be provided during this thesis in chapter six.

The stakeholder-inclusion approach is employed in this research in order to garner expert's view concerning the proposed POEM model for sustainable neighborhood development. It is developed for assessing the sustainable indicators of GBI certified townships project for Malaysia, which is one of the primary aims of this study work. Indeed, it aims to address the underpinning of the research question: are the current certified GBI township projects in Malaysia is sustainable enough? And how to evaluate and assess sustainability through an adapted sustainable dimensions pillar of POEM? The main reason behind the use of this approach in this study is to determine the criteria which are expected in evaluating and measuring neighborhood sustainability of certified GBI neighborhood projects in Malaysia. This is a vital issue and requires precise understanding from the very knowledgeable individuals who able recognize the different dimensions of environment, economic, and social pertaining urban development matters of sustainable township/neighborhood. The POEM appraisal of workability and validity is devised via Stakeholders-Inclusion Approach (Phase 3) End-Users/Household Surveys as it provides homeowners, tenants and workers opinion on sustainability towards GBI certified neighborhood.

3.4 Adopted Research Methodology

This research focusses on the listed study questions: How POE model can be developed against sustainable triple bottom line dimensions? And; what are the most sustainable urban criteria? And; how these criteria can be tested? The significance of this intended framework is to offer an evaluation criteria which will be used in assessing GBI Township Assessment Criteria and certified GBI projects. The studies reviews sustainable urban development phases in Malaysia specifically and at global generally in understanding the sustainable criteria, the indicators and weighing scores in developing the model. The latter is then gauged using a Stakeholders-Inclusion Approach. The first two phases (Phase 1 and Phase 2) in Stakeholders-Inclusion

Approach can be explained as a technical and professional team decision technique, which involves a high skilled capability of profound experience and knowledge of the related issues, (Okoli and Pawlowski 2004) for this particular studies is sustainable urban neighborhood development. The third phase (Phase 3) of Stakeholders-Inclusion Approach is basically to gauge the sustainability of the certified neighborhood after its being occupied for more than a year via the end-user/household surveys. This is important in finding out whether the development and certification is as vision by urban planners and architects. The Adopted Research Methodology is designed based on Research Conceptual Framework in addressing the Research Objectives and Research Questions. The following sub-chapters detailed out the adopted methods in this study and explain the in the form of tables.

3.4.1 Adopted RM for Research Objectives 1 & Research Questions 1

Table 4: Research Methodology for RO1 & RQ1
Source: Author

Objectives / Questions	Data Collection	Process of Data Collection	Method of Data Analysis
RO1: To identify and formulate post-POEM based on SDP towards SND for Malaysia. **RQ1: What are most significant sustainable urban framework criteria and how can the POEM framework be successfully developed?**	The RO & RQ were answered by collecting following data: **LR Survey & Content Analysis** - Central Library, Chulalongkorn University - EDS Library, Chulalongkorn University - PTAR, UiTM - Far Eastern University, Manila - Malaysian Green Building Confederation - ARCHIDEX, KL - GBI's related website	Data was downloaded from repository mentions in Data collection column. Cited references were downloaded and saved in Endnote 8	Tabulation of Data Comparative Analysis
	Experts Semi-structured Interviews (Phase 1: Stakeholders-Inclusion Approach) Consist of 3 SS questions	Targeted respondents of this phase is 24 experts, but the author managed to interview 31 experts. The experts are the respondents who designed and developed	Transcribing of Interviews Qualitative Analysis Coding

	- Current SND in Klang Valley - Further elaborations on SND - POEM draft	GBI-TAC (Pre-occupancy criteria) The expert respondents are: - MGBC Technical Team - GBI Evaluator & Facilitator - Authority Representatives - Academicians	Diagrams / Tables tabulations
	Experts Surveys Questionnaires (Phase 1: Stakeholders-Inclusion Approach) Consist of 4 SQ questions - POEM contents - POEM vs SDP - Other contents of POEM - Further elaborations on POEM	Targeted respondents of this phase is 24 experts, but the study managed to interview 31 experts. The experts are the respondents who designed and developed GBI-TAC (Pre-occupancy criteria) The expert respondents are: - MGBC Technical Team - GBI Evaluator & Facilitator - Authority Representatives - Academicians	Statistical Analysis of means and standard deviation values. (SPSS 22 Package) Diagrams / Tables tabulations
	Professional Survey Questionnaires (Phase 2: Stakeholders-Inclusion Approach) Consist of SDP Adaptations on GBI-TAC (Pre-occupancy) Total Questions: CC x SDP (52 x 3 questions) - CEW x SDP - EEC x SDP - CPD x SDP - TRC x SDP - BDR x SDP - BSI x SDP	Targeted respondents of this phase was 50 professionals, but the author managed to interview 61 professionals. The professionals are the respondents who implemented GBI-TAC (Pre-occupancy criteria) The professionals respondents are: - Urban Planners - Architects - Engineers - Designers - Surveyors - Academicians	Statistical Analysis of means and standard deviation values. (SPSS 22 Package) Diagrams / Tables tabulations
	Household Survey Questionnaires (POEM) (Phase 3: Stakeholders-Inclusion Approach)	Targeted respondents of this phase was 300 households, but the author managed to interview 378 household. The households are the respondents who lived	Statistical Analysis of means and standard deviation values. (SPSS 22 Package) Statistical Analysis of Cross-Tabulation (SPSS 22 Package)

	Consist of 6 general understanding on SD questions. - SND Awareness - SDP Awareness - Certified SND Awareness - Role in Certified SND - Influence staying in SND - Duration to dwell in SND Consist of 24 SDP evaluation criteria (8 x 3 dimension) Environment (EnP) - 8 questions Social (SoP) - 8 questions Economic (EcP) - 8 questions	and experienced certified SND The household respondents were: - Ken Rimba 122 households - Rimbayu 125 households - Sunway 131 households	Statistical Analysis of 1 way ANOVA (SPSS 22 Package) Diagrams / Tables tabulations

3.4.2 Adopted RM for Research Objectives 2, Research Questions 2 & Research Questions 4

Table 5: Research Methodology for RO2, RQ2 & RQ4
Source: Author

Objectives / Questions	Data Collection	Process of Data Collection	Method of Data Analysis
RO2: To implement post-occupancy evaluation model in assessing & evaluate GBI certified neighborhood towards sustainable urban development for Malaysia. **RQ2: How can the POEM framework be implemented and measured?** **RQ4: How can these criteria be tested on the workability through urban development project?**	The RO & RQ were answered by collecting following data: **POEM Handbook Implementation (Test & Evaluation)** at 3 selected Certified SND in Malaysia. The POEM Evaluation are divided into two: The first part are demographic and general **Sustainable Awareness.** - SND Awareness - SDP Awareness - Certified SND Awareness - Role in Certified SND	The GBI Certified SND are: 1. Ken Rimba 2. Bandar Rimbayu 3. Sunway Resort City The POEM Implementation (Test & Evaluation) are based on the procedures and guidelines outlined in the handbook which consist of 4 steps: 1. Identify & Select Case Study 2. Gather SND information &	The data is analyze using POEM Handbook Procedure. The Analysis include: 1. EnP Dimension Score 2. SoP Dimension Score 3. EcP Dimension Score 4. Total Dimension Score The analysis output include: Tabulation of Data Comparative Analysis

	- Influence staying in SND - Duration to dwell in SND The second part are POEM evaluation criteria which contain 24 survey questions based on pillar of SD. The SD evaluation are: **Environment (EnP)** EnP Q1.Sufficient Designated Green Area EnP Q2.Sufficient Street Or Park Lighting EnP Q3.Generate Or Use Renewable Energy EnP Q4.Reduced Or Recycle Water Practice EnP Q5.Bio-Diversity Reserved Availability EnP Q6.Flood / Drainage Clogging Experience EnP Q7. Infrastructure Services Efficiency EnP Q8.Pollution Control & Experience **Social (SoP)** SoP Q1. Sufficient Communal Greenspaces SoP Q2.Population Density & Development Level SoP Q3.Universal Accessibility Availability SoP Q4.Security And Safety Experience SoP Q5 Public Health Concerns SoP Q6 Recycling Facilities Or Practices SoP Q7.Community Diversification SoP Q8.Community Engagement & Management **Economic (EcP)** EcP Q1.Distance To Community Amenities EcP Q2. Public	Setting-up survey database bank 3. Data Collection 4. Report of Outcomes The sampling method of POEM Implementation was using Purposive Sampling. The study targeted 100 household for each case study. Total no. of household participated in this procedures were: 1. Ken Rimba - 122 households 2. Bandar Rimbayu - 125 households 3. Sunway Resort City - 131 households	Qualitative Analysis Coding Diagrams / Tables tabulations

	Transport Reliability EcP Q3. Sufficient Pedestrian & Cycling Networks EcP Q4 Low Impact & Regional Materials EcP Q5. Promotion Of Sustainable Construction EcP Q6. Construction Waste & Sedimentation EcP Q7. Sufficient Commercial Amenities EcP Q8.Innovative Development		

3.4.3 Adopted RM for Research Objectives 3 & Research Questions 3

Table 6: Research Methodology for RO3 & RQ3
Source: Author

Objectives / Questions	**Data Collection**	**Process of Data Collection**	**Method of Data Analysis**
RO3: To evaluate similarity and discrepancy of Post-occupancy evaluation theory and variables are differ from pre-occupancy assessment theory and variables. **RQ3: Would and Why theory of post-occupancy differ from pre-occupancy?**	The RO & RQ were answered by collecting following data: **Pre-Occupancy Evaluation Professional Survey Questionnaires (Phase 2: Stakeholders-Inclusion Approach)** Consist of SDP Adaptations on GBI-TAC (Pre-occupancy) Total Questions: CC x SDP (52 x 3 questions) - CEW x SDP - EEC x SDP - CPD x SDP - TRC x SDP - BDR x SDP - BSI x SDP	Targeted respondents of this phase was 50 professionals, but the author managed to interview 61 professionals. The professionals were the respondents who implemented GBI-TAC (Pre-occupancy criteria) The professionals respondents were: - Urban Planners - Architects - Engineers - Designers - Surveyors - Academicians	Reliability Analysis of Cronbach Alpha (SPSS 22 Package) Confirmatory Factor Analysis (CFA) and Full Structural Equation Modeling (SEM) – (SPSS-AMOS 22 package)
	Post-Occupancy Evaluation	Targeted respondents of this phase was 300 households, but the author managed to	Reliability Analysis of Cronbach Alpha (SPSS 22 Package)

	Household Survey Questionnaires (POEM) (Phase 3: Stakeholders-Inclusion Approach) Consist of 6 general understanding on SD questions. Consist of 24 SDP evaluation criteria (8 x 3 dimension) Environment (EnP) - 8 questions Social (SoP) - 8 questions Economic (EcP) - 8 questions	interview 378 household. The households are the respondents who lived and experienced certified SND The household respondents are: - Ken Rimba 122 households - Rimbayu 125 households - Sunway 131 households	Confirmatory Factor Analysis (CFA) and Full Structural Equation Modeling (SEM) – (SPSS-AMOS 22 package)

3.4.4 Adopted RM for Research Objectives 4

Table 7: Research Methodology for RO4
Source: Author

Objectives	Data Collection	Process of Data Collection	Method of Data Analysis
RO4: To recommend the adaptation of POEM findings to similar development phenomenon in the region and country throughout the world.	The RO was answered by collecting following data: **The status of Pre-Occupancy and Post-Occupancy of SND in the ASEAN region.** Secondary Data for ASEAN Nation's GBI & LR Survey - MGBC Malaysia - TGBI Thailand - SGBC Singapore - PGBC Philippines - GBC Brunei - GBC Cambodia - VGBC Vietnam - GBCI Indonesia	Data was downloaded from repository mentions in Data collection column. Cited references was downloaded and saved in Endnote 8	Tabulation of Data Comparative Analysis
	POEM Implementation (Test & Evaluation) at Regional Case Study in Bangkok, Thailand	The SND are: - Parinyada Village, Bangkok. The POEM Handbook Implementation (Test	The data is analyze using POEM Handbook Procedure. The Analysis include: 5. EnP Dimension Score

	The POEM Handbook Evaluation are divided into two: The first part are demographic and general **Sustainable Awareness.** - SND Awareness - SDP Awareness - Certified SND Awareness - Role in Certified SND - Influence staying in SND - Duration to dwell in SND The second part are POEM evaluation criteria which contain 24 survey questions based on pillar of SD. The SD evaluation are: **Environment (EnP)** EnP Q1.Sufficient Designated Green Area EnP Q2.Sufficient Street Or Park Lighting EnP Q3.Generate Or Use Renewable Energy EnP Q4.Reduced Or Recycle Water Practice EnP Q5.Bio-Diversity Reserved Availability EnP Q6.Flood / Drainage Clogging Experience EnP Q7. Infrastructure Services Efficiency EnP Q8.Pollution Control & Experience **Social (SoP)** SoP Q1. Sufficient Communal Greenspaces SoP Q2.Population Density & Development Level SoP Q3.Universal Accessibility Availability SoP Q4.Security And Safety Experience	& Evaluation) are based on the procedures and guidelines outlined in the handbook which consist of 4 steps: 1. Identify & Select Case Study 2. Gather SND information & Setting-up survey database bank 3. Data Collection 4. Report of Outcomes The sampling method of POEM Handbook Implementation is using Purposiveness Sampling. The study targeted 30 household for this regional case study. Parinyada Village was selected as the regional case study as it's suitable and have sustainable features comparable to selected case studies in Malaysia. The selection of Parinyada Village as a regional case study also upon discussion and deliberation of EDS experts in the SND and urban development subjects For this regional case study, a collaborator and evaluator was appointed (Ms. Kespanerai Kokchang, Energy Research Institute, Chulalongkorn University).	6. SoP Dimension Score 7. EcP Dimension Score 8. Total Dimension The analysis output include: Tabulation of Data Comparative Analysis Qualitative Analysis Coding Diagrams / Tables tabulations

	SoP Q5 Public Health Concerns SoP Q6 Recycling Facilities Or Practices SoP Q7.Community Diversification SoP Q8.Community Engagement & Management **Economic (EcP)** EcP Q1.Distance To Community Amenities EcP Q2. Public Transport Reliability EcP Q3. Sufficient Pedestrian & Cycling Networks EcP Q4 Low Impact & Regional Materials EcP Q5. Promotion Of Sustainable Construction EcP Q6. Construction Waste & Sedimentation EcP Q7. Sufficient Commercial Amenities EcP Q8.Innovative Development		
	Recommendation of POEM for ASEAN & Asia Region	Based on summary of overall study, POEM-SND status in ASEAN and Regional Case Study	

3.5 Stakeholders-Inclusion Approach

In this research, the "include-all" Stakeholders-Inclusion Approach is intended for the composition of the surveys, data gathering and analyses of the obtained data (Roy, Kalle et al. 2001). This method of study has been shown to in a number of scientific investigation's (Powell 2003, Okoli and Pawlowski 2004, Vidal and Adam 2007, Vidal, Marle et al. 2011). The method derived from the dissemination of the Stakeholders-Inclusion Approach semi-structured interview and survey process into three sequential phases: 1. Content analysis; 2. SDP adaptations; and 3. On-site evaluation. Table 8 below illustrates this Stakeholders-Inclusion Approach continual process.

Table 8: Stakeholders-Inclusion Approach Continual Administration Process.
Source: Author

Phases	Administration Process
Phase 1: Content Analysis Expert's Interviews & Surveys	• It is devised to determine the current sustainable urban neighborhood development and certification in Malaysia. It is also to find-out whether the assessment criteria and POEM are comprehensive and understandable • Experts are ask to evaluate the POEM, add a related contents and comments • Experts are ask to identify any unclear contents or dimension relevancy and to verify it
Phase 2: SDP Adaptations Professional's Surveys	• Professional's stakeholders are asked to give opinion on SDP adaptations based on the assessment sub-criteria and it's indexing scores upon feedback and comments provided from Phase 1 • Stakeholders are requested to add their comments
Phase 3: On-site Evaluations End-Users/Household Surveys	• End-Users/Household are requested to rate the rate the level of sustainability dimensions of simplified post-occupancy evaluation criteria in order to establish sustainable priorities • The level of importance will be rated via 5 point Likert Scale

3.5.1 Phase 1: Stakeholders-Inclusion Approach – Expert's Semi-Structured Interviews/Surveys

This research apply the Stakeholders-Inclusion Approach to deliver opinions concerning SDP dimensions of existing green township assessment criteria progress and to develop the obtained findings towards post occupancy evaluation of certified GBI neighborhood. Therefore, Stakeholders-Inclusion Approach is appropriate and will be adopted for this research. For Phase 1 and Phase 2 Stakeholders-Inclusion Approach, it constitutes a team of policy-makers and urban development professionals in accordance of their intellectual merit, rank in the order for decision-making and their competency or experience in sustainable urban development field. The conventional surveys methods experience richness in issues, meanwhile in Stakeholders-Inclusion Approach expert's and stakeholders surveys will basically supply richer feedback data, that is due to numerous iterations and responses, where the experts participating in Stakeholders-Inclusion Approach are positive towards additional enquiries for further

elaborations (Okoli and Pawlowski 2004). The selected Phase 1 experts' line up for this research is the pool of Technical Team from Malaysian Green Building Confederations (MGBC) Board members, GBI Assessors + Facilitators, Government Agency Representatives and Academicians. The most crucial needs within phase 1 is the option of selected proficient professionals as a respondents. This phase shall be performed in several-step list method in identifying the experts. The selection of experts panel in this study are based on a four-tier procedures in determining the experts and to prepare selection list as stated in the following Table 9. This is to give a wider perspective and opinion in finding the most comprehensive post-occupancy evaluation perspectives of sustainable neighborhood development. In this research where Stakeholders-Inclusion Approach is employed, the participating selected experts are known to the researcher. This permits the researchers to follow up the experts if further additional explanations is required.

Table 9: Four-step process expert's selection list.
Source: Author

Steps	**Process**
Step 1: Identify Experts	• Identify relevant disciplines: professionals, academicians, government officials • Identify organizations
Step 2: List Experts	• Tabulate the names of experts in relevant disciplines and organizations that directly involved in GBI Township Assessment Criteria • List the names of experts from professional institute, government agency and academic establishment
Step 3: Select Experts	• Rank and select experts based POEM research relevancy • Notify the nominated experts for study availability
Step 4: Invite Experts	• Invite selected experts for interview / survey session • Invite experts according to their POEM ranking relevancy • Target size is 20-30 • Discontinue collecting response or survey once the target size has meet.

Additionally, this POEM studies also concerned in determining the issues that will be anticipated in evaluating and gauge sustainable township development in Malaysia,

especially the GBI Township Assessment Criteria tools and certified GBI township projects. This is an important factors, thus it required a specific understanding from the extremely qualified experts who are familiar within different sustainable dimension of environmental, economic, and social, as well in planning, design and urban development issues in Malaysia. Another advantage feature that makes Stakeholders-Inclusion Approach prevalent is that the selected experts are directly involved as the technical team or as a first hand person in devising GBI Township Assessment Criteria and they are also the Facilitator or Assessor of GBI Certified Neighborhood development. The surveys are also done via the use of online system, hence widen the feedback to other related stakeholders in the building industry for wider consensus.

3.5.2 Phase 2: Stakeholders-Inclusion Approach – Professional's Surveys

For Phase 2: Stakeholders-Inclusion Approach, professional's surveys is employed. The term 'professional' in this phase are basically an individuals or representatives from sustainable building industry related institutions or professionals such as urban planners, architects, engineers, designers, builders, manufacturers and academicians. These professional are key players in implementing GBI Township Assessment Criteria whether directly or indirectly involved in sustainable urban neighborhood development in Malaysia. The respondents for Phase 2: Professional's Surveys is listed mainly from list of participants of sustainable workshops and continuing professional development programs conducted by MGBC and other professional building related profession in Malaysia. The limitations of this phase is to get the response from the listed professional respondents, this is probably due to their busy schedule and non-available of time to answer the survey.

The Professional's Surveys was conducted via online questionnaires surveys using Google Documents software package. The online surveys was emailed to the list respondents for feedback. A total 100 onlinePprofessional's Surveys was disseminated to the listed respondents with a target of 50 returned response. The returned response in this phase is analyzed using SPSS statistical software package. The main objective of this phase is gather data for SDP adaptations balanced in all GBI assessment sub-criteria and its scoring weight. These basically will give a feedback on SDP balanced based on Phase 1 Expert's opinion of core-criteria in GBI Township Assessment

Criteria. These findings is also simplified to design Phase 3 End-User/Household Surveys questionnaires. This phase research administration is shown in table 10.

Table 10: Phase 2: Professional's Surveys five-step research administration process. Source: Author

Steps	Process
Step 1: Questionnaires Design	• Get feedback from Phase 1 Expert's semi-structured interviews and surveys on SDP in GBI Township core-criteria. • Designed a questionnaire for SDP adaptations against GBI assessment sub-criteria. • Prepared online survey forms using Google Doc software package •
Step 2: List Professional's	• List relevant disciplines of professionals and academicians that directly or indirectly involved with MGBC sustainable programs and Professional Institution CPD programs • Identify individuals, organizations, email and mobile contacts for professional's surveys questionnaires dissemination.
Step 3: Disseminate Surveys	• List the valid names and email contacts of Professional's from MGBC and professional institute given list. • Email the Phase 2 Professional's Surveys to all valid list. • 100 online Professional's Surveys disseminated with a target of minimum 50 returned response
Step 4: Professional's Response	• Gather online response from Professional's Surveys • Discontinue collecting response or survey once the target size has meet.
Step 5: Response Analysis	• Convert online CSV gathered data into SPSS enabled analyzed data. • Analyzed the data using SPSS software packages • Surveys on SDP adaptation again sub-criteria and scoring weight outcomes.

3.5.3 Phase 3: Stakeholders-Inclusion Approach – End-User/Household Surveys

Phase 3: Stakeholders-Inclusion Approach end-user/household surveys is to rate the level of sustainability of GBI certified neighborhood. The term 'end-user/household' in

this phase are referring to homeowners, tenants or workers in GBI certified neighborhood. These end-users are key respondents in implementing POEM for sustainable neighborhood as it act as a main samples for validating and appraising the workability of POEM in selected GBI certified township. The respondents for Phase 3: End-User/Household Surveys is occupants of GBI certified neighborhood which was occupied for a minimum of one year occupancy. The selected on-site GBI certified neighborhood is as gazette by GBI Malaysia and MGBC.

For this phase, selected GBI certified neighborhood are Ken Rimba Development, Bandar Rimbayu and Sunway Resort City. All these three on-site case study are awarded with sustainable township ratings from GBI Malaysia. Since GBI Township Assessment Criteria tools are relatively new, only these three neighborhood or township was certified and being occupied for more than year. Hence, it is the only available neighborhood for this study. The end-user/household surveys data was collected via door to door survey with a help of research assistant. Three research assistant was employed to gather door to door data collection for each neighborhood. For this phase, a minimum 100 responses from end-user/household respondents was targeted for each selected on-site case studies. The returned response in this phase is analyzed using SPSS statistical software package. The main objective of this phase is gather data for POEM of sustainable neighborhood in GBI certified neighborhood. The aim to rate sustainability level of GBI certified neighborhood upon a minimum one year occupancy. The output of all research process in Stakeholders-Inclusion Approach is POEM Handbook which is also for further research validation and appraised the applicability of POEM in actual context of neighborhood post occupancy evaluation in Malaysia. This phase research sequential process administration is shown in table 11.

Table 11: Phase 2: Stakeholders Surveys six-step research administration process. Source: Author

Steps	Process
Step 1: Questionnaires Design	• Get feedback from Phase 1 and Phase 2 surveys on GBI Township Assessment Criteria and POEM. • Simplified the criteria and designed a questionnaire for sustainability ratings for GBI certified neighborhood. • Prepared door to door survey forms using Google Doc software package •
Step 2: List Certified Neighborhood	• Identify GBI certified neighborhood for on-site case studies • According to GBI Malaysia and MGBC only three certified neighborhood with minimum one year of occupancy available for study • The certified neighborhood are Ken Rimba Development, Bandar Rimbayu and Sunway Resort City.
Step 3: Disseminate Surveys	• Appoint 9 research assistants (3 for each neighborhood) for door to door surveys • Disseminate a minimum 100 of end-users/household surveys in each neighborhood
Step 4: End-users Response	• Gather door-to-door response from End-User/Household Surveys • Research assistant to key-in data entry in Google Docs for CSV data file.
Step 5: Response Analysis	• Convert CSV data file into SPSS enabled analyzed data. • Analyzed the data using SPSS software packages • Surveys on sustainable level of GBI certified neighborhood upon a minimum 1 year occupancy
Step 6: POEM Handbook	• To further validate and appraised the applicability of POEM of sustainable neighborhood in actual context • POEM Handbook as a research output

3.6 Structural Equation Modeling (SEM)

Besides using SPSS analysis, the other main statistical instrument employed to analyze the data and to examine the hypotheses in this research is Structural Equation Modeling (SEM). SEM is a robust multivariate data analysis technique (Alavi & Ghaemi, 2011; Hair, Anderson, Tatham, & Black, 1998; Gerbing & Anderson, 1988) and a flexible (Leung, Wang, & Deng, 2014; Thomas, 2013; In'nami & Koizumi, 2013; Kyriakidou,

Michalakelis, & Sphicopoulos, 2013) which enables researchers to instantaneously observe several correlations between manifest against latent variables (Kock, 2010). It's also provides a suitable technique for studying complicated correlation among interrelated factors (Eggert, Helm, & Tax, 2013; Chin, Ebesutani, & Young, 2013; Garnefeld, Sun & Xiao, 201; Chang-zheng & Hui-min, 2011).

Furthermore, Structural Equation Modeling allows the researcher to resolve a set of correlated research inquiries using a specific, organized and all-embracing analysis through modeling the correlation among several and dependent constructs concurrently (Gefen, Straub and Boudreau, 2000). The Structural Equation Modeling are highly proficient for simultaneous analysis, and differs considerably from most of the first-generation regression modeling. Moreover, Structural Equation Modeling is also capable to measure the mediation effect of the structural model simultaneously instead of separate regression analyzes measuring (Iacobucci, 2010).

Formerly, Structural Equation Modeling was used commonly in social sciences study but recently it is progressively used in other study disciplines (Christ, Lee, Lam, & Zheng, 2014) and has changed into a common technique in various research areas (Sarstedt, Ringle, Smith, Reams, & Hair, 2014). The Structural Equation Modeling study method is very appropriate for research in social science, particularly in the subject of behavioral studies (Baumgartner and Steenkamp, 1996). Based on the robustness and capability of Structural Equation Modeling analysis technique, to date lots of behavioral studies area including sustainable development related studies have utilized this technique (Wang, Law, Hung, & Guillet, 2014; Nusair & Hua, 2010; Oh & Hsu, 2014; A. Chen & Peng, 2014; Ritchie, Ruhanen, & Moyle, 2014; Stylidis & Terzidou, 2014; Sangkyun Kim & Assaker, 2014; McLennan, Nunkoo *et al*., 2013; Assaker, Huang, & Hallak, 2012; Nunkoo & Ramkissoon, 2012; Jong-Hyeong Kim, Ritchie, & Tung, 2010).

Justification for Structural Equation Modeling.

A decade and half ago not many of researchers applied Structural Equation Modeling to analyze their outcomes (Reisinger & Turner, 1999). Since then, numerous researches in the behavioral studies discipline have utilized Structural Equation Modeling. Moreover, Structural Equation Modeling offers numerous advantages for the researcher

to analyze their study data. Nunkoo and Ramkissoon (2012) point out advantages of Structural Equation Modeling upon regression analysis: (1) modeling of unexplained variances and measurement errors, (2) instantaneous testing of correlations, (3) the capability to relate micro and macro evaluations, and (4) fit indices model and theory establishment. Nunkoo *et al*. (2013) further reported that largely most of top-tier research publication journal opted for research which uses Structural Equation Modeling instead of Ordinary Least Squares (OLS) for data analysis.

Structural Equation Modeling is among the most suitable method to analyze several equations as defined in the POEM for SND framework. Moreover, in this study, it is considered as a further enhancement of a range of statistical analysis methods used including descriptive analysis, cross-tabulation and Multiple Regression/ANOVA. Structural Equation Modeling is among the more robust statistical techniques (Lamb, Mengersen, Stewart, Attanayake, & Siciliano, 2014; Nusair & Hua, 2010) which can employ to analyze a multifarious correlation concerning numerous independent variables against one or more dependent variables (Zainudin, 2012, 2014).

The application of Structural Equation Modeling method in this study is suitable as the study implicated analyzes of the causal correlation among several independent variables (Climate, Energy & Water, Environment & Ecology, Community Planning & Design, Transportation & Connectivity, Building & Resources and Business & Innovation) and dependent variables (SDP Adaptation) for Phase 2 Analysis, meanwhile the causal correlation among several independent variables (Environment Dimension, Social Dimension and Economic Dimension) and dependent variables (POEM for SND) for Phase 3 Analysis. Zainudin (2012, 2014) stressed that Structural Equation Modeling is an effective and efficient means to measure the causal correlation among latent construct and the observed variables. Thus, for that justification, the Structural Equation Modeling is an appropriate method in analyzing both Phases of study dataset.

Confirmatory Factor Analysis (CFA)

Hair *et al*. (2009) suggest that two stages are needed to execute Structural Equation Modeling: the first stage is to validate the measurement path model and the second stage is to validate the full structural model. A measurement path model is representing

hypotheses about relationships among indicators and factors which can be assessed using Confirmatory Factor Analysis (CFA) technique (Kline, 2011). As stated by Schumaker and Lomax (2004), CFA is employed in determining the sufficiency of the measurement path model. Brown (2012,) point out that CFA was the powerful later improvements (around the past 30 years or so) within factor-analytic convention that devised a computational common case of which factor analysis as well as canonical correlation analysis stance as instances. CFA is to analyze the models of inter-relationship between several latent constructs (Raykov & Marcoulides, 2006) and to validate the correlation among observed and unobserved variables (Diana, 2014). Raykov & Marcoulides (2006) further added that the particular directional correlations are assumed among the constructs, only that the constructs are hypothetically correlated between one to another. This method also can be regard as a means to achieve appropriate CFA model fit (Muala, 2010).

CFA has been employed to this study, as it concerns a validation of the established assumed theory and the new study items constructed parallel with the intention of the study and hypotheses testing in SEM. CFA consist of four level of processes: (1) outlining the specific construct, (2) establishing the measurement model, (3) proposing a research to yield empirical outcomes, and (4) evaluating the measurement path model validity (Zainudin, 2012, 2014). Thus, several appropriate measurements for Confirmatory Factor Analysis have been used, which are unidimensionality and the assessment of validity and reliability.

Unidimensionality

Hair *et al*. (2010) stated that unidimensionality is reliability calculation of an underlying assumption and is explained when the statistics of a construct develop adequate fit on a solitary-factor or one (1) dimensional) model. Unidimensionality is a substantial countenance of a evaluating and clarifying an overall score of the instrument (Forkmann, Gauggel, Spangenberg, Brähler, & Glaesmer, 2013; Denehy *et al*., 2013). The function of unidimensionality is to verify whether a group of indicators allots only a specific construct (Bagozzi & Yi, 2011). CFA is a means to ascertain the unidimensionality of the measures (Gerbing & Anderson, 1988). Zainudin (2012, 2014) stressed that unidimensionality can be achieved if the measured items obtain passable

factor loadings for the specific latent construct. Measuring the unidimensionality is needed preceding to progress reliability and validity of designated construct (Hair *et al*., 2009). Unidimensionality can be attained within several measurements, and these comprise the goodness of fit indices, standardized residuals and modification indices produced by AMOS software.

Validity

Validity is referring as the capability of instrument to measure what it supposed to be measured for a construct (Zainudin, 2012, 2014). Generally, there are three types of validity that are required for a measurement model, for instance, Convergent Validity, Construct Validity and Discriminant Validity (Zainudin, 2014).

Convergent Validity

The adequacy of the measurement model was also tested for Convergent Validity to measure the overall fit. As stated in Hair *et al*., (2010) Convergent Validity is the degree to which items serving as indicators of a specific construct should converge or share a high proportion of variance in common. Kim *et al*. (2009, p. 56) state that Convergent Validity exists when the research proposed scale items for the same construct are correlated strongly with significance. In other words, Convergent Validity is used to refer to a measure that similar concepts are in agreement (Dong, Cheng, & Wu, 2014). According to (Hair *et al*., 2009) Zikmund *et al*. (2013, p. 305) Convergent Validity requires that the concept that should be related, is indeed related. Zainudin (2012, 2014) adds to achieve the Convergent Validity all items in a measurement model are statistically significant. Hair *et al*. (2009) posit that item reliability; Composite Reliability and Average Variance Extracted (AVE) are the means of determining the Convergent Validity of a measurement model. Convergent Validity is achieved when the value of Average Variance Extracted is greater or equal to 0.5 (Zainudin, 2012, 2014).

Construct Validity

Construct Validity indicates that the instrument used in study measure the construct that is intended to measure (Alumran, Hou, Sun, Yousef, & Hurst, 2014). In order to achieve

construct validity, several fitness indexes must be achieve to the required level, this includes; GFI= 0.90 or higher, CFI = 0.90 or higher, RMSEA = 0.08 or less, and the ratio of Chisq/df / Normed Chi Square is less than 5.0 (Zainudin, 2012, 2014).

Discriminant Validity

As stated by Zikmund *et al*. (2013), Discriminant Validity exemplifies the distinctiveness or uniqueness of the measure; a measure supposed to not too highly correlate among a measure of a distinctive construct. Kim *et al*. (2009) stressed out that the verification of Discriminant Validity is showed when theoretically different constructs are less correlated between themselves. This suggests that the levels of the measure items are adequately differentiated among themselves. As stated by Zainudin (2012, 2014), in achieving the Discriminant Validity the measurement path model should be off from redundant measure items. Few methods can be used to attain the Discriminant Validity, which include omitting either one of the redundant measure items as generated in Modification Indices (MI) in AMOS output results and to set the interrelated pair-set as a free parameter assessments (Zainudin, 2012, 2014).

Reliability

Zainudin (2012) refers the reliability as the degree of how reliable is the measurement model in measuring the intended latent construct. There are three assessments for reliability of a measurement model; these include Internal Reliability, Construct Reliability, and Average Variance Extracted.

Internal Reliability

As suggested by Norton (1978), the Internal Reliability is an outcome from a reliability test of the number of items and the range of the scale used. It is a way of gauging if an item in a questionnaire is reliable (Fitzsimmons, Wheelwright, & Johnson, 2012) and is used to measure the connection or correlation of the items of the scale (Klein, Dumpe, Katz, & Bena, 2010). Internal Reliability is achieved when the Cronbach's Alpha (α) value is 0.6 or higher (Hair *et al*., 1998), an indication of acceptable validity. However, an Alpha value of 0.70 to 0.90 shows a sufficient value for reliability (DeVellis, 2012; Nunnaly & Bernstein, 1994; Streiner & Norman, 2008).

Assessing the Model FIT

To appraise whether the study model is fit or otherwise, a goodness-of-fit indices were used in employing Confirmatory Factor Analysis. As affirmed by Hair *et al*. (2006), the goodness-of-fit is "the level to which the definite or observed entered matrix (covariance or correlations) is projected by the assessed model". Furthermore, reasoning to the statement that goodness-of-fit has been reviewed by many scholars, it has derived to an enhancements and improvements from the original model (Hair *et al*., 2006). Goodness-of-fit indices is normally represented thru chi-square test ($\chi 2$), goodness-of-fit index (GFI) and adjusted goodness-of-fit index (AGFI), standardized root mean square residual (SRMR) and the root mean error of approximation (RMSEA) (Hair *et al*., 2006). Moreover, Kline (2011) recommended that goodness-of-fit index (GFI), Normed Fit Index (NFI), Comparative Fit Index (CFI), Non-Normed Fir Index (NNFI) and Standardized Root Mean Square Residual (SRMR) as the determine to distinguish the fit of the studied model.

Based on several of researchers (Hair *et al*., 2006; Holmes-Smith, Coote, & Cunningham, 2006; Hu & Bentler, 1999; Kline, 2011; Zainudin, 2012) recommend the application of three types goodness-of-fit measures: the first is absolute-fit index that measures the overall model, without any adjustment, the second is incremental fit type which evaluated the proposed study model with other model developed by other researcher, and the last is parsimonious assesses which modify the assess of fit in order to show an evaluation between the models. According to Zainudin (2012, 2014) the indexes which highlighted in bold are suggested since it's were immensely described in literatures. The suitable measurement of model fit for Confirmatory Factor Analysis is illustrated in Table 12.

Absolute Fit Indices

Absolute fit indices allow a comprehensive vital indication concerning the projected model fit (Russo *et al*., 2014). Russo (2014) suggested three index measurements of absolute fit; these comprise the Discrepancy Chi Square (ChiSq), the Root Mean Square of Error Approximation (RMSEA) and the Goodness-of-fit index (GFI).

As stated by Bollen (1989) chi-square ($\chi 2$) is deemed as one of the utmost fundamental

measure to conclude the inclusive fit of the model scope (Bollen & Long, 1993) and it is profoundly subjects by the quantity of sampling (Zopiatis, Constanti, & Theocharous, 2014; Chen, Lin, Chen, & Liu, 2014; Sarabia-Sánchez, Rodríguez-Sánchez, & Hyder, 2014; Filo, Roberts, Reid, Schroeder, & Norris, 2013; Nunkoo *et al*., 2013; Pearl, French, Dumas, Moreland, & Prinz, 2012; Chen, King, & Funk, 2011). However, a several researchers have commented the chi-square test as it is too receptive to the quantity of samples (Deutsch, Yoon, & Goulias, 2013; Roberts *et al*., 2013; Nunkoo *et al*., 2013; Filo *et al*., 2011; Yuksel *et al*., 2010; Petrick & Backman, 2001). Kline (2011) further stressed out that the assess of the chi-square analysis for the majority of study that has larger size sample, should not assume the chi-square analysis of model fit to be insignificant.

Root Mean Square of Error Approximation (RMSEA) is between the important assesses of a model complexity (Davis *et al*., 2007). RMSEA enables the refining of inclination for chi-square to eliminate or reject the specific model, normally with a considerable quantity of samplings (Ramadani, Gunawan, & Jamaliah, 2013). Several researchers have implied diverse threshold value for RMSEA; for example, Browne and Cudeck (1993) recommended values of ≤ 0.05 as a good fit, a values range from 0.05 to 0.08 as an acceptable fit, and values range from 0.08 to 1.00 as an average fit, and the value ≥ 1.0 as not acceptable. Thus, this has shown an agreement with MacCallum and Browne (1993) who proposed that the value of RMSEA lower than 1.0 is deemed as a reasonable fit. Meanwhile, Holmes-Smith *et al*. (2006) suggests that RMSEA must be lower than 0.05 value. While Hu & Bentler (1999) mentioned that threshold value of RMSEA must be lower than 0.06. Whereas, as observed by Hair *et al*. (1998), a value range from .05 to .08 is commonly tolerable.

Goodness-of-Fit indices is a common assessment in statistics (Batsidis, Martin, Pardo, & Zografos, 2014) and is an important component in measuring the Structural Equation Modeling (Bollen, 1989). It is a sum-up of the model implementation (Ritter & Muñoz-Carpena, 2013; Bardsley, 2013; Legates & McCabe, 1999) and to establish model fit (Peck *et al*., 2013; Cetó, O' Mahony, Wang, & Del Valle, 2013; Rovine, & Molenaar, 2012; Constantinou, Panayiotou, Konstantinou, Loutsiou-Ladd, & Kapardis, 2011; Danielsen, Wiium, Wilhelmsen, & Wold, 2010; Liu,). It is also an assessment to verify the total of variance and covariance explained within the model (Byrne, 1989).

Zainudin (2012, 2014) suggested four fitness indexes measurement for incremental fit which are Tucker-Lewis Index (TLI), Adjusted Goodness of Fit (AGFI), Normed Fit Index (NFI) and Comparative Fit Index (CFI).

Incremental Fit Indices

Zainudin (2012, 2014) stated that four fitness indexes measurements for incremental fit which include Tucker-Lewis Index (TLI), Adjusted Goodness of Fit (AGFI), Normed Fit Index (NFI) and Comparative Fit Index (CFI).

Tucker-Lewis Index (TLI) was established by Tucker and Lewis (1973). The suggested level for Tucker-Lewis Index is 0.90 or above (Zainudin, 2012, 2014; Hair *et al*., 2009).

Adjusted Goodness-of-Fit Index (AGFI) was developed by Jöreskog and Sörbom (1989), it is meant to alter for a bias resulting of model complexity (Schermelleh-Engel, Moosbrugger, & Müller, 2003). The acceptance level for Adjusted Goodness-of-Fit Index must be above 0.90, and as suggested by Zainudin (2012, 2014), AGFI value above 0.95 is signified a good fit.

According to Gerbing and Anderson (1992) comparative fit index (CFI) is the implied index of general fit. CFI is the most described fit index for Structural Equation Modeling study (Schaupp & Belanger, 2006; Gerbing & Anderson, 1992). The threshold value of CFI should be above 0.90 (Gefen *et al*., 2000), while CFI value ≥ 0.95 verified a high significant fit (Zainudin, 2012, 2014; Gefen *et al*., 2000). Zainudin (2012, 2014) stated that describing on Comparative Fit Index (CFI) for incremental fit is commonly reported in published articles and literatures.

Bentler (1990) described that Normed Fit Index (NI) is a generic in incremental fit. NFI is a robust fit measurer which capable to reveals comparison among the model and the null model (Booth-Butterfield & Booth-Butterfield, 1993). The suggested threshold level of Normed Fit Index is at 0.90 (Zainudin, 2012, 2014; Hair *et al*., 2009; Bentler & Bonnet, 1980) and 0.95 is deemed as an appropriate fit (Zainudin, 2012, 2014) and 1.0 is an excellent fit (Hair *et al*., 2009).

Parsimonious Fit Indices

Parsimonious fit indexes assess the goodness-of-fit which signify the level of model fit for all estimated coefficient (Yu & Hsu, 2012). As stated by Zainudin (2012, 2014)

normed chi-square (Normed Chi Square) or ChiSq/df fulfils as the index for parsimonious fit. Normed chi-square (Normed Chi Square) or ChiSq/df is the index of chi-square allotted by level of freedom (χ / df) (Kline, 2011). The ChiSq/df is applied to verify the level to which the hypothesized measurement path model methodically fit the sampling (Hair *et al*., 2009). Zainudin (2012, 2014) imply the value of normed chi-square should be lower than 5.0 value, while value below than 3.0 signifies a acceptable fit (Segars & Grover, 1993), 1.0 value denotes the model is above fitted (Jöreskog, 1969).

Table 12: Fitness indexes category and the level of acceptance.
Source: Zainudin, 2012

Name of Category	Name of Index	Level of Acceptance	Comment
1. **Absolute fit**	Chisq P-value (x^2)	P > 0.05	Sensitive to sample size >200
	Root Mean Square Error of Approximation (**RMSEA**)	RMSEA < 0.08	Range 0.05 to 0.10 acceptable
	Goodness-of-Fit (**GFI**)	GFI > 0.90	GFI = 0.95 is a good fit
2. **Incremental fit**	Adjusted Goodness-of-Fit (AGFI)	AGFI > 0.90	AGFI = 0.95 is a good fit
	Comparative Fit Index (**CFI**)	CFI > 0.90	CFI = 0.95 is a good fit
	Tucker-Lewis Index (TLI)	TLI > 0.90	TLI = 0.95 is a good fit
	Normed Fit Index (NFI)	NFI > 0.90	NFI = 0.95 is a good fit
3. **Parsimonious fit**	**Chisq/df**	Chi square/ df< 5.0	The value should be below 5.0

3.7 Summary of Research Methodology

Sustainable development as defined in Our Common Future of 1987 Brundtland Commission report are the; “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Wced 1987). It means we need to know what to stay sustain, how to gauge sustain and how to managed sustain. Hence, we need to measure the sustain ‘ness’ of what we experienced so far and so forth. To answer all these questions, a scientific research need to be conducted and it should be a successful one

The success of research depending on the proper and suitable research method adopted in the studies. Thus, the accomplished research aims and objectives required right

selection of research procedure within scope parameter. Since it is a Stakeholders-Inclusion Approach and with a case studies of existing real context situation, a most comprehensive feedback is required to fulfil this objective. Research design and strategy is devised according to the most suitable manner. Pertaining to this, a six tier research strategy is being lay-out in order to reach the desired outcomes. The research process will consist of content analysis, semi-structured interviews and surveys with an experts and stakeholders surveys analysis will be used to compute and analyze the data and; finally on-site end-user/household surveys will be conducted in order to validate and appraise the workability of the POEM.

The present chapter has discussed the research methods used in this study: research design, population sampling, research instruments, pilot study, data collection, data analysis, and Structural Equation Modeling have all been covered. Furthermore, the discussion of basic statistical analysis by using SPSS software was discussed, along with the analysis of Structural Equation Modeling (SEM) which includes tests for unidimensionality, goodness-of-fit, and convergent and Discriminant Validity of the research findings. This particular segment offers a justification for the quantitative method employed in this research. The final output of this study is POEM Handbook for further validation and applicability of POEM in assessing post-occupancy evaluation of sustainable urban neighborhood development.

CHAPTER 4:

THE CASE STUDIES

4.1 Introduction

The purpose of this chapter is to give a comprehensive review of the selected case studies in Greater KL, Malaysia.

4.2 The Case Studies: GBI Certified Neighborhood.

4.2.1 Case Study 1: Ken Rimba Development

Ken Rimba neighborhood is a township development masterpiece developed by Ken Holdings Limited under its' subsidiary wings, Ken Rimba Private Limited. As the first Malaysia Multiple Award Winner of Green Developer, Ken Holdings has a vast construction development industry experience for more than 33 years. Currently, Ken Holdings Group has completed over 700 million (RM) worth of construction and engineering projects and over 1 billion (RM) worth of property development projects.

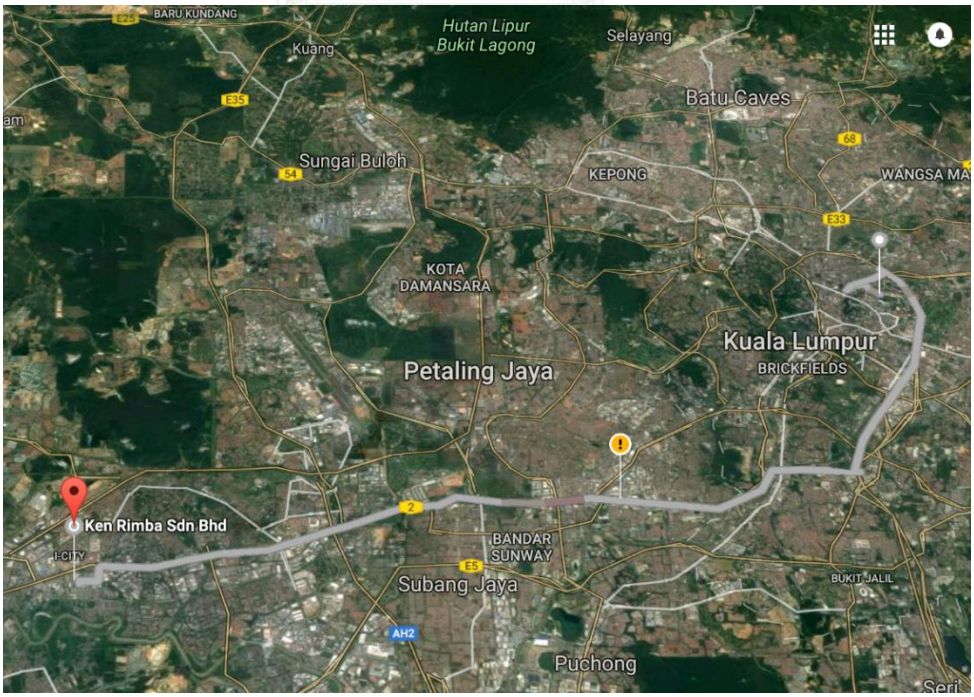


Figure33: Google Earth map of Ken Rimba location in Klang Valley.

Source: Google earth map, accessed on 2017

Ken Rimba neighborhood development theme is ‘the promise of beauty, luxury, nature’. It is an integrated neighborhood / township development in the prime vicinity of Shah Alam within Klang Valley or Greater Kuala Lumpur. This premium urban neighborhood township development comprises of Ken Rimba Commercial Centre, Ken Rimba Legian neighborhood residences, Ken Rimba Jimbaran neighborhood residences and 2 phases of Ken Rimba Condominium developments. Ken Rimba neighborhood township development plot spread across 60 acres of a freehold tenure ship prime land that traps all the luxury and exclusivity. It is also the first green township in Malaysia that has revolutionized the land-use changed of an industrial area into landscape paradise-like neighborhood enclave in Shah Alam.

Figure34: Entrance gateway to Ken Rimba Development.

Source: Ken Rimba, 2012

Ken Rimba Development Sustainable Features and Facilities

Ken Rimba development neighborhood layout planning applied passive design principle. Most of the built units in Jimbaran and Legian residences are facing to the north-south orientation in order to avoid direct gained solar heat but yet capturing effective cross air-flow ventilation and abundance natural daylighting. The neighborhood residences are designed with environmental friendly features that promoted high efficiency in energy, natural daylighting and air-flow ventilation.

The neighborhood units are innovatively designed with lofty ceilings and an atrium skylight for better internal space day lit illumination. Other interesting but yet practical features are ‘Australian’ louvered windows which allow controllable continuous air flow cross the internal space. The units also come with patented breath-able roof systems for trap heat to be discharged efficiently. The external coat finishing of the units are finished with low VOC and heat reflective paint for keeping the good internal thermal comfort. The neighborhood residences are also provided with strategically located rain water harvesting tanks and efficient water fixtures with sub-meter system for closed water usage monitoring.

Figure35: Linear gardens at Ken Rimba neighborhood.
Source: Ken Rimba, 2012

Ken Rimba terraced residences are designed with side paths and distinctive linear greens for an aesthetically appealing neighborhood environment. Other sustainable but yet attractive facilities offered by this exclusive neighborhood enclave are the provision of neighborhood community bicycles for residents’ use and kids’ playground with adult exercise equipment station. The neighborhood is planned with lush greenery ambiances, tree lined boulevards and paved walkways make Ken Rimba development as an ideal surroundings for great community living and healthy lifestyles.

Figure36: Community bicycles.
Source: Ken Rimba, 2012

Ken Rimba neighborhood is surrounded by numerous conveniences and amenities which include an array of commercial centers, shopping retreats and business hubs. Well known centers spots within neighborhood vicinity are Giant, Tesco and AEON Big Hypermarket. Public schools and higher learning institutions surrounding this neighborhood are SJK (C) Taman Rashna, SEGi University College and Universiti Teknologi MARA.

Ken Rimba neighborhood development is accessible easily using various motorways. The most common expressway to Ken Rimba neighborhood are the Federal Highway, Kota Kemuning – Shah Alam Highway, North Klang Valley Expressway, Selat Klang Highway and North – South Central Link Highway. Ken Rimba neighborhood development is only 20 – 25 minutes' drive from Kuala Lumpur city center and 10 – 15 minutes' drive to other established neighborhoods of Subang Jaya and Petaling Jaya.

Ken Rimba Commercial Centre

Ken Rimba Commercial Centre is partial of greater Ken Rimba neighborhood township development. It has been recognized for its design philosophy that integrates green initiatives development. Ken Rimba Commercial Centre was awarded with Provisional Green Mark Certified certification from Building and Construction Authority (BCA) Singapore. As a picture-perfect neighborhood and township development commercial

center, its offer premium commercial plot with high business potential.

The commercial center consist of 109 units of 2 story and 3 story shop lots ranging from 1,800 to 2,800 square feet in floor area. The shop lots are designed with naturally ventilated common areas, a well-defined lots to boost optimum business activities and ease of indoor movement. Ken Rimba Commercial Centre is also provided recycling facilities with equipped designated recycle bins. The center also promote healthy living environment by introducing lush greenery and improve air quality by using low VOC paint finishes in its building. Other sustainable feature are disabled parking lot and accessible ramp for universal access.

Figure37: Ken Rimba Commercial Center.

Source: Ken Rimba, 2012

Ken Rimba Legian Residences

Ken Rimba Legian residences is made of a spacious two-story terraced units that measuring from 1,800 square feet to 2,200 square feet. The corner units' residences are built with swimming pools and unique internal garden for expressing natural aesthetics.

Ken Rimba Legian residences are neighborhood development that comprising of 328 terraced home units in the city of Shah Alam. It's demonstrated that environmentally sound practice during construction is not only restricted to high cost luxury property developments.

Ken Rimba Legian residences applied policy on waste management during its construction phase. A comprehensive waste management policy was implemented and communicated to on-site workers during the phase. The on-site waste material was basically divided to three management categories. first category is re-use of waste materials of waste concrete is crushed and was re-used as hardcore for paving the pavement and waste concrete that was re-used as a temporary access road. The second policy is recycle where waste material which is recyclable like steel re-bars was sent to recycling facilities. The third policy is landfill, whereby any waste material which was not fit the reuse and recycle policy will be sent to landfill for disposal.

One of the key point that bagged Ken Rimba Legian residences an award from Green Building Index (GBI) Malaysia certification is the implementation of sustainable design and construction of medium priced homes. The Ken Rimba Legian neighborhood is a good example of environmentally viable, desirable and affordable residences where it also recipient of Green Mark Gold Award from Singapore Building and Construction Authority (BCA Singapore). These two prestigious awards are the testament of Malaysia's first truly green neighborhood/township.

Figure38: Ken Rimba Legian units.

Source: Ken Rimba, 2012

KEN Rimba Jimbaran Residences

Ken Rimba Jimbaran is a high-end residence development within Ken Rimba neighborhood that presents top-notch quality landed terrace homes. The Jimbaran residences was awarded with Provisional GreenRE Gold Award and Singapore BCA Green Mark Gold Plus Award. It consist of 168 home units that feature generous floor built-up area measuring from 2,300 square feet to 2,600 square feet. This measured built-up area is considered a luxury space as it was located in prime urban development plot. Sustainable highlights of Jimbaran residences are solar PV water heater and

elongated passive designed floor layout for efficient cross ventilation. Besides, Jimbaran residences received ample natural daylighting through skylight, hence, reduced excessive energy for artificial lighting. It also equipped with indoor landscape areas which suggest and encourage dwellers in incorporating garden's greenery within their dwellings.

Figure39: Ken Rimba Jimbaran residences.

Source: Ken Rimba, 2012

Jimbaran residence features built materials and fitting selected with sustainable design in mind. The conception of green lifestyle is an evident aspect of the buildings, from layout planning, design elements, used materials and finishing finishes are of sustainable concerned. An elongated floor layout with fenestration windows of opposite walls and adjustable 'Australian' louvered panels boast control-able cross air ventilation. It's naturally cooling down the occupied spaces when air conditioning system are not in used. All Jimbaran residences are also equipped with rated efficient water fixtures and fitting by Water Efficiency Labeling Scheme (WELS) of Singapore. The features are targeted to save water usage at approximately by 37%. Besides, the neighborhood units are also provided with rain water harvesting tanks where the collected water can be used for routines such as garden irrigation and porch's car washing. The neighborhood is also connected to nearby KTM Padang Jawa Commuter Station with a covered pedestrian walkways.

Ken Rimba Condominiums.

The vertical living of Ken Rimba neighborhood are designed distinctively with north-south façade orientation in order to capitalize excellent ventilation and to enhance better indoor thermal comfort. Ken Rimba Condominiums is still under construction and expected to be completed by 2018. It is developed in to two phases. Phase 1 condominiums comprises of total 679 living units and Phase 2 comprises of 2,240 living units. The living units of Ken Rimba condominiums floor area measured from minimum 1,000 square feet with varieties ranging from standard living units, penthouse living units and villa living units. Both phases of condominiums are aiming for GreenRE Gold Award and BCA Green Mark Gold Plus Award of Singapore.

Figure40: Ken Rimba Condominiums.

Source: Ken Rimba, 2012

Ken Rimba condominium is an eco-friendly rated green neighborhood development with 24 hours security and safety surveillance, systematic rain water harvesting features and low VOC painting finishes. It's also offered wide array of condominium facilities such as swimming pool, leisure viewing decks, squash sports courts, health fitness facilities and manicured greenery landscapes.

4.2.2 Case Study 2: Bandar Rimbayu Development

Bandar Rimbayu development is a premium project that inspired from nostalgia time where simple life and people are living close to nature, in a supportive and safe neighborhood / township. The development setting is a serene and tranquil surrounding of 1,879 acre site plot. The total development will take 25 years to complete. Bandar Rimbayu development is set to be an iconic mixed neighborhood development composed of integrated residential area, commercial hub, recreational centre and parkland. The total value of gross development is RM11 billion.

Figure41: The ARC at Bandar Rimbayu.
Source: IJM Development, 2016

The development components of Bandar Rimbayu spread throughout four precincts, namely Bayu, Fauna, Flora and Commercial Hub. The Flora precinct is a mixed neighborhood components of residential, schools and recreational facilities. The residential components is a strata homes, link homes, apartments and condominiums. Prominent feature in this precinct is THE ARC, located at the heart of Bandar Rimbayu. It served as a recreational amenities, social gathering main venue and the icon landmark of Rimbayu. The second precinct is Fauna, an integrated components of residences,

schools and shop lots. The residences in this precinct are link home and bungalow units. The third precinct is Bayu neighborhood, a vast 280 acre lakeside area transformed as a high-end waterfront residences development. The Bayu precincts is a scenic view of unending waterfront vistas, a residences along or by lakesides. The fourth precinct is a Commercial Hub, a business center within canal neighborhood charm. This precinct development is a dynamic hub with cul de sac and pathways dispersing into neighborhood squares. The place of alfresco café which provide lively venues of meeting point, coffee breaks and people sightings. This precinct also will house a serviced apartments, shopping malls, private educational institution and medical centers' in the future.

Figure42: Aerial View of Bandar Rimbayu development.
Source: IJM Development, 2016

Bandar Rimbayu situated next to Kota Kemuning in Shah Alam district. Its strategic location is within easy accessibility via five major expressway to Kuala Lumpur City Centre, and to other Klang Valley established neighborhood such as Shah Alam, Klang, Puchong, Subang Jaya and Petaling Jaya. Major expressways connectivity from Bandar Rimbayu are via five highways; KESAS Highways (Lebuhraya Shah Alam) and LKSA Highways (Lebuhraya Kemuning Shah Alam) connect Bandar Rimbayu to Kuala Lumpur and many other major city in Klang Valley; SKVE Expressway (Lebuhraya Selatan Lembah Klang) links Bandar Rimbayu to Cyberjaya, Putrajaya and Kajang.

ELITE Expressway (Lebuhraya Lingkaran Tengah) connects Bandar Rimbayu to Kuala Lumpur International Airport and Southern Region of Peninsular Malaysia and future proposed WCE Expressway (Lebuhraya Pantai Barat) will link Bandar Rimbayu to Banting and Northern Region of Peninsular Malaysia. Besides vehicular transportation connectivity, Bandar Rimbayu also provided with seamless linkages within the neighborhood itself. It's equipped with designated cycling tracks and pedestrian walkways for ease of connection between four precincts. Bandar Rimbayu also excellent in online connectivity with high speed broadband.

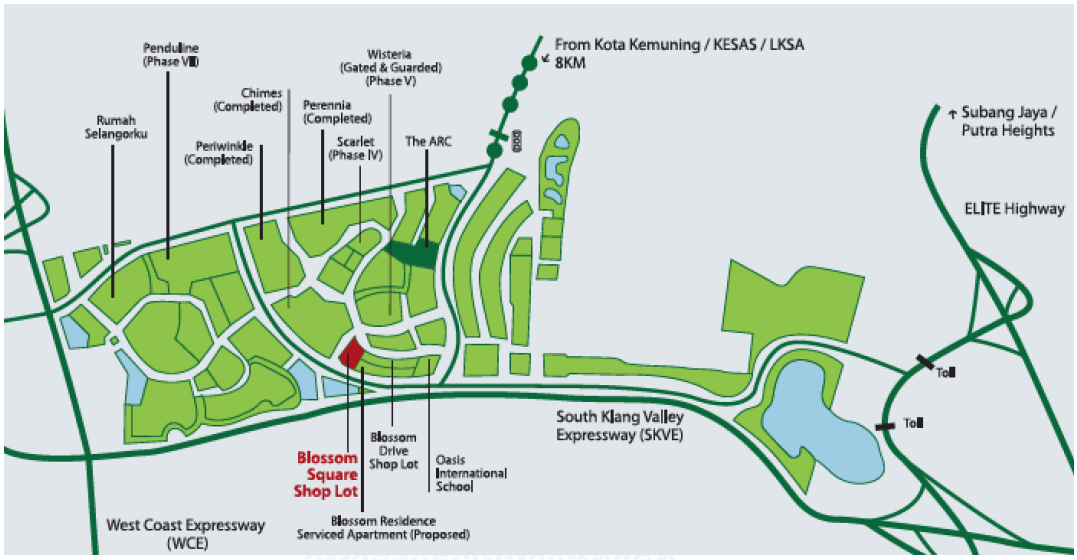


Figure43: Access Map of Bandar Rimbayu development via expressways.
Source: IJM Development, 2016

Bandar Rimbayu Development Sustainable Features and Facilities

In all Bandar Rimbayu four precincts development, sustainable concept is highly valued. Master planning and design is to attain and maintain natural terrain and topography of the existing site. The neighborhood setting very much bringing the nature into daily living. Bandar Rimbayu commitment is to relatively sustain the natural surroundings and habitat remain untouched, so that residents wake up to bird songs, enjoy natures walk and cycling within indigenous flora.

The fully completed and near future development of Bandar Rimbayu use sustainable elements and neighborhood design that promote sustainable solutions. The development applied sisilation coated roofs to reduce heat island effect, rain water

harvesting system in selected buildings, solar PV panels to minimize electricity consumption and abundance of green-scapes to regenerate fresh air. Bandar Rimbayu neighborhood also created with numerous canals and creeks to further cool down the surroundings with added scenic allure. Environment sustainability and sensitivity is the influential guiding principle in Bandar Rimbayu development, THE ARC & Sales Gallery was planted with more than 50,000 species of trees, shrubs, garden's flower, herbs, climbers and aquatic plants. With active greening commitment in this neighborhood development, the developer; IJM Land Limited has acquired the certification of GBI Green Township from GBI Malaysia.

Bandar Rimbayu neighborhood are well equipped with security and safety measures. The neighborhood are designed with guided principle of 'Crime Prevention Through environmental Design' (CPTED) (Ju et al., 2011). CPTED is a 'defensible space' design solutions that make safer surroundings for the neighborhood community. The neighborhood have a smaller cluster residences arrangements, distinction territorial fencing, well lighted pathways, dedicated security and entry checkpoints, card access are convincing preventions against unwanted intruders. Neighborhood traffic calming solutions via integrated roadways hierarchy, cul de sac, humps and pedestrian pathways is to control traffic speed flow, walker by safety and low traffic. All these deterrent, protective measure is to ensure neighborhood safety where children can play and run freely outdoor. Bandar Rimbayu residences is a private and precious neighborhood that admires the environment and allow communities to enrich neighborhood style of living.

THE ARC of Bandar Rimbayu

Figure44: Elevated landscape, THE ARC at Bandar Rimbayu.
Source: Steven Ngu & Andy Lim, 2016

Figure45: The water body, THE ARC at Bandar Rimbayu.
Source: Steven Ngu & Andy Lim, 2016

THE ARC is designed to respond to the environment, principally in addressing the tropical climate conditions of the received sunlight, heat gain, and humidity level and

rain precipitation. As such, it is formed of a lofty and broad covered gradual walkway which also act as a shelter for intended communal events. THE ARC is metaphorically is a built intervention that demarcated the act of iconic green place identity making for the neighborhood and community. Whereas functionally, it is a shelter and collective public domain for variety of communities facilities.

Figure46: The Sale Office, THE ARC at Bandar Rimbayu.
Source: Steven Ngu & Andy Lim, 2016

THE ARC served as canal garden surrounds, compartment landscaped terraces in between sales gallery buildings and elevated roof deck parkland for any range of community activities. The covered landscaped canopy walk path with green elevated

roof deck connected pedestrian pave way to the building complex at ground and upper level. It's also equipped with landscaped forecourt parking, community area, multi-purpose hall, shop units, washroom and praying area. Besides, it also have sport's field and multiple playgrounds for any groups of age.

Figure47: The elevated play area, THE ARC at Bandar Rimbayu.
Source: Steven Ngu & Andy Lim, 2016

THE ARC is an integrated solutions and innovations in sustainable passive design. Its responsive to climate condition, variety in function, and adaptability. Its encourage and engage the community with social activities and communal amenities. The sustainable approaches is considered holistically. Beyond physical building sustainably, THE ARC is equally important in long term sustainable perspective, it built community sustainability awareness through its initiatives programs, community events and

experiential learning. It is to achieve sustainable way of life, culture and attitude of towards the people in the community.

Figure48: The Koi pond and timber deck, THE ARC at Bandar Rimbayu.
Source: Steven Ngu & Andy Lim, 2016

Chimes Residences

Chimes residences at Bandar Rimbayu development is a precious and private enclaved that appreciates the environment and enrich neighborhood lifestyle. It is developed in more than 56 acres of land plot with 526 units in total. Chimes residences consist of two different size types of twin story homes measuring 22 feet x 75 feet and 24 feet x 75 feet. These residence units are divided into smaller clusters which encourages residents to live in close knit sub-community that concern for each other. The Chimes residences accessibility planning allows only single entry and exit point via the Green Entrance gateway designed with wind chimes features and green vertical landscape.

Figure49: Chimes Residence Green Entrance Gateway and outdoor garden.
Source: IJM Development, 2016

Chimes residences is planned with garden, parks and landscaped walkways that are bound to stimulate green neighborhood. Community can make use of the outdoor open area to organize community activities. For a more active lifestyle, the linear pathways can be a track for a brisk walking, running or exercising for a healthier community living. Toddlers and youngster can also play and make use of the playground and multipurpose court in a controlled and safe neighborhood.

Chimes residences layout are planned in a north-south orientation to minimize direct exposure to sunlight, thus increases the thermal comfort of the interiors. The interior space is also designed with high ceiling for better air circulation in the space and the sky lighted staircase make available of sufficient natural day light into the house. Chimes residences use green features that helps to reduce minimum wastage. All en-suite bathroom is fitted with dual flushing water closet, solar PV heated water and rainwater harvesting system for outdoor and gardening usage.

Perennia Residences

Perennia residences is characterized by its contemporary colonial frontage and an internal courtyard. Perennia residences consist of 484 units. It is made up of double-story link units measuring 22 feet x 80 feet and 24 feet x 80 feet. Sustainable concept of Perennia is to embrace the sun, wind and rain, a life balance in a neighborhood that allows residents to enjoy sunny, breezy days and revel in the freedom to move around and yet at the same time to keep wastage at minimum. Perennia residences green design features are open planning and high volume space for an airier spatial sense of internal space. Indoor air-well and skylight courtyard improves air ventilation and gives natural day lighting. The units also come with rain water harvesting tank system for outdoor water usage and solar PV panel water heating system in all bathrooms. The neighborhood is also planned with lush greenery and landscaped streets for outdoor activities.

Figure50: Perennia Residence landscaped area and playground.

Source: IJM Development, 2016

Penduline Residences

Penduline residences is a collection of two story link home units that are designed with pre-conceived mind of several of families' sizes and kinds. Total development area for Penduline neighborhood is 8.4 acres comprising a centralized park, pocket green areas,

a football field, a multipurpose sports court and a futsal yard. Penduline residences home total is 246 units. The well planned floor layouts is to ensure that each member of family will have a comfortable and private place of their own. It is cozy and practical in layout with dedicated entry and exit point to the neighborhood.

Figure51: Penduline Residence Boulevard.
Source: IJM Development, 2016

Penduline homes land area measure at 20 feet X 70 feet with built up area from 1,771 square feet to 2,283 square feet. It is passive design orientation at north-south setting in order to capitalize wind flow and to prevent direct sunlight penetration. Penduline residences green feature include high ceilings to provide better internal space air ventilation and large opening panes to bring the external natural surrounding sights and abundance daylight into the interior spaces. This is to bring in nature into a living space.

Figure52: Penduline Residence frontage.

Source: IJM Development, 2016

Commercial Hub

Blossom Drive and Blossom Square is commercial center within the golden location of Bandar Rimbayu development. The development are beside the proposed serviced apartments and an international school. The Commercial Hub is an intensifying catchment developing area as Bandar Rimbayu neighborhood will be 12,000 projected households once the development is fully completed in near future. This hub is the first commercial development in Bandar Rimbayu. It's consist of Blossom Drive, made of 48 units of two and three story shop lots and Blossom Square consists of 88 units of also two and three story shop-offices with land built areas of 22 feet X 70 feet and 22 feet X 75 feet respectively. The Commercial Hub also consist of vertical residences of Blossom Service Apartment which comprises of three varies floor area measured at 872 square feet, 921 square feet and 1,055 square feet.

Figure53: Blossom Square Condominiums,
Source: IJM Development, 2016

This commercial and business hub is set to be one of the neighborhood's key thoroughfare with great accessibility and visibility. Blossom Square is connected with an earlier established neighborhood of Bandar Saujana Putra using SKVE Highways (South Klang Valley Expressway) and ELITE Expressway (Lebuhraya Utara Selatan Hubungan Tengah).

Figure54: Blossom Drive Commercial Area.

Source: IJM Development, 2016

4.2.3 Case Study 3: Sunway Resort City

Sunway Resort City development project by Sunway Property Bhd. is the first fully integrated green town development awarded by the Green Building Index (GBI) Malaysia. The whole development spread across over 800 acres of land. Sunway Resort City annual visitation reach over 42 million visitors. This large township is also known as an education hub and homes to an approximate of half million residents within Bandar Sunway and its surrounding vicinity.

Figure55: The Sunway Lagoon Theme Park at Sunway Resort City.
Source: Sunway Group, 2015

The city is a transformation from 800 acres of quiet dilapidated tin mining area, Sunway Resort City has progressed into a busy and booming township comprising of landed homes, condominiums, office towers, Sunway Resort Hotel & Spa and Sunway Pyramid Convention Centre. The convention centers is one of the largest in Malaysia. Another important development in Sunway Resort City is Sunway Lagoon Multi-theme Park which is the largest man-made surf beach in the world and iconic shopping mall, the Sunway Pyramid with its pyramid and lion's head sphinx landmark. Sunway Resort City also housed a world-class center for healthcare, finest retail and commercial facilities. The total net lettable space in Sunway Resort City is staggering seven million

square feet and make one of the largest concentrated in Klang Valley beside Kuala Lumpur city center.

Figure56: Development Facilities of Sunway Resort City.
Source: Sunway Group, 2015

As one of education hub within Klang Valley. Sunway Resort City or locally known as Bandar Sunway has an approximately 50,000 student's population. This huge student's population stemming from academic institution within the township itself and surrounding neighborhoods. The well-known educational institution within the neighborhood are Sunway University, Taylors University at Lakeside, Monash University Malaysia, Sunway College, Sunway International School and other Public Government Schools.

Sunway Resort City is easily accessible via six major highways which are New Pantai Expressway (NPE), Shah Alam Expressway (SAE), New Klang Valley Expressway (NKVE), North-South Expressway Central Link (ELITE), Damansara-Puchong Expressway (LDP) and Federal Highway. In the form of public transportation, Sunway Resort City pioneer the Malaysia's very first elevated Bus Rapid Transit (BRT) which

was called Sunway Line. This BRT connected Sunway Resort City to Setia Jaya KTM Commuter Station and future USJ 6 LRT Station. There is also free ride shuttle bus provided within the neighborhood of Sunway Resort City. As part of green commitment in the neighborhood, the elevated canopy walk ways was built in connecting Sunway Pyramid, Sunway South Quay, Sunway University, Monash University Malaysia campus and Taylors University at Lakeside.

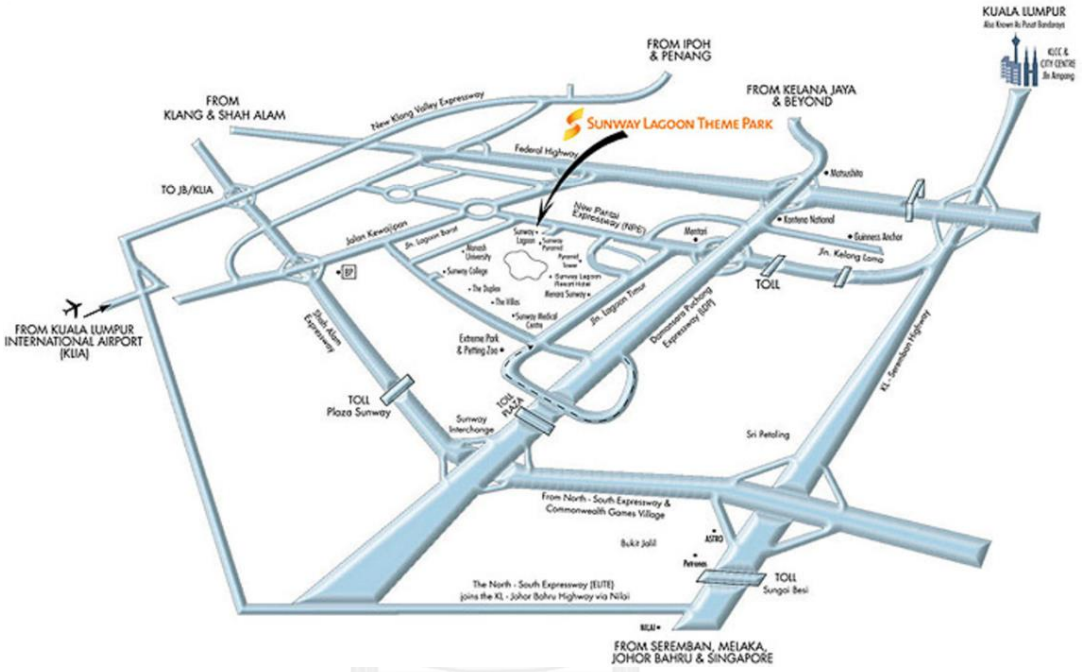


Figure57: Transportation Access to Sunway Resort City and vicinity.
Source: Sunway Group, 2015

Sunway Resort City Sustainable Features and Facilities

Sunway Resort City is the first Certified Green Township and being awarded the Prestigious GBI Green Township Silver Rating by Green Building Index (GBI) Malaysia. To be certified as a green township, GBI Malaysia requires at least 15% of the developed project need to be a greenery. To be recognized as a sustainable township, GBI requires that a minimum 15% of the township be green. Sunway Resort City green area is approximately 30% of its development and surpassed the minimum requirement by twofold. The neighborhood development has been evaluated in six core categories of criteria which is Climate, Energy & Water (CEW), Environmental & Ecology (EEC), Community Planning & Design (CPD), Transportation & Connectivity (TRC), Building & Resources (BRC) and Business & Innovation (BSI).

The green features that specifically achieved by Sunway Resort City according to GBI requirement is lower ambient temperature in surrounding neighborhood environment where by 50% of pedestrian walkways and public spaced are shaded and provision of more than 20% shaded green spaces of total development footprint. The neighborhood also practice water efficiency where more than 20% potable water usage reduction and recycle water system is used for irrigation and other general use. Sunway Resort City also committed to bio-diversity conservation whereby the barren tin mining area was transformed to secondary jungle in Multi-themed Park of Sunway Lagoon and housed 22 species of native birds, 8 frogs' species, small mammals and insects.

Figure58: Aerial View of total development of Bandar Sunway
Source: Sunway Group, 2015

In term of transportation and connectivity, this neighborhood residents can reduce the need to travel by transport as all essential facilities are nearby and within reasonable walk distance. As an established township, Sunway Resort City provided all the conveniences and essentials such as bank, supermarket, convenient/grocery shop, restaurant, hardware store, theatre, beauty salon, fitness center and laundry shops. The neighborhood also have a wide array of public amenities which include police station, library, medical/dental, pharmacy, post office and school. For universal accessibility

the neighborhood provided handicap friendly infrastructure such as disabled parking, access ramp and disabled toilet at public facilities. Pedestrian networks, pathway linkages, open public spaces are also provided with universal accessibility. The pedestrian path network connects to all public transitory hubs such as BRT Stations, LRT Stations and KTM Commuter Stations. 50% of pedestrian's path networks are shaded covered walkway. The neighborhood also committed to reduced transportation carbon emission by promoting the use of public transportation networks, beside elevated BRT system Sunway Resort City provide free ride shuttle buses for residents to travel to major taxi stands and bus stations for transit disperse to other neighborhood in the Klang Valley.

Figure59: BRT Transits in Sunway Resort City.
Source: Sunway Group, 2015

The neighborhood also practice secure design. There is no dark area corner, poor lite pathway, dead-end street in the neighborhood. Besides, there is regular auxiliary police and security officer in patrol and also provision of CCTV on the street. For health in design, there is no industrial pollution in the neighborhood and all discharged waste water from eatery outlet and medical centers is treated properly before it was discharged to main public drainage system. The neighborhood are also provided with recycling practices and facilities. All establishment and business units under Sunway Group for example Sunway Medical Centre, Menara Sunway, Sunway Pyramid mall, Sun U and other business wings implement recycling practice. Sunway Group also practiced yearly recycling program as a form of practice awareness. The neighborhood provides

recycling facilities such as recycling bins are placed in strategic locations, neighborhood recycling center with bin are accessible by garbage collector truck and compactor station. The neighborhood also fostered community thrust. Sunway Group continuously holding active two way dialog with existing neighborhood community within the vicinity to address affected issues related to them. The neighborhood also provided community center to serve the residents.

For sustainable building and resource criteria, Sunway Group developed the neighborhood using up to 70% local and regional building material resources not exceeding or within 500km radius to reduce carbon emission impact via transportation. The sustainable construction management was applied during the construction phase using quality construction system of Qlassic with a stunning score above 70% (Qlassic is an independent quality assessment agency). With more development in near future, the Sunway Group are committed to adopt construction waste management plan. In Innovation criteria, the neighborhood has built an elevated covered walkway for pedestrian to linking all the key area and facilities within the neighborhood. The innovative future plan for the neighborhood is to save 30% of water usage by recycling the lake water for toilets and general usage supply in Sunway Pyramid Shopping Center, Sunway University and other public space within the neighborhood.

Sunway Resort City is obliged for neighborhood security and safety. As part of the Sunway Group effort of safeguarding the neighborhood community 250 Auxiliary Police officers patrols Sunway Resort City round the clock, with an aid of state of the art CCTV system are installed in strategic location around the neighborhood. The group also built the very first State Tourist Police Service Centre in Sunway Pyramid Mall as its continuous efforts to accelerate crime prevention and deterrent efforts in the neighborhood. This State Tourist Police Service Centre functions as a one-stop center to provide quick assistance and solutions for visitors' patronage in Sunway Resort City.

Sunway South Quay

The Sunway Resort City holds an irresistible resort style living in one of its latest development, the Sunway South Quay. This stylish neighborhood located at the south of Sunway Resort City and sprawl across a lavish 178 acres of prime land plot. This

international acclaimed neighborhood includes a variety of residential and commercial developments with a theme of resort living. The developments inside Sunway South Quay neighborhood consist of gated and guarded waterfront garden villa residences and condominiums by lakeside (Figure 60).

Figure60: The Nautiqa, Sunway South Quay.
Source: Sunway Group, 2015

The latest development in this neighborhood is Sunway Geo, an integrated development which include shop-spaces, flexi-suites and residences totaling 2,722 units of property. The gross value of this development is RM2 billion. Sunway Geo neighborhood is a secure and safe development, based on the Sunway Township Safe City initiative which empowered by 500 officers of auxiliary police and 24 hours CCTV surveillance. The neighborhood also recently connected using newly opened Kesas Link that enables trouble-free entry and exit point into Sunway South Quay and the integrated neighborhood. Sunway South Quay is well served by six major highways, directly linked to Sunway South Quay. The township is also linked via elevated pedestrian covered walkways.

The latest development phase in Sunway Geo is the Sunway Geo Residences 3, a leasehold 43 story condominium. The green feature of this vertical living tower is the inclusion of a one-acre green park located in the center of the development. This communal green area featured a swimming pool with rock Jacuzzi and children's wading pool. This offering the residents a communal luxury of a green resort lifestyle in the heart of Sunway Resort City. The communal green park also equipped with indoor kid's gym featured elaborated lush and unique landscape. In terms of community connectivity this neighborhood is conveniently connected to Sunway Geo commercial hub which housed over 200 units of retail outlets and 600 units of office space.

Figure61: Sunway Geo Residences.

Source: Sunway Group, 2015

4.3 Regional Case Study Parinyada Village Bangkok

The development components of Parinyada Village spread throughout three villages, it consisted of two townhouses villages and one single houses village. The main neighborhood development is Parinyada Village which consist of landed bungalows and Village Clubhouse. The prominent built feature in this neighborhood development

is the Village Recreational Clubhouse, located at the heart of Parinyada Village. It functioned as a social meeting main location; recreational facilities and amenities; and the icon landmark of Parinyada Village. The second neighborhood precinct is Parinlak Village is a mixed neighborhood components of townhouses residential, office units, commercial areas and recreational facilities. The third neighborhood precinct is Parinlak Light Village, it consist of integrated components of modern townhouse residences and centralized Clubhouse with dedicated swimming pool and recreational facilities. The total number of households or property unit is 434 units. It consist of Parinyada Village bungalow residences 175 units, Parinlak Village property unit is 135 units and Parinlak Light Village residences is 124 units.

Figure 62: The Gated Entryway at Parinyada Village.
Source: Author

Parinyada Village is situated within Bangkhae district in Bangkok Metropolitan. It's strategic in location where easily accessible through three major expressway to Bangkok City Centre, and to other downtown Bangkok established area such as Sathorn, Pathumwan and Bang Rak. Three major expressways connectivity from Parinyada Village are via Bangkok South Outer Ring Road, Sirat Expressway and Chalerm Maha Nakorn Expressway connect Parinyada Village to downtown Bangkok

and many other major conurbations in Bangkok district; Chalerm Maha Nakorn Expressway and Sirat Expressway connects Pinyarada Village to Suan Luang and Suvarnabhumi International Airport in Ladkrabang. Don Muang Tollway links Pinyarada Village to Chatuchak, Rangsit and Don Muang International Airport and Northen Region of Thailand, and Chalerm Maha Nakorn Expressway will link Pinyarada Village to Samut Prakhan and Southern Region of the Kingdom.

Figure 63: Aerial View of Parinyada Village.

Source: Author

Pre-Occupancy Sustainable Feature of Parinyada Village

Parinyada Village is made up of three precincts development and green features concept is highly adapted in this neighborhood development. The symmetrical layout planning and design is to attain and maintain easy accessibility and security control. The centralized setting of the public facilities and amenities in the neighborhood is very much to enclave social thrust amidst the lavish greenscapes. Parinyada Village

residences is full with considerably matured trees and palms, abundance of shrubs and fountain water feature at every junctions sustain the green surroundings and pleasant vista of the neighborhood. The use of green elements and sustainable neighborhood features promote sustainable solutions. The centralized Clubhouse with dedicated swimming pool and adjoining central green garden enhance the green presence of Parinyada Village. This centralized social and environmental green feature is to reduce heat island effect, rain water retention area instead of storm water slip-off, and abundance of greenscapes to filter and regenerate fresh air to the neighborhood.

Figure 64: The sustainable feature of Parinyada Village.

Source: Author

Parinyada Village neighborhood are well equipped with security and safety measures. The Village is highly secure with gated entry and exit checkpoint at all of its three villages and walking patrolling security officers within the neighborhood. The villages are also equipped with CCTV surveillance for an enhanced security measure. Linear grid planning arrangement along main arterial road circulating the main Clubhouse and adjoining green park create a safer surroundings for the neighborhood community. This

has resultant for a smaller cluster residences arrangements at every main arterial road exits to the residences, distinct fencing perimeter and well illuminated pathways. Neighborhood traffic calming solutions via integrated roadways hierarchy, cul de sac, humps and pedestrian pathways is to control traffic speed flow, walker by safety and low traffic. All these deterrent, protective measure is to ensure neighborhood safety where recreational outdoor activities is conducted.

CHAPTER 5:

POST-OCCUPANCY EVALUATION MODEL FOR SUSTAINABLE NEIGHBORHOOD DEVELOPMENT (POEM for SND)

5.1 POEM Development

5.1.1 Introduction – RO1 & RQ1

This chapter will present the analysis, findings and discussion of the Research Objective 1 (RO1) and Research Question 1 (RQ1):

RO1: To identify and formulate post-occupancy evaluation model (POEM) based on sustainable dimension pillars (SDP) towards sustainable neighborhood development (SND) for Malaysia.

RQ1: How can the Post Occupancy Evaluation Model (POEM) be successfully developed and implemented?

In this research methodology, the Stakeholders-Inclusion Approach is followed for four reasons. The first justification is to investigate expert's views (Phase 1) regarding the significance of the proposed sustainable model for post occupancy evaluation of GBI certified neighborhood in Malaysia and its township / neighborhood assessment criteria and current sustainable urban neighborhood development in Malaysia. This Phase 1 research aims to find out the suitability and possibility of employing of such post occupancy evaluation model. The second justification is to find out key professional stakeholders opinion (Phase 2) regarding the adaptation of sustainable dimension pillars (SDP) in GBI Township Assessment Criteria. Phase 2 research aims is to find out whether the assessment criteria adapted a balanced SDP which later it will be simplified for post occupancy evaluation model for end-users/households.

The third justification is to investigate end-user/household's opinions (Phase 3)

regarding their occupied certified neighborhood based on POEM for sustainable urban neighborhood development. Phase 3 research aims is to find out whether the certified neighborhood is sustainable as per certified vision upon its occupancy. With this rationale, the Stakeholders-Inclusion Approach could be considered a validation tool of the proposed model, as it assesses the feasibility of this framework in terms of its clarity and adequacy in addition to ensuring that the framework is reasonably solid. The research output of this Stakeholders-Inclusion Approach is POEM Handbook where it will further validate and appraised the applicability of post occupancy evaluation model (POEM). Chapter 5 begins with a clarification of the main data collection and analysis methods and a report of the main Stakeholders-Inclusion Approach validation findings that are collected in regard of the proposed post occupancy evaluation model (POEM). Finally, this chapter will end up with a general discussion of the main findings outcome.

5.1.2 Stakeholders-Inclusion Approach Validation Results

In this study, three phases of Stakeholders-Inclusion Approach were executed. The experts who directly involved in GBI Assessment Criteria, the professional stakeholders who involved in neighborhood development and end-users who occupied the certified neighborhood were asked to response in all these three phases of Stakeholders-Inclusion Approach. The three phases of Stakeholders-Inclusion Approach have been carried out through August to December 2016. Main data analysis has been accomplished through the application of Google Docs and SPSS software package.

5.1.3 Stakeholders-Inclusion Approach (Phase 1): Experts Semi-Structure Interview Questionnaires.

For phase 1 study, experts were asked to view out the current sustainable neighborhood development and to determine the significance of the proposed sustainable model for post occupancy evaluation (POEM) of GBI certified (Figure 5 - Page 16, Chapter 1) neighborhood in Malaysia and its township / neighborhood assessment criteria. The experts are the Board Members and Technical Team which include GBI Assessor and

GBI Facilitator from Malaysia Green Building Confederation (MGBC), Representatives from Department of Urban & Town Planning Malaysia and Academicians. The experts list were obtained from Malaysia Green Building Confederation (MGBC). From listed 60 experts 32 agreed to participate in this research and have completed the first phase of Stakeholders-Inclusion Approach.

The first section in Phase 1 study is on the current sustainable neighborhood development in Klang Valley/Greater KL. This section consist of four questions (Q1-Q4). The first semi-structured interview/survey question is the experts' opinion on current sustainable township / neighborhood development in the Klang Valley. The question is open-ended and qualitative data in nature. Below is the analysis table (Figure 65) for Q1.

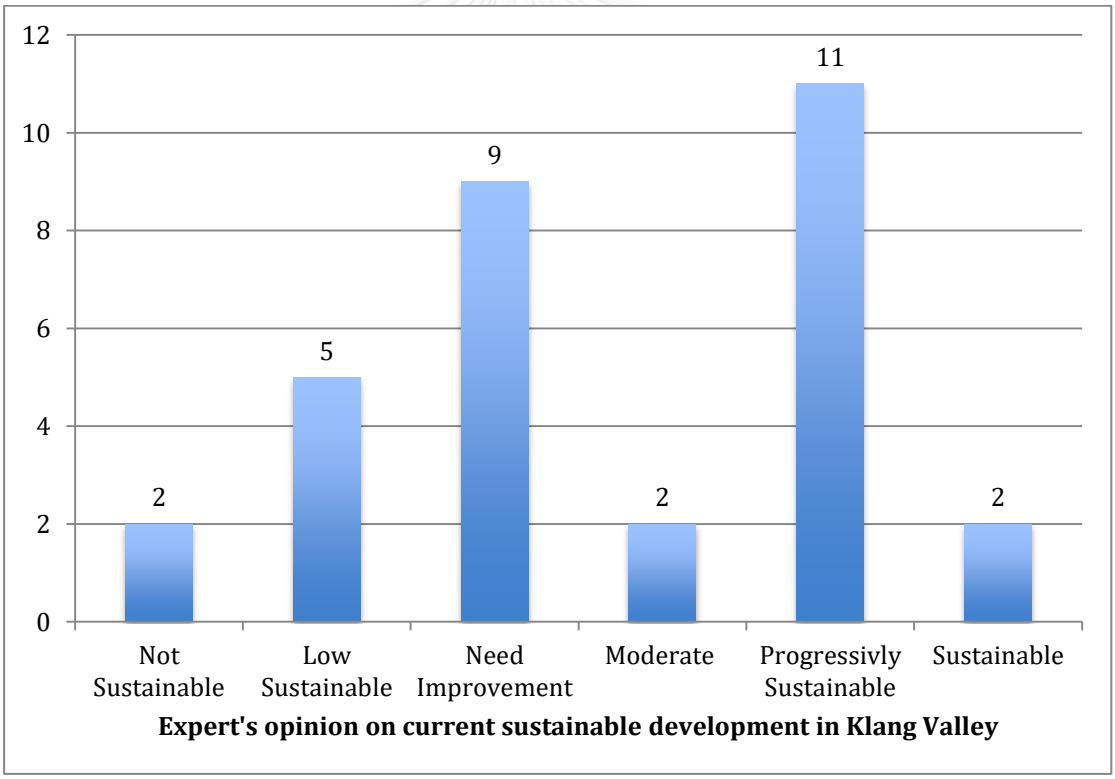


Figure65: Findings for Q1, expert's opinion on current sustainable development. Source: Author

Figure 65 shows that expert's opinion on current sustainable development in Klang Valley/Greater KL. Based on semi- structured interviews to 31 experts, the finding

suggest majority of experts consent that sustainable development in Klang Valley/Greater KL is progressive and required enhancement. Hence, this finding accord with the problem statement of the study whereby it is timely to assess and gauge the current GBI Certified Sustainable Neighborhood and GBI Green Township Assessment Criteria using POEM as sustainable development is progressive and need further improvement.

The second (Q2) and third (Q3) is closed ended survey questions based on seven-point Likert, where 1 represented extremely disagree and 7 represented extremely agree. The Q2 is to find out expert's opinion think to what extent the current certified township/neighborhood fulfilled the sustainable dimension pillars. As presented in Figure 66, the majority of experts are in agreement, they opinion out with moderately agree (28%), slightly agree (25.8%) and extremely agree (16.1%), 13% of experts are not in agreement while 16.1% are neither agree nor disagree that the current certified township/neighborhood fulfilled the sustainable dimension pillars (SDP). The findings suggest SDP is fulfilled, but with more than half (moderately agree - 28%, slightly agree - 25.8%) of the experts think it is moderate and slightly agreed it means there is a considerable gap in SDP fulfilment that need to be addressed.

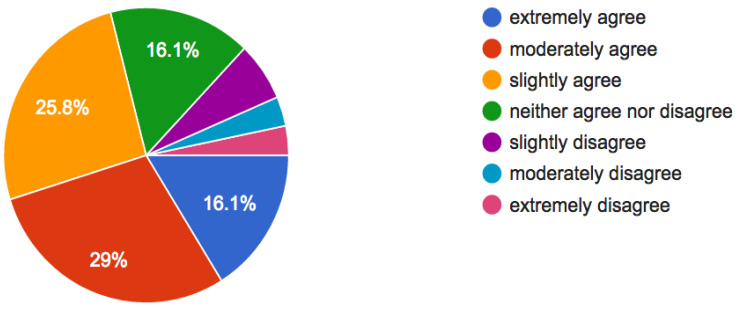


Figure66: Experts opinion on SDP fulfilment in current certified township/neighborhood. Source: Author

The Q3 is to gather experts' opinion on current GBI Township Tools that being used in assessing the current certified township/neighborhood on adaptation of SDP. As shown in Figure 67, 29% are moderately agree, 22.6% are slightly agree, 19.4% are extremely agree, 12.9% are neutral and the balance percentage are disagree. Based on the Q3

findings, GBI Township Tools adapted the SDP. Anyhow, with more 51% consensus is on moderate-slightly agree scale it suggest there is a missing SDP adaptations in the Tools.

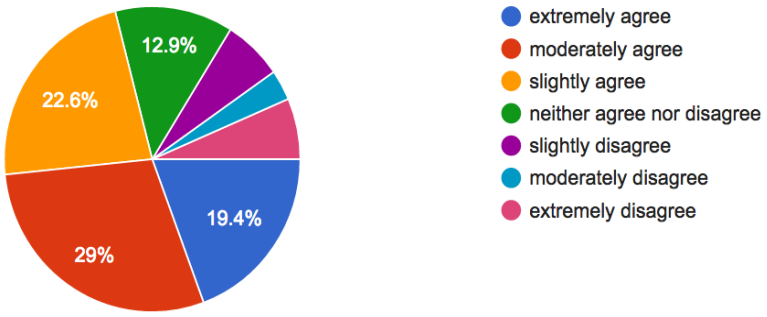


Figure67: Experts opinion on SDP adaptation in current GBI Township Tools. Source: Author

The final question in first section of phase 1 study is experts' further comments on current status of sustainable development in Klang Valley (Q4). The question is open-ended qualitative question. Based on the feedback from 31 expert respondents the answer is coded five broad theme. Figure 68 below shows that 32% of experts think more awareness should be instilled in current sustainable development, both 19% suggested more implementation and more improvement each respectively, 16% believe there should be more responsibilities to be taken of in current sustainable development and the balance 13% think there should be more connectivity is current sustainable development. Based on the findings the main issues to be looked into in current sustainable development is the awareness, followed by implementation, improvement, responsibilities and connectivity sequentially.

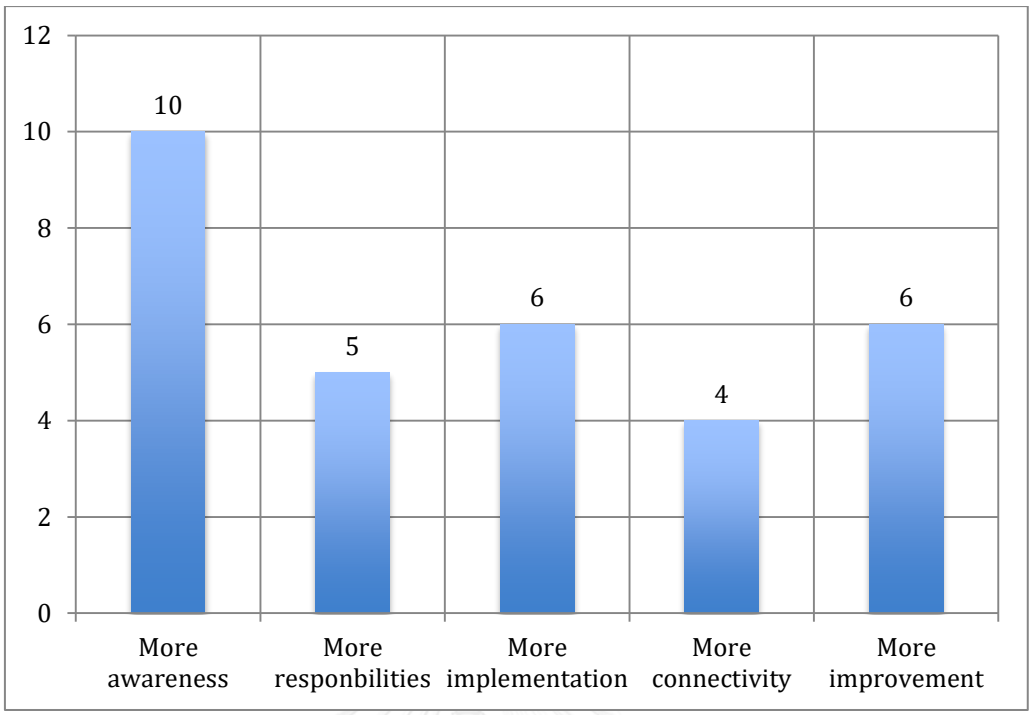


Figure68: Experts opinion on further comments of current sustainable development. Source: Author

The SPSS statistic descriptive analysis for first section of phase 1 study (Table 13) Q2 and Q3 below shows that the mean values of the current sustainable development are in the range 5.34 and 5.40 base on seven-point Likert scale. Standard deviations for Q2 is 1.23 and for Q3 is 1.52 which means there is varies consensus on the fulfilment and adaptation of SDP hence suggested possible gap in it.

Table 13: SPSS descriptive analysis for Q2 & Q3. Source: Author

	N	Mean	Std. Deviation
Q2. Fulfilled the sustainable pillar dimensions	32	5.34	1.23417
Q3. Adapted the sustainable pillar dimensions	32	5.40	1.52102

The second section in Phase 1 study is on the contents of the proposed POEM (Figure 69) for sustainable neighborhood development in Klang Valley/Greater KL. This section consist of three questions (Q5-Q8). The first three survey question (Q5-Q7) is closed-ended using 7-point Likert scale, where 1 point represent extremely disagree and 7-point represent extremely agree. Q5 is to find out the experts' opinion whether they

agree/disagree with the contents of the proposed POEM. As shown in Figure 82 below, majority of the experts are agreeable with the proposed POEM contents, 43.3% extremely agree, 40% moderately agree, 13.9% slightly agree and the balance percentage is neutral. None of the experts are not agreeable with the proposed POEM contents. Based on the findings of this Q5 all experts are in agreement with this proposed POEM, and small percentage of slightly agree (13.9%) suggest a minor improvement need to be addressed.

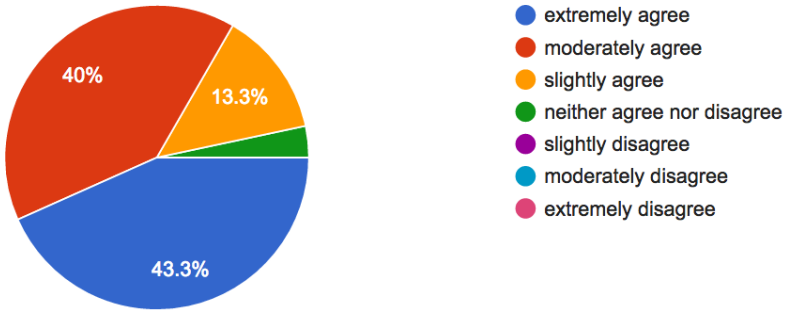


Figure69: Experts opinion on agree/disagree with the proposed POEM contents. Source: Author

The Q6 is to find out experts opinion on extensiveness of contents which include the core assessment criteria, SDP and loading factors of the proposed POEM for sustainable neighborhood development (SND). Analysis of Q6 findings in Figure 70, majority experts suggested the proposed POEM for SND is about the right contents (61.3%), 16.1% of experts think slightly too much contents, 12.9% say somewhat too much contents and the balance of a very small percentage of experts think too less contents.

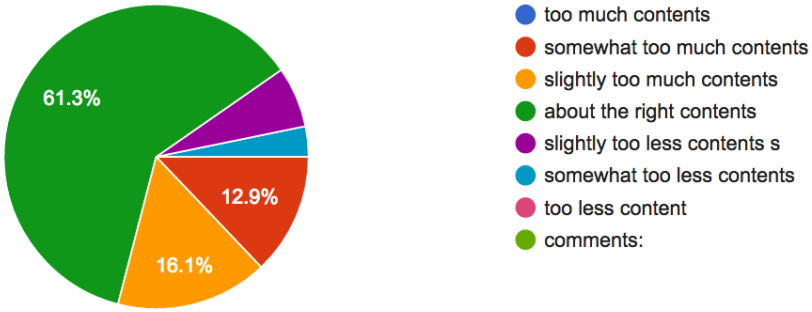


Figure70: Experts opinion on extensiveness of the proposed POEM contents. Source: Author

The last closed ended survey questions in second section of phase 1 study is Q7 using

3-point Likert scale, where 1-point is not sure, 2-point is no and 3-point is yes. The objective of Q7 is to find out experts opinion whether there should be other contents/factors that should be included in the proposed POEM for SND. Figure 71 below show the analysis for Q7, 40% of the experts think there should not be any other contents/factors in the proposed POEM for SND. 33.3% experts answer not sure and the balance 26.7% say yes there should be other contents to be included.

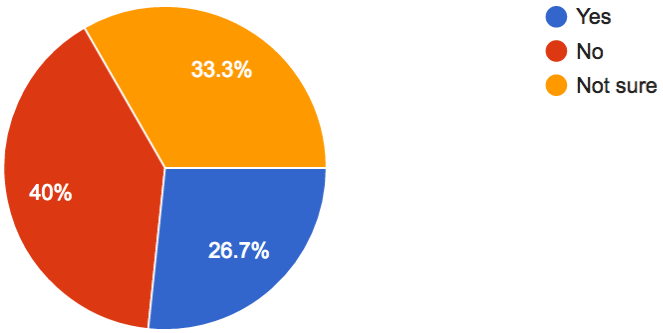


Figure71: Experts opinion on other comments/factors to be included in proposed POEM. Source: Author

The final question in second section of phase 1 study is experts' further comments on the proposed POEM for SND (Q8). The question is open-ended qualitative question. From 31 experts only 14 respondents answer this question. Based on the feedback from 14 experts the answer is coded four broad theme of 'comprehensive contents', 'more contents', 'less contents' and 'further explanation'. Figure 72 below shows that 6 experts think the contents of the proposed POEM is comprehensive enough, both 4 experts each for 'more contents' and 'further explanation' theme and only 1 expert think the proposed POEM content is less. Based on the findings, the proposed POEM is comprehensive but required additional content or further explanation for improvement.

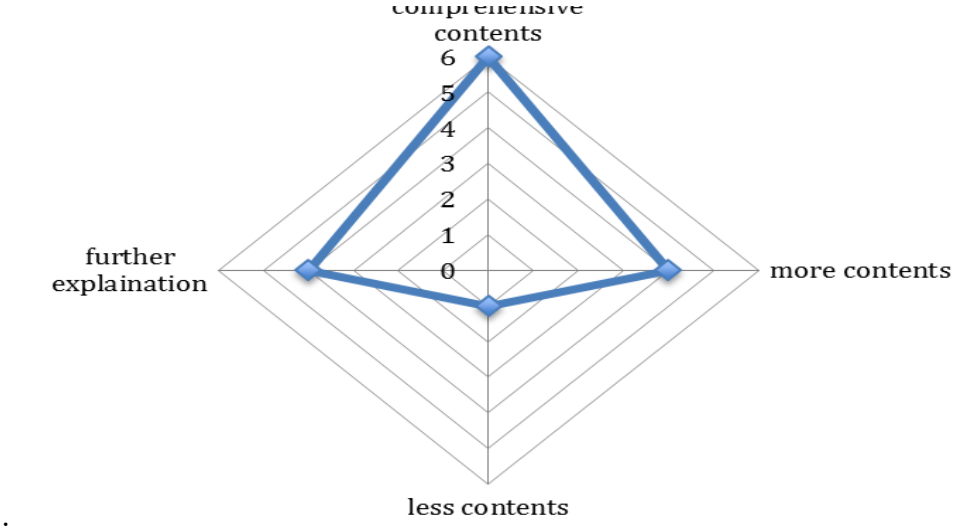


Figure72: Analysis of expert's further comment on proposed POEM for SND. Source: Author

The SPSS statistic descriptive analysis for second section of phase 1 study (Table 14) below shows that the mean values of the proposed POEM for sustainable neighborhood development are 4.34 (Q6) and 6.12 (Q5) base on seven-point Likert scale. High mean value for Q5 on expert's agreement with the contents of the proposed POEM suggested the proposed POEM are well developed. Standard deviations for Q5 and Q6 which is below 1 value meaning the experts are at congruence and consensus on the proposed POEM.

Table 14: SPSS descriptive analysis for Q5 & Q6. Source: Author

	N	Mean	Std. Deviation
Q5. Agreement with the contents of this proposed POEM?	32	6.12	.83280
Q6. Extensiveness of the contents of this proposed POEM?	32	4.34	.93703
Valid N (listwise)	32		

5.1.4 Stakeholders-Inclusion Approach (Phase 2): Professional's Stakeholder Surveys

For Phase 2 study, the professionals' stakeholder were asked for opinion of sustainability dimension pillars (SDP) adaptations in GBI Township Assessment Criteria. The term 'professionals' stakeholders in this phase are basically an individuals

or representatives from sustainable building industry related institutions or professionals such as urban planners, architects, engineers, designers, builders, manufacturers and academicians. These stakeholders are key players in implementing GBI Township Assessment Criteria whether directly or indirectly is sustainable urban neighborhood development in Malaysia. The respondents for Phase 2: Professional's Surveys is listed mainly from list of participants of sustainable workshops and continuing professional development programs conducted by MGBC and other professional building related profession in Malaysia. A total 100 online Professional's Surveys was disseminated to the listed respondents with a target of 50 returned response. From 100 emailed Phase 2 survey form to professional stakeholders, 61 have responded and revert back to the Phase 2 database bank.The main objective of this phase is gather data for SDP adaptations balanced in all GBI assessment sub-criteria and its scoring weight. These basically will give a feedback on SDP balanced based on Phase 1 Expert's opinion of core-criteria in GBI Township Assessment Criteria. These findings is also simplified to design Phase 3 End-User/Household Surveys questionnaires. This phase 2 surveys consist of total 136 questions (Q1.1-Q6.3 + Q7). These questions are designed based on GBI Township Assessment core-criteria where Q1.1-Q1.6 concern on the CEW- Climate, Energy & Water core-criteria, Q2.1-Q2.10 concern on the EEC- Environmental & Ecology, Q3.1-Q311 concern on CPD- Community Planning & Design, Q4.1-Q4.6 concern on TRC- Transportation & Connectivity, Q5.1-Q5.6 concern on BRC- Building & Resources and Q6.1-Q6.3 concern BSI- Business & Innovation. Q1.1-Q6.3 is closed-ended survey questions based on 5-points Likert scale where 1 point is very low adaptation and 5-points is very high adaptation. Each sub-criteria is asked on adaptation level of SOP – Social Dimension Pillar, ENP – Environmental Dimension Pillar and ENP – Economy Dimension Pillar. Q7 is semi-structured interview/survey question is the professional stakeholder's opinion on SDP adaptations in GBI Township Assessment Criteria. The question is open-ended and qualitative data in nature. Table 15 to Table 20 below shows the descriptive statistics of Stakeholders-Inclusion Approach (Phase 2) for Q1.1-Q6.3. Based on the 15 to Table 20 the highest mean values is 4.24 (Q4.3ENP) which mean the highest adapted SDP adaptations and the lowest mean values is 2.86 (Q5.2SOP) hence represent lowest SDP adaptations.

Table 15: Descriptive statistics for SDP balanced adaptations of GBI Township Assessment Climate Water & Energy Core-Criteria.
Source: Author

Survey Questions	N	Mean	Std. Deviation
Climate Water & Energy Core-Criteria Legend: SOP: Social Dimension Pillar Adaptations ENP: Environment Dimension Pillar Adaptations ECP: Economic Dimension Pillar Adaptations			
Q1.1SOP-Urban Heat Island Principles	61	3.1475	.85315
Q1.1ENP-Urban Heat Island Principles	61	3.8689	.88460
Q1.1ECP-Urban Heat Island Principles	61	3.2459	.82977
Q1.2SOP-Efficient Public Lighting	61	3.4754	.90566
Q1.2ENP-Efficient Public Lighting	61	3.7049	.86302
Q1.2ECP-Efficient Public Lighting	61	3.3770	.77812
Q1.3SOP-On-site Energy Generation	61	2.9508	.93855
Q1.3ENP-On-site Energy Generation	61	3.6885	1.04149
Q1.3ECP-On-site Energy Generation	61	3.6230	.91586
Q1.4SOP-Renewable Energy	61	2.9836	.99149
Q1.4ENP-Renewable Energy	61	3.6885	1.14806
Q1.4ECP-Renewable Energy	61	3.3770	1.05141
Q1.5SOP-Reduced Water Consumption	61	3.3279	1.17928
Q1.5ENP-Reduced Water Consumption	61	3.6885	1.05737
Q1.5ECP-Reduced Water Consumption	61	3.5902	1.07047
Q1.6SOP-Water Recycling	61	3.2459	.97734
Q1.6ENP-Water Recycling	61	3.7705	.98984
Q1.6ECP-Water Recycling	61	3.5738	1.00762

Based on Table 15, for core criteria mean values category; CEW- Climate, Energy & Water core-criteria Q1.1 ENP is the highest mean value of 3.86 and Q1.3 SOP is the lowest mean values of 2.95.

Table 16: Descriptive statistics for SDP balanced adaptations of GBI Township Assessment Environment & Ecology Core-Criteria.
Source: Author

Survey Questions	N	Mean	Std. Deviation
Environmental and Ecology Legend: SOP: Social Dimension Pillar Adaptations ENP: Environment Dimension Pillar Adaptations ECP: Economic Dimension Pillar Adaptations			
Q2.1ENP-Biodiversity Conservation	61	3.6721	1.10637
Q2.1ECP-Biodiversity Conservation	61	3.1311	.99122
Q2.2SOP-Land Reuse	61	3.3607	1.00055
Q2.2ENP-Land Reuse	61	3.5738	1.10241
Q2.2ECP-Land Reuse	61	3.6230	1.08265
Q2.3SOP-Ecology Preservation	61	3.3115	.86681
Q2.3ENP-Ecology Preservation	61	3.8033	1.02988
Q2.3ECP-Ecology Preservation	61	3.3770	.93388
Q2.4SOP-Flood Management & Mitigation	61	3.3770	1.22697
Q2.4ENP-Flood Management & Mitigation	61	3.6885	1.17673
Q2.4ECP-Flood Management & Mitigation	61	3.4590	1.19127
Q2.5SOP-Bluescape Conservation	61	3.1803	.95757
Q2.5ENP-Bluescape Conservation	61	3.7213	1.12740
Q2.5ECP-Bluescape Conservation	61	3.2787	1.05089
Q2.6SOP-Agricultural Land Preserve	61	3.2459	.94262
Q2.6ENP-Agricultural Land Preserve	61	3.6066	1.12958
Q2.6ECP-Agricultural Land Preserve	61	3.4098	1.08593
Q2.7SOP-Hill Slope Development	61	3.0820	.97117
Q2.7ENP-Hill Slope Development	61	3.7377	1.03121
Q2.7ECP-Hill Slope Development	61	3.4590	1.13393
Q2.8SOP-Sustainable Storm water Management	61	3.5902	1.05478
Q2.8ENP-Sustainable Storm water Management	61	3.5574	1.02509
Q2.8ECP-Sustainable Storm water Management	61	3.6885	1.04149
Q2.9SOP-Proximity to Exist. Infrastructure	61	3.4426	.97510
Q2.9ECP-Proximity to Exist. Infrastructure	61	3.6721	.88922
Q2.10SOP-Services Infrastructure Provision	61	3.1148	.91466
Q2.10ENP-Services Infrastructure Provision	61	3.3770	.95156
Q2.10ECP-Services Infrastructure Provision	61	3.0984	.94348

Based on Table 16, for core criteria mean values category; EEC-Environmental & Ecology Q2.3 ENP is the highest mean value of 3.80 and Q2.10 ECP is the lowest mean values of 3.09.

Table 17: Descriptive statistics for SDP balanced adaptations of GBI Township Community Planning & Design Core-Criteria.
Source: Author

Survey Questions	N	Mean	Std. Deviation
Community Planning and Design Legend: SOP: Social Dimension Pillar Adaptations ENP: Environment Dimension Pillar Adaptations ECP: Economic Dimension Pillar Adaptations			
Q3.1SOP-Greenspaces	61	3.8033	.89106
Q3.1ENP-Greenspaces	61	3.9672	.93036
Q3.1ECP-Greenspaces	61	3.3934	.95357
Q3.2SOP-Compact Development	61	3.6885	.95814
Q3.2ENP-Compact Development	61	3.6230	.96892
Q3.2ECP-Compact Development	61	3.6885	.92270
Q3.3SOP-Amenities for Communities	61	3.8525	1.03015
Q3.3ENP-Amenities for Communities	61	3.5410	1.02589
Q3.3ECP-Amenities for Communities	61	3.6230	.89748
Q3.4SOP-Universal Accessibility	61	3.8361	1.03570
Q3.4ENP-Universal Accessibility	61	3.4262	1.04018
Q3.4ECP-Universal Accessibility	61	3.4590	1.02589
Q3.5SOP-Secure Design	61	3.7705	1.02296
Q3.5ENP-Secure Design	61	3.2951	1.08542
Q3.5ECP-Secure Design	61	3.4426	1.02509
Q3.6SOP-Health Design	61	3.7049	1.08542
Q3.6ENP-Health Design	61	3.5574	1.05711
Q3.6ECP-Health Design	61	3.5410	1.00952
Q3.7SOP-Recycling Facilities	61	3.5410	.90506
Q3.7ENP-Recycling Facilities	61	3.7869	1.05063
Q3.7ECP-Recycling Facilities	61	3.5082	1.08969
Q3.8SOP-Community Diversity	61	3.8033	.90957
Q3.8ENP-Community Diversity	61	3.3279	.92595
Q3.8ECP-Community Diversity	61	3.3770	.96892
Q3.9SOP-Affordable Housing	61	3.7541	1.13513
Q3.9ENP-Affordable Housing	61	3.2787	1.17091
Q3.9ECP-Affordable Housing	61	3.5902	1.26987

Survey Questions	N	Mean	Std. Deviation
Q3.10ENP-Community Thrust	61	3.3115	1.07302
Q3.10ECP-Community Thrust	61	3.3443	.98124
Q3.11SOP-Governance	61	3.5574	1.10340
Q3.11ENP-Governance	61	3.2623	1.15328
Q3.11ECP-Governance	61	3.3934	1.11473

Based on Table 17, for core criteria mean values category; CPD- Community Planning & Design Q3.1 ENP is the highest mean value of 3.96 and Q3.9 ENP is the lowest mean values of 3.27.

Table 18: Descriptive statistics for SDP balanced adaptations of GBI Township Transportation & Connectivity Core-Criteria.
Source: Author

Survey Questions	N	Mean	Std. Deviation
Transportation and Connectivity Legend: SOP: Social Dimension Pillar Adaptations ENP: Environment Dimension Pillar Adaptations ECP: Economic Dimension Pillar Adaptations			
Q4.1SOP-Green Transport Plan	61	3.6557	1.13850
Q4.1ENP-Green Transport Plan	61	3.7869	1.17068
Q4.1ECP-Green Transport Plan	61	3.7541	1.13513
Q4.2SOP-Reliable Public Transport	61	3.8033	1.13754
Q4.2ENP-Reliable Public Transport	61	3.4426	1.05711
Q4.2ECP-Reliable Public Transport	61	3.6885	1.16248
Q4.3SOP-Facilities of Public Transport	61	3.7869	1.11228
Q4.3ENP-Facilities of Public Transport	61	4.2459	6.68744
Q4.3ECP-Facilities of Public Transport	61	3.6557	1.09370
Q4.4SOP-Pedestrian Network	61	3.7049	1.14520
Q4.4ENP-Pedestrian Network	61	3.5082	1.10488
Q4.4ECP-Pedestrian Network	61	3.2623	1.04724
Q4.5SOP-Cycling Network	61	3.4098	1.18852
Q4.5ENP-Cycling Network	61	3.4754	1.19173
Q4.5ECP-Cycling Network	61	3.0656	1.09345
Q4.6SOP-Alternative Transport Option	61	3.4590	1.17720
Q4.6ENP-Alternative Transport Option	61	3.1803	1.11816
Q4.6ECP-Alternative Transport Option	61	3.2623	1.13874

Based on Table 17, for core criteria mean values category; TRC- Transportation & Connectivity Q4.3 ENP is the highest mean value of 4.24 and Q4.5 ECP is the lowest mean values of 3.06,

Table 19: Descriptive statistics for SDP balanced adaptations of GBI Township Building & Resources Core-Criteria.
Source: Author

Survey Questions	N	Mean	Std. Deviation
Building and Resources Legend: SOP: Social Dimension Pillar Adaptations ENP: Environment Dimension Pillar Adaptations ECP: Economic Dimension Pillar Adaptations			
Q5.1SOP-Low Impact Material (Infrastructure)	61	3.0164	.84640
Q5.1ENP-Low Impact Material (Infrastructure)	61	3.3934	1.03728
Q5.1ECP-Low Impact Material (Infrastructure)	61	3.3115	1.00898
Q5.2SOP-Low Impact Material (Buildings)	61	2.8689	.86555
Q5.2ENP-Low Impact Material (Buildings)	61	3.4426	1.00871
Q5.2ECP-Low Impact Material (Buildings)	61	3.4918	1.04280
Q5.3SOP-Regional Material	61	2.9508	1.05556
Q5.3ENP-Regional Material	61	3.3607	1.00055
Q5.3ECP-Regional Material	61	3.4098	1.08593
Q5.4SOP-Construction Quality	61	3.3115	1.10365
Q5.4ENP-Construction Quality	61	3.5082	1.05866
Q5.4ECP-Construction Quality	61	3.7541	1.05918
Q5.5SOP-Construction Waste Management	61	3.0984	1.12108
Q5.5ENP-Construction Waste Management	61	3.7377	1.09395
Q5.5ECP-Construction Waste Management	61	3.5574	1.04123
Q5.6SOP-Sedimentation & Pollution Control	61	3.2459	.97734
Q5.6ENP-Sedimentation & Pollution Control	61	3.8197	1.00843
Q5.6ECP-Sedimentation & Pollution Control	61	3.3443	1.12376
Q5.7SOP-Sustainable Construction Practice	61	3.2131	.95070
Q5.7ENP-Sustainable Construction Practice	61	3.7049	.95471
Q5.7ECP-Sustainable Construction Practice	61	3.5082	1.05866
Q5.8SOP-GBI Certified Buildings	61	3.2459	.97734
Q5.8ENP-GBI Certified Buildings	61	3.7377	1.01492
Q5.8ECP-GBI Certified Buildings	61	3.5410	.95871

Based on Table 19, for core criteria mean values category; BDR- Building & Resources Q5.6 ENP is the highest mean value of 3.81 and Q5.2 SOP is the lowest mean values of 2.86

Table 20: Descriptive statistics for SDP balanced adaptations of GBI Township Business & Innovation Core-Criteria.
Source: Author

Survey Questions	N	Mean	Std. Deviation
Business and Innovation Legend: SOP: Social Dimension Pillar Adaptations ENP: Environment Dimension Pillar Adaptations ECP: Economic Dimension Pillar Adaptations			
Q6.1SOP-Business	61	3.4590	.90506
Q6.1ENP-Business	61	3.1967	.83306
Q6.1ECP-Business	61	3.7869	.93300
Q6.2SOP-Innovation	61	3.3443	1.03094
Q6.2ENP-Innovation	61	3.4590	.95871
Q6.2ECP-Innovation	61	3.6557	1.04698
Q6.3SOP-GBI Facilitator	61	3.0492	.99039
Q6.3ENP-GBI Facilitator	61	3.4098	.97257
Q6.3ECP-GBI Facilitator	61	3.4590	.95871
Valid N (listwise)	61		

Based on Table 20 above, for core criteria mean values category; BSI- Business & Innovation Q6.1 ECP is the highest mean value of 3.76 and Q6.1 ENP is the lowest mean values of 3.19. For standard deviations, all values under 1 suggested congruence and consensus by professional stakeholders with Q1.2 ECP standard deviation value of 0.77 is the lowest values and the most deviated questions on SDP adaptations is Q4.3 ENP (TRC: Transportation & Connectivity – Environmental Dimension Pillar) with values of 6.68.

The final question in phase 2 study is experts' further comments on SDP adaptations in GBI Township Assessment Criteria (Q7). The question is open-ended qualitative question. From 61 professional stakeholders only 7 answer this question. Based on the feedback from 7 professional stakeholders the answer is coded three broad theme of

'awareness & education', 'monitoring' and 'comparative'. Figure 86 below shows that 3 professional stakeholders think 'awareness & education' should be considered in promoting GBI Township Assessment Criteria and SDP adaptations, another 3 professional stakeholders believe 'comparative' measure should be done GBI Township Assessment Criteria and SDP adaptations and only 1 professional stakeholders think the 'monitoring' is vital. Based on this findings, the GBI Township Assessment Criteria and SDP adaptations is still lacking in term of awareness and education to all stakeholders in this industry.

Q7

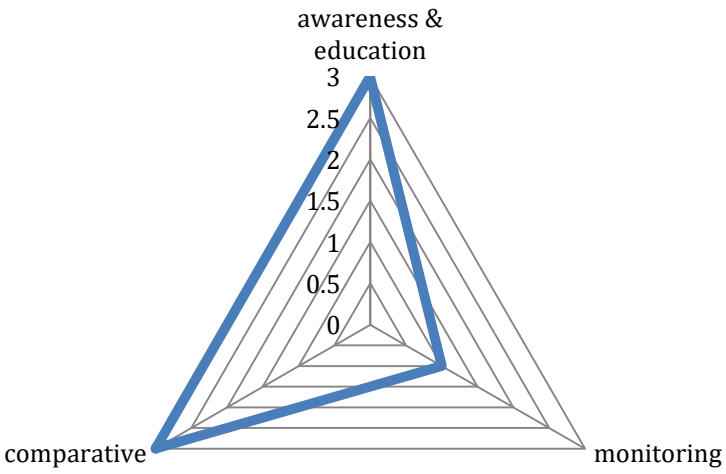


Figure73: Analysis of expert's further comment on SDP adaptations. Source: Author

5.1.5 Stakeholders-Inclusion Approach (Phase 3): Household Survey Questionnaires

For Phase 3 study, the survey questionnaires is designed to rate the sustainability level of GBI certified neighborhood based on end-user/household opinion. The term 'end-user/household' in this phase are referring to homeowners, tenants or workers in GBI certified neighborhood. These end-users are key respondents in implementing POEM for sustainable neighborhood as it act as a main samples for validating and appraising the workability of POEM in selected GBI certified township. The respondents for Phase

3: End-User/Household Surveys is occupants of GBI certified neighborhood which was occupied the said neighborhood for a minimum of one year occupancy or more.

For phase 3, the selected GBI certified neighborhood are Ken Rimba Development, Bandar Rimbayu and Sunway Resort City. All these three on-site case study are awarded with sustainable township ratings from GBI Malaysia. Since GBI Township Assessment Criteria tools are relatively new, only these three neighborhood or township was certified and being occupied for more than year. Hence, it is the only available neighborhood for this study. The end-user/household surveys data was collected via door to door survey with a help of research assistant. Three research assistant was employed to gather door to door data collection for each neighborhood. For this phase, a minimum 100 responses from end-user/household respondents was targeted for each selected on-site case studies. The total no of respondents' participated for this phase is 378 respondents (Table 24) despite the targeted total 300 responses returned. The number of respondents for each selected case study is Ken Rimba respondents total at 122, Bandar Rimbayu respondents total at 125 and Sunway Resort City respondents total at 131. The returned response in this phase is analyzed using SPSS statistical software package. The main objective of this phase is gather data for POEM of sustainable neighborhood in GBI certified neighborhood.

In Phase 3 study, the first 6 questions is to find out general understanding on sustainable neighborhood, sustainable dimension pillars and sustainable neighborhood development. The findings for phase 3 Q1, Q2, Q3, Q4 & Q6 is as presented below (Table 21 – Table 25).

Table 21: Frequency Analysis for Q1. Understanding of sustainable /green neighborhood. Source: Author

Q1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	293	77.5	77.5	77.5
	NOT SURE	81	21.4	21.4	98.9
	NO	4	1.1	1.1	100.0
	Total	378	100.0	100.0	

Table 22: Frequency Analysis for Q2. Awareness pillars of sustainable dimension; economic, social & environment.
Source: Author

Q2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	159	42.1	42.1	42.1
	NOT SURE	192	50.8	50.8	92.9
	NO	27	7.1	7.1	100.0
	Total	378	100.0	100.0	

Table 23: Frequency Analysis for Q3. Awareness that this neighborhood is certified sustainable/green neighborhood.
Source: Author

Q3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	203	53.7	53.7	53.7
	NOT SURE	148	39.2	39.2	92.9
	NO	27	7.1	7.1	100.0
	Total	378	100.0	100.0	

Table 24: Frequency Analysis for Q4. Are you the homeowners, tenants, or workers of this certified neighborhood?
Source: Author

Q4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	HOMEOWNER	201	53.2	53.2	53.2
	TENANT	131	34.7	34.7	87.8
	WORKERS	46	12.2	12.2	100.0
	Total	378	100.0	100.0	

Table 25: Frequency Analysis for Q6. Are you planning to stay permanently/long-term in this certified neighborhood?
Source: Author

Q6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	230	60.8	60.8	60.8
	NOT SURE	134	35.4	35.4	96.3
	NO	14	3.7	3.7	100.0
	Total	378	100.0	100.0	

For question Q5. What influence your decision making to purchase this property or stay in this neighborhood? And the respondents can mark more than 1 answer. The findings for this questions is as described in Figure 74 below. This Figure also described the findings for Q7 which is the continuation from Q6 where the respondents is asked to justify in an open-ended questions.

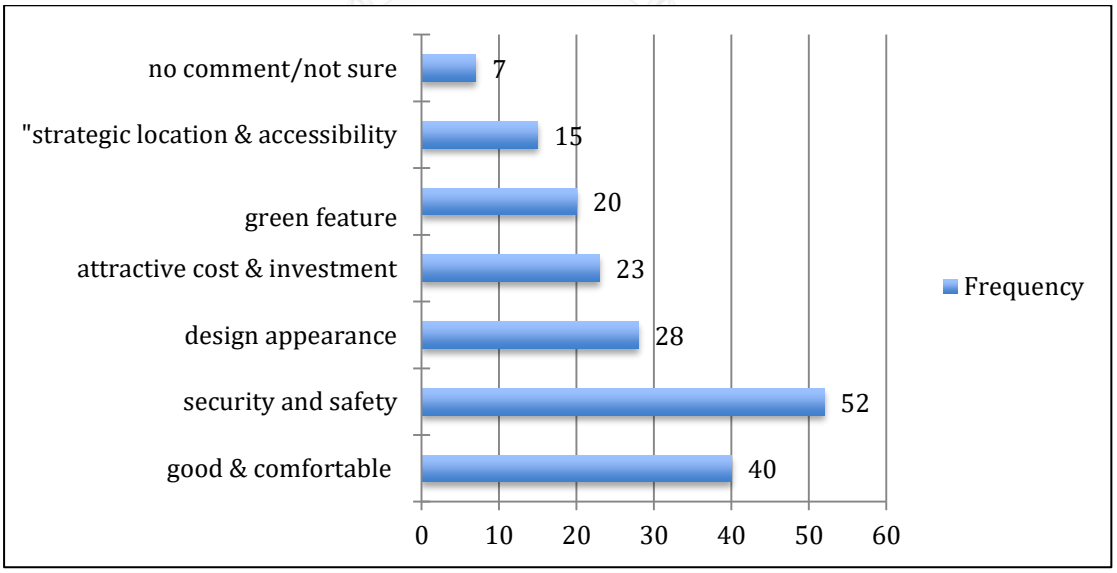


Figure74: Frequency Analysis for Q5 what influence decision making staying in the neighborhood and Q7. Justification planning of staying as in Q6.
Source: Author

Besides descriptive and frequency analysis , the first 5 questions (Q1, Q2, Q3, Q4 & Q6) is also analyzed using Crosstabulations analysis in order to find out the comparisons between the three selected Case Studies. The findings of Crosstabulations analysis for phase 3 Q1, Q2, Q3, Q4 & Q6 is as presented below (Table 26 – Table 30).

Table 26: Crosstabulations analysis on Sustainable Neighborhood understanding (Q1) between 3 selected Case Studies.
Source: Author

CS * Q1 Crosstabulation

			Q1			Total
			YES	NOT SURE	NO	
CS	KEN RIMBA	Count	73	47	2	122
		% within CS	59.8%	38.5%	1.6%	100.0%
	BANDAR RIMBAYU	Count	120	4	1	125
		% within CS	96.0%	3.2%	0.8%	100.0%
	SUNWAY	Count	100	30	1	131
		% within CS	76.3%	22.9%	0.8%	100.0%
Total		Count	293	81	4	378
		% within CS	77.5%	21.4%	1.1%	100.0%

Table 27: Crosstabulations analysis on Awareness in SDP (Q2) between 3 selected Case Studies.
Source: Author

CS * Q2 Crosstabulation

			Q2			Total
			YES	NOT SURE	NO	
CS	KEN RIMBA	Count	43	70	9	122
		% within CS	35.2%	57.4%	7.4%	100.0%
	BANDAR RIMBAYU	Count	64	56	5	125
		% within CS	51.2%	44.8%	4.0%	100.0%
	SUNWAY	Count	52	66	13	131
		% within CS	39.7%	50.4%	9.9%	100.0%
Total		Count	159	192	27	378
		% within CS	42.1%	50.8%	7.1%	100.0%

Table 28: Crosstabulations analysis on Awareness whether the occupied neighborhood is GBI certified neighborhood (Q3) between 3 selected Case Studies.
Source: Author

CS * Q3 Crosstabulation

			Q3			Total
			YES	NOT SURE	NO	
CS	KEN RIMBA	Count	44	66	12	122
		% within CS	36.1%	54.1%	9.8%	100.0%
	BANDAR RIMBAYU	Count	98	25	2	125
		% within CS	78.4%	20.0%	1.6%	100.0%
	SUNWAY	Count	61	57	13	131
		% within CS	46.6%	43.5%	9.9%	100.0%
Total		Count	203	148	27	378
		% within CS	53.7%	39.2%	7.1%	100.0%

Table 29: Crosstabulations analysis whether respondents is owner, tenants of workers (Q4) between 3 selected Case Studies.
Source: Author

CS * Q4 Crosstabulation

			Q4			Total
			HOMEOWNER	TENANT	WORKERS	
CS	KEN RIMBA	Count	59	54	9	122
		% within CS	48.4%	44.3%	7.4%	100%
	BANDAR RIMBAYU	Count	72	38	15	125
		% within CS	57.6%	30.4%	12.0%	100%
	SUNWAY	Count	70	39	22	131
		% within CS	53.4%	29.8%	16.8%	100%
Total		Count	201	131	46	378
		% within CS	53.2%	34.7%	12.2%	100%

Table 30: Crosstabulations analysis on respondents planning of stay in the neighborhood (Q6) between 3 selected Case Studies.
Source: Author

CS * Q6 Crosstabulation

			Q6			Total
			YES	NOT SURE	NO	
CS	KEN RIMBA	Count	63	54	5	122
		% within CS	51.6%	44.3%	4.1%	100.0%
	BANDAR RIMBAYU	Count	104	20	1	125
		% within CS	83.2%	16.0%	0.8%	100.0%
	SUNWAY	Count	63	60	8	131
		% within CS	48.1%	45.8%	6.1%	100.0%
Total		Count	230	134	14	378
		% within CS	60.8%	35.4%	3.7%	100.0%

The second section in Phase 3 survey questionnaires is to find out end-users/households opinion based on their experiences occupying certified sustainable neighborhood. This section consist of 25 questions (Q8.1-Q8.25). The survey questions is closed-ended and using 5-point Likert scale, where 1 point represent extremely less feasible/sufficient and 7-point represent extremely high feasible/sufficient. The questioned was designed based on GBI Township Assessment Criteria and is simplified for layman terminologies in order to find out the level of sustainable criteria perceived. The total no of respondents from three selected Case Studies is 378 respondents. Table 31 show the descriptive statistic findings for question Q8.1 – Q8.25. The mean values for these section of surveys is between 3.07 and 3.95. Standard Deviation values is below 1 except for Q8.5 (1.26), Q8.20 (1.41) and Q8.23 (1.71).

Table 31: Descriptive statistics for POEM end-users/households survey.
Source: Author

	N	Mean	Std. Deviation

Q8.1 Sufficient Designated Green Area	378	3.7513	.74032
Q8.2 Sufficient Street & Park Lighting	378	3.7910	.73649
Q8.3 Generate Renewable Energy	378	2.8228	.91426
Q8.4 Reduce & Recycling Water	378	3.0291	.96995
Q8.5 Biodiversity Reserved Availability	378	4.1481	1.26334
Q8.6 Flash Flooding/Drainage Clogging	378	3.4418	.93732
Q8.7 Good Infrastructures Services	378	3.6243	.57502
Q8.8 Pollution Experiences	378	3.3466	.75271
Q8.9 Sufficient Public Green Spaces	378	3.8254	.75426
Q8.10 Dense Population & Development	378	3.4471	.61683
Q8.11 Walkable Community Amenities	378	3.3862	.81369
Q8.12 Universal Accessibility	378	3.1640	.67118
Q8.13 Security & Safety	378	3.6958	.65149
Q8.14 Public Health Concerns	378	3.5106	.69568
Q8.15 Recycling Facilities & Practice	378	3.3439	.95702
Q8.16 Community Diversification	378	3.4841	.70317
Q8.17 Community Participation	378	3.2275	.88073
Q8.18 Public Transportation Reliability	378	3.2698	.78188
Q8.19 Pedestrian & Cycling Network	378	3.1878	.67871
Q8.20 Low Impact & Regional Material	378	2.7354	1.41753
Q8.21 Quality Sustainable Construction	378	3.4259	.65233
Q8.22 Waste & Sedimentation	378	3.2619	.79633
Q8.23 Business & Employability	378	2.0794	1.71715
Q8.24 Sufficient Commercial Area	378	3.8545	.65754
Q8.25 Innovative Adaptation	378	3.9577	.83891
Valid N (listwise)	378		

For mean values comparison on end-users/households opinion towards post-occupation of sustainable neighborhood (Q8.1-Q8.25), Table 32 below shows the mean comparison between Ken Rimba Development, Bandar Rimbayu and Sunway Resorts City. Based on the findings, the mean values for Ken Rimba is 1.75 to 3.77, the mean values for Bandar Rimbayu is between 2.08 to 4.66 and the mean values for Sunway Resort City is between 2.37 to 4.34. The lowest mean values is 1.75 for Q8.23 whether respondents own a business or working within the neighborhood, the comparative mean values is Ken Rimba 1.75, Bandar Rimbayu 2.08 and Sunway Resort City is 2.37, the findings suggested that most of the respondents either homeowners of tenants are not owning business or working within the neighborhood. The highest mean values is for Q8.5 is there any biodiversity reserve such as forest reserve, wildlife reserve, river

reserve or wetland in your neighborhood? The comparative mean values is Ken Rimba 3.40, Bandar Rimbayu 4.66 and Sunway Resort City 4.34, the findings suggested that Bandar Rimbayu has the largest biodiversity reserved followed by Sunway Resort City and Ken Rimba. Standard deviations for all comparative selected case studies are below 1, meaning all respondents in the three selected case studies are in congruence and consensus in responding to this study. Table 32 below described the full mean values and standard deviations for all questions according to selected case studies.

Table 32: Mean Comparison for case studies of POEM end-users/households survey. Source: Author

		N	Mean	Std. Dev.	Std. Error	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
Q8.1	KEN RIMBA	122	3.6639	.81930	.07418	3.5171	3.8108
	RIMBAYU	125	4.0640	.45337	.04055	3.9837	4.1443
	SUNWAY	131	3.5344	.78738	.06879	3.3983	3.6705
	Total	378	3.7513	.74032	.03808	3.6765	3.8262
Q8.2	KEN RIMBA	122	3.7787	.74426	.06738	3.6453	3.9121
	RIMBAYU	125	4.0720	.44316	.03964	3.9935	4.1505
	SUNWAY	131	3.5344	.85303	.07453	3.3869	3.6818
	Total	378	3.7910	.73649	.03788	3.7165	3.8655
Q8.3	KEN RIMBA	122	2.8525	.92417	.08367	2.6868	3.0181
	RIMBAYU	125	2.8560	.64388	.05759	2.7420	2.9700
	SUNWAY	131	2.7634	1.10824	.09683	2.5718	2.9549
	Total	378	2.8228	.91426	.04702	2.7303	2.9152
Q8.4	KEN RIMBA	122	3.1148	1.03010	.09326	2.9301	3.2994
	RIMBAYU	125	2.8240	.71914	.06432	2.6967	2.9513
	SUNWAY	131	3.1450	1.08926	.09517	2.9568	3.3333
	Total	378	3.0291	.96995	.04989	2.9310	3.1272
Q8.5	KEN RIMBA	122	3.4098	1.45315	.13156	3.1494	3.6703
	RIMBAYU	125	4.6640	.75074	.06715	4.5311	4.7969
	SUNWAY	131	4.3435	1.14872	.10036	4.1450	4.5421
	Total	378	4.1481	1.26334	.06498	4.0204	4.2759
Q8.6	KEN RIMBA	122	3.4262	1.01165	.09159	3.2449	3.6076

	BANDAR	125	3.4640	.73555	.06579	3.3338	3.5942
	SUNWAY	131	3.4351	1.03848	.09073	3.2556	3.6146
	Total	378	3.4418	.93732	.04821	3.3470	3.5366
Q8.7	KEN RIMBA	122	3.6393	.61745	.05590	3.5287	3.7500
	BANDAR	125	3.7600	.48193	.04311	3.6747	3.8453
	SUNWAY	131	3.4809	.58640	.05123	3.3796	3.5823
	Total	378	3.6243	.57502	.02958	3.5662	3.6825
Q8.8	KEN RIMBA	122	3.2623	.86055	.07791	3.1081	3.4165
	RIMBAYU	125	3.5520	.62805	.05617	3.4408	3.6632
	SUNWAY	131	3.2290	.71860	.06278	3.1048	3.3532
	Total	378	3.3466	.75271	.03872	3.2704	3.4227
Q8.9	KEN RIMBA	122	3.7459	.67495	.06111	3.6249	3.8669
	RIMBAYU	125	4.2240	.59384	.05311	4.1189	4.3291
	SUNWAY	131	3.5191	.79760	.06969	3.3812	3.6570
	Total	378	3.8254	.75426	.03879	3.7491	3.9017
Q8.10	KEN RIMBA	122	3.4754	.61943	.05608	3.3644	3.5864
	RIMBAYU	125	3.3120	.49864	.04460	3.2237	3.4003
	SUNWAY	131	3.5496	.69297	.06055	3.4298	3.6694
	Total	378	3.4471	.61683	.03173	3.3847	3.5095
Q8.11	KEN RIMBA	122	3.8033	.77821	.07046	3.6638	3.9428
	RIMBAYU	125	2.8480	.56876	.05087	2.7473	2.9487
	SUNWAY	131	3.5115	.76828	.06712	3.3787	3.6442
	Total	378	3.3862	.81369	.04185	3.3040	3.4685
Q8.12	KEN RIMBA	122	3.4754	.63263	.05728	3.3620	3.5888
	RIMBAYU	125	2.7200	.45081	.04032	2.6402	2.7998
	SUNWAY	131	3.2977	.66442	.05805	3.1829	3.4126
	Total	378	3.1640	.67118	.03452	3.0961	3.2319
Q8.13	KEN RIMBA	122	3.6393	.66885	.06056	3.5195	3.7592
	RIMBAYU	125	4.0640	.32981	.02950	4.0056	4.1224
	SUNWAY	131	3.3969	.69812	.06100	3.2763	3.5176
	Total	378	3.6958	.65149	.03351	3.6299	3.7617
Q8.14	KEN RIMBA	122	3.4180	.75886	.06870	3.2820	3.5541
	RIMBAYU	125	3.7040	.45833	.04099	3.6229	3.7851
	SUNWAY	131	3.4122	.78319	.06843	3.2768	3.5476
	Total	378	3.5106	.69568	.03578	3.4402	3.5809
Q8.15	KEN RIMBA	122	3.1721	1.10366	.09992	2.9743	3.3700
	RIMBAYU	125	3.6480	.66303	.05930	3.5306	3.7654
	SUNWAY	131	3.2137	.98455	.08602	3.0436	3.3839
	Total	378	3.3439	.95702	.04922	3.2471	3.4407
Q8.16	KEN RIMBA	122	3.5082	.76327	.06910	3.3714	3.6450

	RIMBAYU	125	3.5280	.64227	.05745	3.4143	3.6417
	SUNWAY	131	3.4198	.70114	.06126	3.2987	3.5410
	Total	378	3.4841	.70317	.03617	3.4130	3.5552
Q8.17	KEN RIMBA	122	3.2377	.80344	.07274	3.0937	3.3817
	RIMBAYU	125	3.5280	.84792	.07584	3.3779	3.6781
	SUNWAY	131	2.9313	.88744	.07754	2.7779	3.0847
	Total	378	3.2275	.88073	.04530	3.1384	3.3166
Q8.18	KEN RIMBA	122	3.2459	.82634	.07481	3.0978	3.3940
	RIMBAYU	125	2.8800	.57642	.05156	2.7780	2.9820
	SUNWAY	131	3.6641	.71909	.06283	3.5398	3.7884
	Total	378	3.2698	.78188	.04022	3.1908	3.3489
Q8.19	KEN RIMBA	122	3.1475	.68842	.06233	3.0241	3.2709
	RIMBAYU	125	3.0720	.54144	.04843	2.9761	3.1679
	SUNWAY	131	3.3359	.76067	.06646	3.2044	3.4674
	Total	378	3.1878	.67871	.03491	3.1192	3.2565
Q8.20	KEN RIMBA	122	2.4754	1.33121	.12052	2.2368	2.7140
	RIMBAYU	125	2.9680	1.45877	.13048	2.7098	3.2262
	SUNWAY	131	2.7557	1.42554	.12455	2.5093	3.0021
	Total	378	2.7354	1.41753	.07291	2.5921	2.8788
Q8.21	KEN RIMBA	122	3.2131	.53365	.04831	3.1175	3.3088
	RIMBAYU	125	3.8320	.54972	.04917	3.7347	3.9293
	SUNWAY	131	3.2366	.66601	.05819	3.1215	3.3518
	Total	378	3.4259	.65233	.03355	3.3600	3.4919
Q8.22	KEN RIMBA	122	3.2541	.79836	.07228	3.1110	3.3972
	RIMBAYU	125	3.7120	.47206	.04222	3.6284	3.7956
	SUNWAY	131	2.8397	.81162	.07091	2.6994	2.9800
	Total	378	3.2619	.79633	.04096	3.1814	3.3424
Q8.23	KEN RIMBA	122	1.7541	1.48442	.13439	1.4880	2.0202
	RIMBAYU	125	2.0880	1.76898	.15822	1.7748	2.4012
	SUNWAY	131	2.3740	1.82435	.15939	2.0587	2.6894
	Total	378	2.0794	1.71715	.08832	1.9057	2.2530
Q8.24	KEN RIMBA	122	3.7049	.74621	.06756	3.5712	3.8387
	RIMBAYU	125	3.8720	.55323	.04948	3.7741	3.9699
	SUNWAY	131	3.9771	.63809	.05575	3.8668	4.0874
	Total	378	3.8545	.65754	.03382	3.7880	3.9210
Q8.25	KEN RIMBA	122	3.5820	.75886	.06870	3.4459	3.7180
	RIMBAYU	125	4.5840	.67423	.06030	4.4646	4.7034
	SUNWAY	131	3.7099	.70698	.06177	3.5877	3.8321
	Total	378	3.9577	.83891	.04315	3.8728	4.0425

A one-way ANOVA was conducted to compare the effect of POEM evaluation criteria for SND on GBI Certified Neighborhoods/Townships (Case Studies). The total number of evaluation criteria is 25 (Q8.1 – Q8.25). Table 33 below showed the result of ANOVA.

Table 33: Analysis result of ANOVA.
Source: Author

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Q8.1	Between Groups	19.320	2	9.660	19.340	.000
	Within Groups	187.305	375	.499		
	Total	206.624	377			
Q8.2	Between Groups	18.517	2	9.259	18.670	.000
	Within Groups	185.972	375	.496		
	Total	204.489	377			
Q8.3	Between Groups	.708	2	.354	.422	.656
	Within Groups	314.416	375	.838		
	Total	315.124	377			
Q8.4	Between Groups	7.914	2	3.957	4.279	.015
	Within Groups	346.766	375	.925		
	Total	354.680	377			
Q8.5	Between Groups	104.766	2	52.383	39.529	.000
	Within Groups	496.938	375	1.325		
	Total	601.704	377			
Q8.6	Between Groups	.097	2	.049	.055	.947
	Within Groups	331.123	375	.883		
	Total	331.220	377			
Q8.7	Between Groups	5.023	2	2.511	7.872	.000
	Within Groups	119.633	375	.319		
	Total	124.656	377			
Q8.8	Between Groups	7.952	2	3.976	7.250	.001
	Within Groups	205.648	375	.548		
	Total	213.601	377			
Q8.9	Between Groups	32.923	2	16.461	34.001	.000
	Within Groups	181.553	375	.484		
	Total	214.476	377			
Q8.10	Between Groups	3.756	2	1.878	5.042	.007
	Within Groups	139.686	375	.372		
	Total	143.442	377			

Q8.11	Between Groups	59.485	2	29.742	58.664	.000
	Within Groups	190.124	375	.507		
	Total	249.608	377			
Q8.12	Between Groups	38.815	2	19.408	55.549	.000
	Within Groups	131.016	375	.349		
	Total	169.831	377			
Q8.13	Between Groups	29.035	2	14.518	41.565	.000
	Within Groups	130.978	375	.349		
	Total	160.013	377			
Q8.14	Between Groups	6.989	2	3.494	7.468	.001
	Within Groups	175.469	375	.468		
	Total	182.458	377			
Q8.15	Between Groups	17.378	2	8.689	9.937	.000
	Within Groups	327.913	375	.874		
	Total	345.291	377			
Q8.16	Between Groups	.853	2	.426	.862	.423
	Within Groups	185.552	375	.495		
	Total	186.405	377			
Q8.17	Between Groups	22.794	2	11.397	15.850	.000
	Within Groups	269.640	375	.719		
	Total	292.434	377			
Q8.18	Between Groups	39.432	2	19.716	38.700	.000
	Within Groups	191.044	375	.509		
	Total	230.476	377			
Q8.19	Between Groups	4.746	2	2.373	5.269	.006
	Within Groups	168.918	375	.450		
	Total	173.664	377			
Q8.20	Between Groups	15.064	2	7.532	3.804	.023
	Within Groups	742.481	375	1.980		
	Total	757.545	377			
Q8.21	Between Groups	30.831	2	15.415	44.606	.000
	Within Groups	129.595	375	.346		
	Total	160.426	377			
Q8.22	Between Groups	48.683	2	24.341	47.944	.000
	Within Groups	190.389	375	.508		
	Total	239.071	377			
Q8.23	Between Groups	24.292	2	12.146	4.189	.016
	Within Groups	1087.327	375	2.900		
	Total	1111.619	377			
Q8.24	Between Groups	4.737	2	2.369	5.612	.004
	Within Groups	158.260	375	.422		

	Total	162.997	377			
	Between Groups	74.297	2	37.149	72.926	.000
Q8.25	Within Groups	191.025	375	.509		
	Total	265.323	377			

For Q8.1 is there sufficient greenery or designated green area in your neighborhood? An analysis of variance showed that the effect of POEM for SND on Q8.1 was **significant,** F (2,375) = 19.34, p=0.000. Based on the findings there is a difference in an opinion where Bandar Rimbayu respondents has the highest mean value followed by Sunway Resort City and Ken Rimba.

For Q8.2 is there sufficient street and park lighting in your neighborhood? An analysis of variance showed that the effect of POEM for SND on Q8.2 was **significant,** F (2,375) = 18.67, p=0.000. The findings suggest there is a difference view between all the three (3) case studies. Bandar Rimbayu has the highest sufficiency in street and park lighting followed by Ken Rimba and Sunway Resort City.

For Q8.3 To what extent this neighborhood or your house generate energy or use renewable energy? i.e. solar pv, wind energy or any type Renewable Energy?? An analysis of variance showed that the effect of POEM for SND on Q8.2 was **not significant,** F (2,375) = 0.42, p=0.657. The outcome suggest similarity in opinion where this criteria mean value is between 2.76 – 2.85.

For Q8.4 do you or your community practice or put an effort in reducing water use or recycling waste water and to what extent? An analysis of variance showed that the effect of POEM for SND on Q8.4 was **significant,** F (2,375) = 4.27, p=0.015. Based on the findings there is a difference in an opinion on water efficiency criteria where Sunway Resort City has the highest mean value followed by Ken Rimba and Bandar Rimbayu.

For Q8.5 is there any biodiversity reserve such as forest reserve, wildlife reserve, river reserve or wetland in your neighborhood? An analysis of variance showed that the effect of POEM for SND on Q8.5 was **significant,** F (2,375) = 39.52, p=0.00. The findings suggest there is a difference view between all the three (3) case studies. Bandar Rimbayu has the highest biodiversity reserved followed by Sunway Resort City and Ken Rimba.

For Q8.6 does this neighborhood experience flash flooding or drainage clogging and

how frequent it is? An analysis of variance showed that the effect of POEM for SND on Q8.6 was **not significant**, F (2,375) = 0.05, p=0.65. The outcome suggest similarity in opinion where this criteria mean value is between 3.42 – 3.46.

For Q8.7 does this neighborhood have a good infrastructure services? I.e. sewage treatments, power supply, water supply, telecommunications, etc... An analysis of variance showed that the effect of POEM for SND on Q8.7 was **significant**, F (2,375) = 7.87, p=0.00. Based on the findings there is a difference in an opinion where Bandar Rimbayu respondents has the highest mean value followed by Ken Rimba and Sunway Resort City.

For Q8.8 does this neighborhood experience light, noise or any form of pollution? An analysis of variance showed that the effect of POEM for SND on Q8.8 was **significant**, F (2,375) = 7.25, p=0.001. The outcome suggest dissimilarity in opinion of this criteria, Bandar Rimbayu is the least polluted neighborhood, followed by Ken Rimba and Sunway Resort City.

For Q8.9 does this neighborhood have sufficient common greenspaces? i.e. playground, recreational lake, public park, community garden, etc.. An analysis of variance showed that the effect of POEM for SND on Q8.9 was **significant**, F (2,375) = 34.00, p=0.000. Based on the findings there is a difference in an opinion where Bandar Rimbayu respondents has the highest mean value followed by Ken Rimba and Sunway Resort City.

For Q8.10 do you think this neighborhood is highly dense populated or over developed? An analysis of variance showed that the effect of POEM for SND on Q8.10 was **significant**, F (2,375) = 5.04, p=0.007. The outcome suggest differences in opinion where Sunway Resort City is the most dense and developed, followed by Ken Rimba and Bandar Rimbayu.

For Q8.11 does amenities for community within your walking distance? i.e community center, place of worship, groceries, eateries, etc... An analysis of variance showed that the effect of POEM for SND on Q8.11 was **significant**, F (2,375) = 58.66, p=0.000. The outcome suggest differences in opinion where this criteria where Ken Rimba amenities is within walking distance, followed by Sunway Resort City and Bandar Rimbayu.

For Q8.12 does this neighborhood have universal accessibility / handicapped friendly facilities? An analysis of variance showed that the effect of POEM for SND on Q8.12 was significant, F (2,375) = 55.54, p=0.000. Based on the findings there is a difference in an opinion where Ken Rimba has the most universal/handicapped friendly facilities followed by Sunway Resort City and Bandar Rimbayu.

For Q8.13 do you think this neighborhood is secured? i.e crime free, no disturbance, well lighted...? An analysis of variance showed that the effect of POEM for SND on Q8.13 was **significant**, F (2,375) = 41.56, p=0.000. The outcome suggest dissimilarity in opinion of this criteria, Bandar Rimbayu is the most secured neighborhood, followed by Ken Rimba and Sunway Resort City.

For Q8.14 does this neighborhood's planning & design concerns itself with public health? i.e dengue fever cases or other waterborne diseases, industrial pollution, waste discharge, etc...? An analysis of variance showed that the effect of POEM for SND on Q8.14 was significant, F (2,375) = 7.46, p=0.001. Its mean a differences in opinion, Bandar Rimbayu have the most concerns on public health issues, followed by Sunway Resort City and Ken Rimba.

For Q8.15 does this neighborhood have recycling facilities and practice waste separation? An analysis of variance showed that the effect of POEM for SND on Q8.15 was significant, F (2,375) = 9.94, p=0.000. The finding suggest opinion difference, Bandar Rimbayu have better recycling facilities and practices, followed by Sunway Resort City and Ken Rimba.

For Q8.16 is this neighborhood's community diversified in term of mixed income groups or backgrounds? An analysis of variance showed that the effect of POEM for SND on Q8.16 was **not significant**, F (2,375) = 0.86, p=0.423. The outcome suggest similarity in opinion of this criteria by all the three (3) case studies.

For Q8.17 does this neighborhood have a good community participation and maintenance in sustainable practice? i.e. active dialogue with developers, existing community within vicinity, etc.. An analysis of variance showed that the effect of POEM for SND on Q8.17 was **significant**, F (2,375) = 15.85, p=0.000. Its suggest differences in opinion, Bandar Rimbayu have the best community sustainable practices, followed by Sunway Resort City and Ken Rimba.

For Q8.18 if you are not using your private transport to commute, is the public

transports system reliable and convenient in this neighborhood? An analysis of variance showed that the effect of POEM for SND on Q8.18 was significant, F (2,375) = 19.34, p=0.00. The outcome suggest dissimilarity in opinion of this criteria, Sunway Resort City have more reliable and convenient public transportation, followed by Ken Rimba and Bandar Rimbayu.

For Q8.19 does this neighborhood have a sufficient pedestrian and cycling network? An analysis of variance showed that the effect of POEM for SND on Q8.19 was significant, F (2,375) = 38.70, p=0.000. The outcome suggest differences in opinion where Sunway Resort City is the most sufficient, followed by Ken Rimba and Bandar Rimbayu.

For Q8.20 Do you know the materials used in building and infrastructures in this neighborhood is low impact (green or sustainable) and available locally? Based on your opinion or as explained by the developers. An analysis of variance showed that the effect of POEM for SND on Q8.20 was **significant**, F (2,375) = 3.80, p=0.023. The finding suggest differences in opinion where Bandar Rimbayu have the most low impact and regional materials, followed by Sunway Resort City and Ken Rimba.

For Q8.21 does the quality of property/premises in this neighborhood promote sustainable construction? Based on your opinion or as explained by the developers. An analysis of variance showed that the effect of POEM for SND on Q8.21 was **significant**, F (2,375) = 44.60, p=0.000. The outcome suggest dissimilarity in opinion of this criteria, Bandar Rimbayu have more promotion on quality of sustainable construction, followed by Sunway Resort City and Ken Rimba.

For Q8.22 is there any traces of construction waste, sedimentation or any kind of debris when you move into this neighborhood? An analysis of variance showed that the effect of POEM for SND on Q8.22 was **significant**, F (2,375) = 47.94, p=0.000. The finding show opinion differences, Bandar Rimbayu has the lowest leftover waste/sedimentation/debris upon occupancy, followed by Ken Rimba and Sunway Resort City.

For Q8.23 do you own a business here or work within this neighborhood? An analysis of variance showed that the effect of POEM for SND on Q8.23 was **significant**, F (2,375) = 4.18, p=0.016. The outcome suggest dissimilarity in opinion of this criteria,

Sunway Resort City have the highest rate of respondents who own a business or work within the neighborhood, followed by Bandar Rimbayu and Ken Rimba.

For Q8.24 does this neighborhood have a proper and sufficient commercial area? i.e. shops, banks, leisure & entertainment, etc.. An analysis of variance showed that the effect of POEM for SND on Q8.24 was **significant**, F (2,375) = 5.61, p=0.004. Its suggest differences in opinion, Sunway Resort City have the sufficient commercial area, followed by Bandar Rimbayu and Ken Rimba.

For Q8.25 As part of community in this neighborhood, do you find this neighborhood development is innovative in adapting sustainable development? i.e., economic, social and environmentally? An analysis of variance showed that the effect of POEM for SND on Q8.25 was **significant**, F (2,375) = 72.92, p=0.000. The outcome also suggest dissimilarity in opinion of this criteria, Sunway Resort City is the most innovative in sustainable development, followed by Bandar Rimbayu and Ken Rimba.

Based on the One way ANOVA conducted all the POEM evaluation criteria are **significant** where the value of $p< 0.05$ hence suggested diverse opinion view, except for evaluation criteria of Q8.3, Q8.6 and Q8.16 where the value of $p> 0.05$ which mean **not significant** or show similarity in opinion.

5.2 Descriptions of POEM

As mentioned in Chapter 1, the research findings and output of this thesis is POEM Handbook for Sustainable Neighborhood Development (SND). This sub-chapter is to provide the findings of the RO1 and RQ1 which explain POEM and its descriptive on-site testing procedures that were followed throughout the POEM Handbook evaluation exercise.

This comprises the new post occupancy evaluation scoring and rating approach in order to assess the certified neighborhood development based on the contents and criteria of the proposed POEM for SND. This chapter will describe the three selected case studies that were examined and evaluated using POEM Handbook in order to find out the sustainability level rating upon occupancy for a more than 1 year. Alas, it is aims to obtain whether the certified neighborhood fulfilled the sustainability level as what it is perceived during pre-occupancy stage via POEM Handbook through end-users/households post-occupancy experience. Besides the post-occupancy assessments

of the certified sustainable neighborhood, POEM Handbook is also intended to gather demographic data of the respondents who are the end-users/households of the said selected case studies.

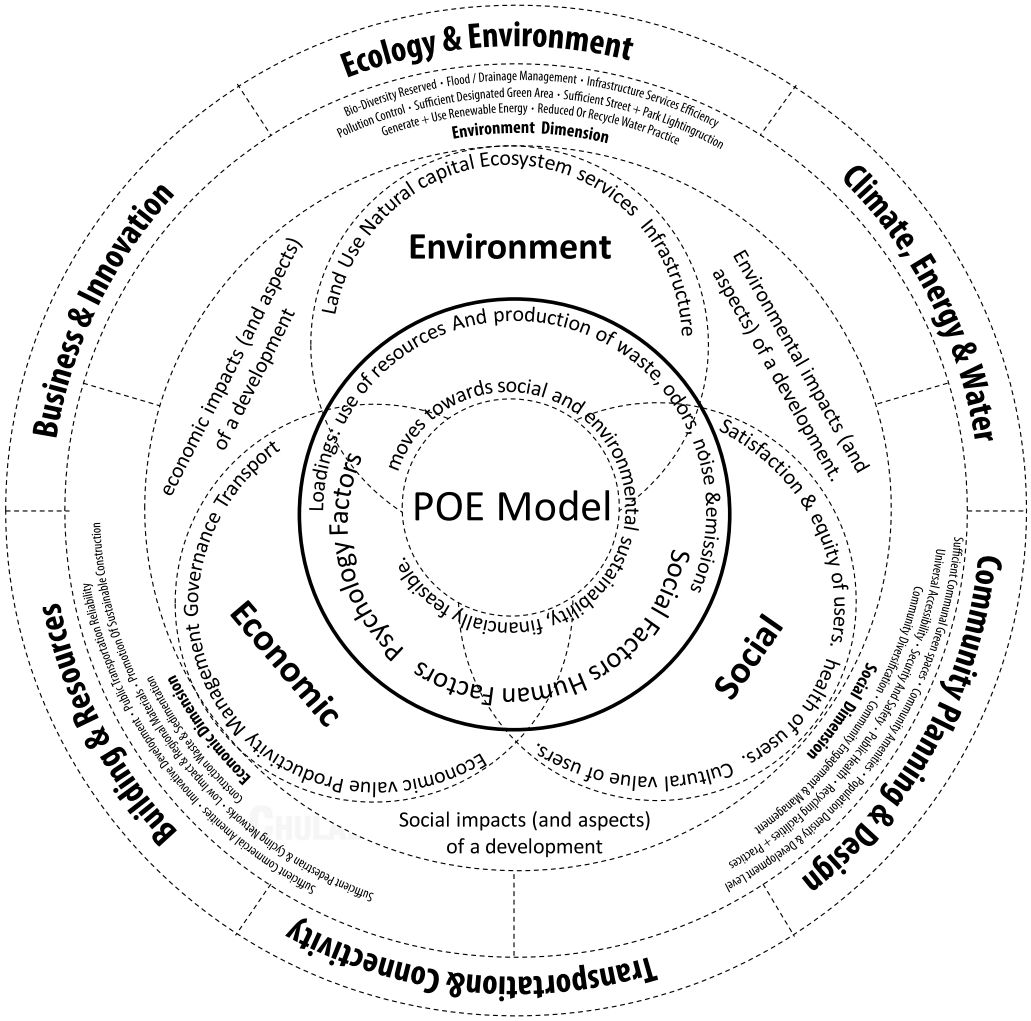


Figure75: The proposed POEM for sustainable neighborhood development based on Stakeholders Inclusion Approach reviews.

Source: Author

In achieving the comparative sustainable comparative level upon occupancy of certified sustainable neighborhood, this study has come-out a scoring and rating system, which was mainly based on the results and weighting system obtained through the phase 2 Stakeholders Inclusion Approach on SDP adaptations in Township Assessment sub-criteria. After the scoring and rating system was simplified and established, a full testing

of the proposed POEM Handbook assessment was conducted to three selected case studies mentioned. The following sub-chapters detailed out the procedure of the POEM Handbook process.

5.2.1 Procedures, Scoring & Rating of POEM Handbook for SND

This POEM Handbook for Sustainable Neighborhood Development outlines the purpose and process of the Post Occupancy Evaluation Model (POEM) for Certified Green Neighborhood from the perspective of an end-users/households undertaking the POEM evaluation process.

5.2.2 Purpose of POEM

The POEM Evaluation methodology was developed to find out end-users/households evaluation of certified green neighborhood and it's criteria that take place at least a minimum one years after the occupation of the neighborhood. The POEM Evaluation methodology supports the GBI Green Township Assessment Criteria – (GBI Township Tool v1, 2011), which is widely used green township assessment criteria in Malaysia.
The purpose of a POEM Evaluation is to:
1. Review actual/assessed certified neighborhood outcomes against vision outcomes;
2. Disseminate awareness to end-users/households;
3. Inform future review decisions/actions.

POEM Evaluation is not intended to be a certification compliance procedure. The methodology outlined in the POEM Evaluation Guideline was developed as a systematic approach to comparing certified neighborhood outcomes against vision outcomes. The application of POEM evaluation process may improve the assessment and certification of future green neighborhood development projects. The POEM evaluation, for example, when looking at social dimension issues such as functional relationships between the developers and homeowners, always does so in relation to the contribution the neighborhood planning and community activities make to the goals of the sustainable neighborhood i.e. the support of community thrust activities.
The 'evaluator' implementing a POEM evaluation process collects and analyze neighborhood end-users'/households' opinions and perceptions, into study

recommendations for future improvement of green neighborhood assessment criteria and certification procedures. Quantitative data is required to evaluate end-users/households opinions towards the occupied certified green neighborhood. Qualitative data is needed to understand the nature and circumstances of the anticipated and attained outcomes. The POEM evaluation is used to evaluate the sustainable level outcomes upon occupancy based on sustainable dimension pillars (SDP) adaptations on certification assessment criteria of Certified Green Neighborhood (CGN).

5.2.3 POEM Evaluation Information

The conceptual model of the POEM (Figure 75) development process derived from the green township assessment core-criteria outlined in GBI Green Township Tools V1, 2011. This model signifies the contents and required key information for the development of a POEM. The assessment core criteria and sub criteria is simplified and summarized in order to adept end-users/households comprehension on POEM evaluation criteria (Table 35). The process is to find out the sustainability level of certified green neighborhood range criteria scores and award category compared to the actual end-users'/households' opinions and perceptions. This outcome is the fundamental of the POEM evaluation process.

There are five phases in completing a POEM Evaluation as shown in the diagram of Figure 76;

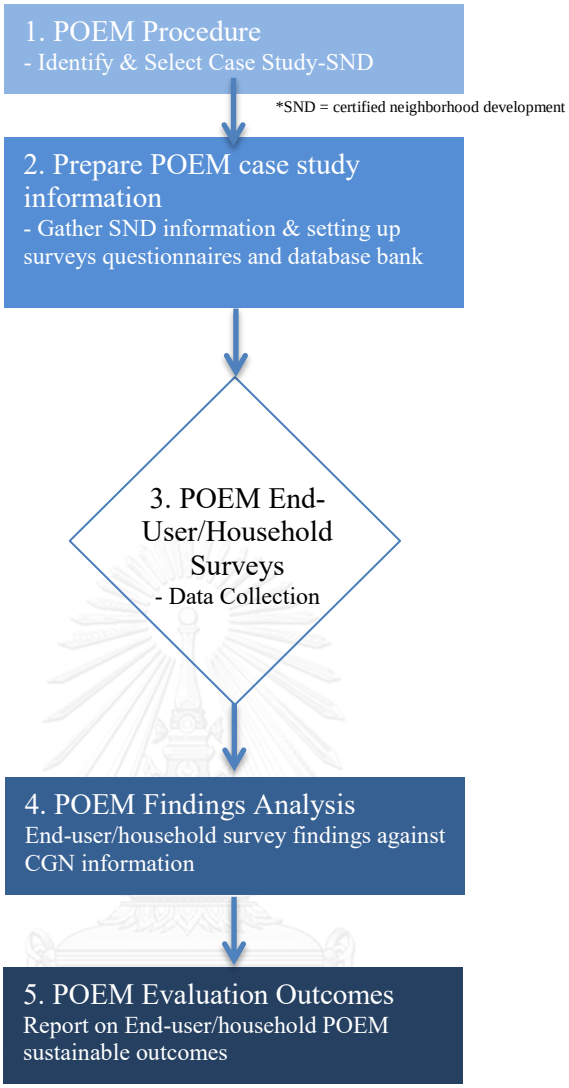


Figure76: Phases of POEM Evaluation Processes.
Source: Author

Sampling Size for POEM Handbook

A POEM Handbook evaluation should be as broadly as possible. The nomination of evaluators and selection of respondents in this POEM evaluation will depend on the agreed intent and investigation level required for this exercise. CGN POEM evaluation focuses on sustainable neighborhood development evaluation, surveys should be conducted to equal numbers of homeowners, tenants and workers for a reliable outcomes. These participants will generally view the evaluation from different perspectives and these will vary from the view of a single respondents group. The number of respondents for study is varies and depending on the number of household

units of the selected CGN.

Issues for consideration

Respondents should always be voluntary and with informed consent.

When selecting respondents for the evaluation, the following issues should be consider:

• Ability to understand and aware on sustainable green neighborhood or sustainable dimension pillar especially in supporting criteria of social, environment and economic amenities, facilities and practices.

• Experience and time spent living/working in the CGN being evaluated. New end-users/households may not have sufficient experience to provide surveys commentary.

5.2.4 POEM Evaluation Survey Components

The Stakeholders-Inclusion Approach POEM Handbook Evaluation Survey has been developed through an Expert's Semi-Structured Interviews and Surveys; Professional Stakeholders Surveys and 3 selected CGN case study process and are based on the GBI Township Assessment Criteria Tools V1, 2011. The Survey template is included as Appendix 1: Stakeholders-Inclusion Approach End-User/Household Survey Form. The Survey consists of 3 parts:

Introduction

This contains an outline of the purpose, an introduction to the survey tasks, an Invitation Letter to Participate in this Stakeholders-Inclusion Approach Surveys which stated the aims, the focus, the required information and the methods of analysis of POEM Evaluation and a Research Undertaking Letter that clearly stated the researcher organization background, the purpose of conducting the research and for what outcome.

Part 1 - Respondent Background

This includes some basic information on Demographic data and contact information of the respondents. This shall include the information of respondents name, the certified neighborhood that been evaluated, designation of the respondents, and contact information such as email address and telephone number.

Scope of study

Scope of study nominated by the research organization that the evaluator should be report on. This will include the background introduction of the study, the operational definitions of the case study, the criteria of the evaluation process and the contributions of the evaluation.

Part 2 – End-Users/Households Role, Understanding & Awareness

End-users'/Households' role, understanding and awareness on sustainable dimension pillars, neighborhood assessment criteria and certified green neighborhood in general. The further information that should be gather include the end-users'/household' decision in purchasing or staying in the neighborhood, planned length of stay and justification on those decision.

Part 3 – End-Users/Households Evaluation Criteria Surveys

End-users'/Households' surveys questionnaires which to obtained their opinions on sustainable features, facilities and practices of occupied certified green neighborhood based on POEM Evaluation criteria as shown in Table 36.

5.2.6 POEM Evaluation Findings Analysis

The fourth process in Stakeholders-Inclusion Approach POEM evaluation is to analyze the gathered data and information. The evaluator will administer and manage the POEM Evaluation findings analysis. For manual face to face surveys, the evaluator will key in the data entry into database in Google Docs while for online form, the quantitative score percentage will be analyzed automatically by Google Docs.

For Part 1 – Respondents Background, evaluator can extract and list the respondents and contact information to be compiled in the POEM Evaluation Outcome Report.

Part 2 – End-Users/Households Role, Understanding & Awareness in on sustainable dimension pillars, neighborhood assessment criteria and certified green neighborhood in general. Evaluator can extract the findings from analyzed responses from the database bank (Google Docs or similar online application). The further information within Part 2 that evaluator gathered include the end-users'/household' decision in

purchasing or staying in the neighborhood, planned length of stay and justification on those decision. All these analyzed data and information is to be compiled in the POEM Evaluation Report.

5.2.7 POEM Scoring & Rating

This sub-chapters explains how the rating of the POEM Handbook of sustainable neighborhood development is calculated, in order to employ it to the selected three case studies. There are few number of constituents that establish the rating of this POEM handbook; the list as follows:

- Post Occupancy Evaluation Model (POEM) rating benchmarks.
- POEM weightings based on the outcome of phase2 SDP Adaptations.
- POEM available credits for each SDP and evaluation criterion.
- POEM achieved credits for each SDP and evaluation criterion.

Each of these constituents will be explained in the following sub-sections. This is followed by a section on direction of how POEM rating calculation is done. Then, there is a section explaining the SDP reference on each dimension evaluation criterion that need to be describe in order to guide the award of available credits.

POEM Rating Benchmarks

The benchmarks for POEM rating are as outlined in Table 34, which illustrates the score, rating description for each achievable level based on the proposed POEM for sustainable neighborhood development. The benchmark of rating systems was based on the content review of GBI Malaysia Township Assessment Criteria in particular, and also from widely-known other frameworks for neighborhood / township / city sustainable development which was discussed in detail in chapter 2: Literature Review (LEED for Neighborhood Development, BREEAM for Communities, CASBEE for Urban Development, HK BEAM Hong Kong, HQE France, DGNB Germany, Green Stars Australia and BCA Green Mark Singapore).

Table 34: POEM Evaluation Classification Ratings:
Source: Author

Scores	POEM-Ratings	Descriptions
86 to 100 TD-CA	Platinum	Beyond outstanding criteria ratings of POEM for Sustainable Neighborhood
76 to 85 TD-CA	Gold	Outstanding criteria ratings of POEM for Sustainable Neighborhood
66 to 75 TD-CA	Silver	Good criteria ratings POEM for Sustainable Neighborhood
50 to 65 TD-CA	Certified	Fulfilled minimum criteria of POEM for Sustainable Neighborhood
Below 50 TD-CA	-	Failed to fulfilled minimum criteria of POEM for Sustainable Neighborhood

In this study, the research problem argued whether the existing GBI Township Assessment Criteria and certified urban neighborhood development project fulfilled the performance, effectiveness and sustainability level according to dimensions Pillars of Sustainability based on end-user's experiences upon occupancy. In other terms, certified sustainable neighborhood development and communities should achieve in par or more than pre occupancy score of the total score in POEM for SND in order to achieve a Pass or Fulfill rating.

POEM Score Weightings

The score methods of the proposed POEM Handbook was determined based on the balanced weightings of SDP adaptations and evaluation criteria of the model obtained through the application phase 2 Stakeholders Inclusion Approach. Table 35 outlines the comparative weightings for each itemized criteria and category of Township Assessment Criteria against POEM Evaluation Criteria. It illustrates the core category of pre-occupancy Township Assessment Criteria against post-occupancy simplified end-users/households evaluation criteria. These convert simplifications of POEM end-users/households evaluation criteria is based on phase 1 Stakeholders Inclusion Approach: Experts Semi-Structure Interviews/Survey's findings, besides it fosters awareness and nurtures education on sustainable neighborhood development to general stakeholders in particular the end-users.

Table 35: Comparative Table of Township Assessment Sub Criteria against POEM End-Users/Households Evaluation Criteria.
Source: Author

GBI Township Assessment Core + Sub Criteria				POEM End-Users/Households Evaluation Criteria		
criteria	item	sco	tot	item	sco	tot
CEW	**CLIMATE, ENERGY & WATER**		20	Sufficient designated green area	1-5	20
CEW1	Heat Island Design Principles	4				
CEW2	Efficient Street And Park Lighting	2		Sufficient street or park lighting	1-5	
CEW3	On-Site Energy Generation	2		Generate or use renewable energy	1-5	
CEW4	Renewable Energy	4				
CEW5	Reduced Water Use	4		Reduced or recycle water	1-5	
CEW6	Reduction In Water Use By Waste Water Treatment	4				
EEC	**ENVIRONMENTAL & ECOLOGY**		15	Bio-diversity reserved	1-5	20
EEC1	Biodiversity Conservation	2				
EEC2	Land Reuse	1				
EEC3	Ecology	3				
EEC4	Flood Management And Avoidance	1		Flood / drainage clogging	1-5	
EEC5	Wetland And Water Body Conservation	1				
EEC6	Agricultural Land Preserve	1				
EEC7	Hill Slope Development	1				
EEC8	Sustainable Storm water Design & Management	2				
EEC9	Proximity To Existing Infrastructure	1		Infrastructure services	1-5	
EEC10	Services Infrastructure Provision	1				
EEC11	Light Pollution	1		Pollution	1-5	
CPD	**COMUNITY PLANNING & DESIGN**		26	Sufficient communal greenspaces	1-5	45
CPD1	Greenspaces	3				
CPD2	Compact Development	1		Population density & development level	1-5	
CPD3	Amenities For Communities	3		Distance of community amenities	1-5	
CPD4	Provision For Universal Accessibility	3		Universal Accessibility	1-5	

GBI Township Assessment Core + Sub Criteria				POEM End-Users/Households Evaluation Criteria		
CPD5	Secure Design	2		Security Experience	1-5	
CPD6	Health In Design	2		Public health concerns	1-5	
CPD7	Recycling Facilities	2		Recycling facilities or practices	1-5	
CPD8	Community Diversity	1		Community diversification	1-5	
CPD9	Affordable Housing	1				
CPD10	Community Thrust	4		Community engagement	1-5	
CPD11	Governance	4				
TRC	**TRANSPORTATION & CONNECTIVITY**		14	Public transport reliability	1-5	10
TRC1	Green Transport Masterplan	8				
TRC2	Availability And Frequency Of Public Transport	1				
TRC3	Facilities For Public Transportation	1				
TRC4	Pedestrian Networks	1		Sufficient pedestrian & cycling networks	1-5	
TRC5	Cycling Networks	2				
TRC6	Alternative Transport Options	1				
BDR	**BUILDING & RESOURCES**		15	Low impact & regional materials	1-5	15
BDR1	Low Impact Material (Infrastructure)	1				
BDR2	Low Impact Material (Buildings Or Structures)	1				
BDR3	Regional Material	1				
BDR4	Quality In Construction	1		Promotion of sustainable construction	1-5	
BDR5	Construction Waste Management	1		Construction waste & sedimentation	1-5	
BDR6	Site Sedimentation And Pollution Control	1				
BDR7	Sustainable Construction Practice	2				
BDR8	Gbi Certified Building	6				
BSI	**BUSINESS & INNOVATION**		10	Sufficient commercial amenities	1-5	10
BSI1	business	3				
BSI2	innovation	6		Innovative development	1-5	
BSI3	gbi facilitator	1				
	TOTAL POINTS		100	TOTAL POINTS		120

POEM Available Score Credits

Parallel to the pre-occupancy evaluation of sustainable township assessment criteria frameworks, for the case in Malaysia which used GBI Township Assessment Criteria V.1.1, this study has applied a systematic methodology for calculating the POEM available score credits. The available score credits is equally divided based on a balanced SDP Adaptations criteria in each dimension that have been consensus consented by professional stakeholders through phase 2 Stakeholders Inclusion Approach. Each POEM evaluation criterion within the proposed handbook will be equal to 1-5 available score credits due to balanced SDP Adaptations notion of the proposed POEM and because of the fact that every measurable criterion is simplified enough since the post-occupancy respondents is targeted to end-users/households. In other terms, the total of available score credits will be based on an equal number of SDP dimensions and evaluation criteria that compose the proposed POEM framework. Hence, this resultants to the total of available score credits is 120 as shown in Table 36.

Table 36: POEM Evaluation Criteria towards Balanced SDP Adaptations.
Source: Author

POEM End-Users/Households Evaluation Criteria Vs SDP Adaptations				
Item	Criteria	Description	Score	Total
Environment Dimension Pillar				
1	EnP Q1	Sufficient Designated Green Area	1-5	
2	EnP Q2	Sufficient Street Or Park Lighting	1-5	
3	EnP Q3	Generate Or Use Renewable Energy	1-5	
4	EnP Q4	Reduced Or Recycle Water Practice	1-5	40
5	EnP Q5	Bio-Diversity Reserved Availability	1-5	
6	EnP Q6	Flood / Drainage Clogging Experience	1-5	
7	EnP Q7	Infrastructure Services Efficiency	1-5	
8	EnP Q8	Pollution Control & Experience	1-5	
Social Dimension Pillar				
1	SoP Q1	Sufficient Communal Greenspaces	1-5	40
2	SoP Q2	Population Density & Development Level	1-5	

3	SoP Q3	Universal Accessibility Availability	1-5	
4	SoP Q4	Security And Safety Experience	1-5	
5	SoP Q5	Public Health Concerns	1-5	
6	SoP Q6	Recycling Facilities Or Practices	1-5	
7	SoP Q7	Community Diversification	1-5	
8	SoP Q8	Community Engagement & Management	1-5	
Economic Dimension Pillar				
1	EcP Q1	Distance To Community Amenities	1-5	
2	EcP Q2	Public Transport Reliability	1-5	
3	EcP Q3	Sufficient Pedestrian & Cycling Networks	1-5	
4	EcP Q4	Low Impact & Regional Materials	1-5	40
5	EcP Q5	Promotion Of Sustainable Construction	1-5	
6	EcP Q6	Construction Waste & Sedimentation	1-5	
7	EcP Q7	Sufficient Commercial Amenities	1-5	
8	EcP Q8	Innovative Development	1-5	
TOTAL POINTS				**120**

POEM Scored Credits

The methods for computing the scored credits and POEM total rating are based on the steps below. These can be summarized in the following points:

- The available credits for each dimension will be calculated based on the number of criteria that have been achieved in accordance with the scoring nominated by end-users/household post-occupancy experience.
- For each POEM SDP dimension the total score achieved be added together to give the overall score achieved in the dimension.
- The method of calculating the individual respondents dimension score achieved is by dividing the total scored credits by the total credits available multiplied by the weighting, as shown by the following equation:

$$\frac{Sc\_CR}{Av\_CR} \times W\ (100\%) = D\_SA$$

Sc_CR: Individual Scored Credits

Av_Cr: Available Credits

W: Weighting

D_SA: Dimension Scored Achieved

- To summarized up the total respondents dimension score achieved (tD_SA) is

by the summation of total respondents dimension score credits (tSc_CR) divide the total sampling (N), as shown by the following equation:

$$\frac{tSc\_CR}{N} = tD\_SA$$

tSc_CR: total respondents Scored Credits

N: total respondents

tD_SA: total Dimension Scored Achieved

- Lastly, the total Dimensions Scored Achieved are compared with the POEM Benchmarks Rating which was previously illustrated in Table 34. To determine the POEM Evaluation Classification Rating, Table 37 is a shown example of how the total respondents Dimensions Scored Achieved is calculated.

Table 37: Example of POEM Scoring Calculation Master Sheet.
Source: Author

POEM Scoring Calculation Master Sheet.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Environment Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EnP Q1	Sufficient Designated Green Area	1-5(n)	3
2	EnP Q2	Sufficient Street Or Park Lighting	1-5(n)	3
3	EnP Q3	Generate Or Use Renewable Energy	1-5(n)	3
4	EnP Q4	Reduced Or Recycle Water Practice	1-5(n)	3
5	EnP Q5	Bio-Diversity Reserved Availability	1-5(n)	3
6	EnP Q6	Flood / Drainage Clogging Experience	1-5(n)	3
7	EnP Q7	Infrastructure Services Efficiency	1-5(n)	3
8	EnP Q8	Pollution Control & Experience	1-5(n)	3
		Dimension Av-Cr / Sc-Cr	40(n)	24

Social Dimension Pillar			Av-Cr	Sc-Cr
1	SoP Q1	Sufficient Communal Greenspaces	1-5(n)	3
2	SoP Q2	Population Density & Development Level	1-5(n)	3
3	SoP Q3	Universal Accessibility Availability	1-5(n)	3
4	SoP Q4	Security And Safety Experience	1-5(n)	3
5	SoP Q5	Public Health Concerns	1-5(n)	3
6	SoP Q6	Recycling Facilities Or Practices	1-5(n)	3
7	SoP Q7	Community Diversification	1-5(n)	3
8	SoP Q8	Community Engagement & Management	1-5(n)	3
		Dimension Av-Cr / Sc-Cr	40(n)	24
Economic Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EcP Q1	Distance To Community Amenities	1-5(n)	3
2	EcP Q2	Public Transport Reliability	1-5(n)	3
3	EcP Q3	Sufficient Pedestrian & Cycling Networks	1-5(n)	3
4	EcP Q4	Low Impact & Regional Materials	1-5(n)	3
5	EcP Q5	Promotion Of Sustainable Construction	1-5(n)	3
6	EcP Q6	Construction Waste & Sedimentation	1-5(n)	3
7	EcP Q7	Sufficient Commercial Amenities	1-5(n)	3
8	EcP Q8	Innovative Development	1-5(n)	3
		Dimension Av-Cr / Sc-Cr	40(n)	24
		Total Dimension Av-Cr / Sc-Cr	120(n)	72
		Sc-Cr (72) / Av-Cr (120) x Weighting (100%)		60%
		Dimension Scored Achieved		**60**

In order to find out the achievement level of post-occupancy evaluation based on end-users/households compared to pre-occupancy certification status of the sustainable neighborhood, this study used a five-point measures scale system for awarding the scored achieved. This five-point scaling system is measured as follows:

1 Av-Cr = Very Less Adapted / Sufficient

2 Av-Cr = Less Adapted / Sufficient

3 Av-Cr = Neutral, neither High nor Less Adapted / Sufficient

4 Av-Cr = High Adapted / Sufficient

5 Av-Cr = Very High Adapted / Sufficient

5.3 Findings and Discussions of POEM

In the first section of Phase 1 Stakeholders Inclusion Approach, majority of experts consented that sustainable development in Klang Valley/Greater KL is progressive and required enhancement. Hence, this finding accord with the problem statement of the

study whereby it is timely to assess and gauge the current GBI Certified Sustainable Neighborhood and GBI Township Assessment Criteria using POEM for further improvement. The majority of experts also opinion out that the current certified township/neighborhood fulfilled the sustainable dimension pillars (SDP) but there is a considerable gap in SDP fulfilment that need to be addressed. On the current GBI Township Tools that being used to assess certified township/neighborhood, the findings from experts suggested GBI Township Tools adapted the SDP but anyhow there is a missing SDP adaptations in the Tools that should be considered. Expert's further comments on current status of sustainable development in Klang Valley shows that most of experts think more awareness should be instilled in current sustainable development, followed by more implementation, more improvement, and more responsibilities to be taken of and lastly there should be more connectivity is current sustainable development. The statistical analysis for first section of phase 1 study shows that the mean values of the current sustainable development are in the range 5.34 and 5.40 while standard deviations is above 1 which means there is a varies consensus on the fulfilment and adaptation of SDP hence suggested possible gap in it.

The second section in Phase 1 study is on the contents of the proposed POEM. The majority of the experts are agreeable with the proposed POEM contents, Based on the findings all experts are in agreement with this proposed POEM, and small percentage suggest a minor improvement need to be addressed. The experts' opinion on extensiveness of contents which include the core assessment criteria, SDP and loading factors of the proposed POEM for sustainable neighborhood development (SND) suggested the proposed POEM for SND is about the right contents. On the further comments on proposed POEM, the experts commented it is comprehensive but required additional content or further explanation for improvement. The statistical analysis for second section of phase 1 study shows that the mean values of the proposed POEM 4.34 and 6.12. High mean value suggested expert's agreement with the contents of the proposed POEM and it are well developed. Standard deviations is below 1 value meaning the experts are at congruence and consensus on the proposed POEM.

For Phase 2 study, the professionals' stakeholder were asked for opinion of sustainability dimension pillars (SDP) adaptations in GBI Township Assessment sub-criteria. The main objective of this phase is gather data for SDP adaptations balanced

These basically will give a feedback on SDP balanced based on Phase 1 Expert's opinion of core-criteria and the findings is simplified to designed Phase 3 End-User/Household Surveys questionnaires. The professional stakeholders opinion out that in CEW- Climate, Energy & Water core-criteria environment dimension has the highest adaptation while social dimension is the lowest, EEC- Environmental & Ecology environment dimension score highest adaptation and economic dimension is the lowest, CPD- Community Planning & Design environment dimension scored the both highest and lowest adaptation values, TRC- Transportation & Connectivity environment dimension has highest adaptation value while economic dimension is the lowest, BRC- Building & Resources environment dimension is the highest adaptation value and social dimension is the lowest and BSI- Business & Innovation economic dimension is the highest value while environment dimension has lowest adaptation. The phase 2 findings suggested there is imbalance SDP adaptations, hence assessment criteria used in pre-occupancy might not fully fulfilled the sustainable neighborhood development upon occupancy. Further comments by professional stakeholders the assessment criteria and SDP adaptations is still lacking in term of awareness and education to all stakeholders in sustainable neighborhood development.

For Phase 3 study, the survey questionnaires is designed to rate the sustainability level of GBI certified neighborhood based on end-user/household's opinion. These end-users are key respondents in implementing POEM for sustainable neighborhood as it act as a main samples for validating and appraising the workability of POEM in selected GBI certified township. The selected GBI certified neighborhood are Ken Rimba Development, Bandar Rimbayu and Sunway Resort City. The end-users/households general understanding on sustainable neighborhood, sustainable dimension pillars and sustainable neighborhood development suggested the most well versed are the Bandar Rimbayu, followed by Sunway Resorts City and Ken Rimba respectively. The second section in Phase 3 survey questionnaires is to find out end-users/households opinion based on their experiences occupying certified sustainable neighborhood. Based on the findings, the POEM sustainability level value for Ken Rimba is between 1.75 to 3.77, Bandar Rimbayu is between 2.08 to 4.66 and Sunway Resort City is between 2.37 to 4.34. Thus, Bandar Rimbayu comparatively has the highest post occupancy sustainable level, followed by Sunway Resort City and lastly Ken Rimba. The lowest post

occupancy sustainable level values is criteria Q8.23 whether respondents own a business or working within the neighborhood, the findings suggested that most of the respondents either homeowners of tenants are not owning business or working within the neighborhood. The highest post occupancy sustainable level values is for criteria Q8.5 Is there any biodiversity reserve such as forest reserve, wildlife reserve, river reserve or wetland in your neighborhood? The findings suggested that Bandar Rimbayu has the largest biodiversity reserved followed by Sunway Resort City and Ken Rimba. The standard deviations for all comparative selected case studies are below 1, meaning all respondents in the three selected case studies are in congruence and consensus in responding to this study.

Figure 75 shows the proposed POEM after it has been apprised based on the findings obtained via the Stakeholders Inclusion Approach process particularly in Phase 1 and Phase 2. Ending of this discussion, this study concludes that the expert and professional stakeholders were in consensus regarding the contents of the proposed POEM for sustainable neighborhood development, and emphasized the significance of a balanced SDP adaptations being implemented in POEM criteria. The end-users/households stakeholders confirm that the implementation of the proposed POEM will support to assess and evaluate the post occupancy sustainable level of the certified sustainable neighborhood.

5.4 Conclusion of POEM

The purpose of this chapter was to present a thorough review of the Stakeholders Inclusion Approach analysis and findings. The main intention of this approach was to obtain all included stakeholders opinions ranging from experts who developed and regulated the assessment criteria, professionals who applied the sustainable criteria and end-users/households who occupied the sustainable neighborhoods regarding the usefulness, development and applicability of the proposed POEM for sustainable neighborhood development designed for the Klang Valley/Greater KL during this study. It is also aimed to appraise the feasibility of this POEM in terms of adequacy and clarity in addition to ensure that the POEM was reasonably solid.

In this study, the Stakeholders Inclusion Approach was used to obtain all stakeholders opinions in respect of the proposed POEM in order to meet the research questions: **How**

can the Post Occupancy Evaluation Model (POEM) be successfully developed and implemented? **What** are most significant sustainable urban framework criteria? **How** can these criteria be tested on the workability and implemented through urban development project? For the first **How** questions, The expert's stakeholders has reached a consensus on the necessity and suitability of the proposed POEM, as well as its contents and criteria, for post occupancy evaluation of a certified sustainable neighborhood development in the Klang Valley/Greater KL. For the **What** question, the professional stakeholders suggested a balanced SDP adaptations in developing criteria for POEM in order to achieve sustainable neighborhood upon occupancy. For the last **How** question, the end-users/households stakeholders demonstrated that SDP should be taken into account equally on the same level of the importance in order to achieve post occupancy sustainability for the certified neighborhood development. The overall average ratings of the phase 3 POEM criteria was significant, which means that there is consensus agreement between the respondents.

CHAPTER 6:

POEM IMPLEMENTATION (TEST & EVALUATION) IN CERTIFIED SND IN MALAYSIA

6.1. POEM Implementation

6.1.1 Introduction

This chapter will present the analysis, findings and discussion of the Research Objective 2 (RO2), Research Question 2 (RQ2) and Research Question 4 (RO4):

RO2: To implement POEM in assessing & evaluating GBI certified neighborhood towards sustainable urban development for Malaysia

RQ2: What are most significant sustainable urban framework criteria?

RQ4: How can these criteria be tested on the workability and implemented through urban development project?

The selection of case studies are the appropriate technique used to test a multi-dimensional model to see how well it might be applied for development and a tool for understanding and evaluating actual post-occupancy development projects (Turcotte & Geiser, 2010). The developed model of this study work is examined through three number of phases including structural equation modeling (SEM) in order to confirm that the proposed POEM is reasonably fit and considered satisfactory. The overall result outcomes and findings concluded through the application of Stakeholders Inclusion Approach methods and Structural Equation Modeling have emphasized the significance of the model due to various issues, problems and challenges that need to be comprehended and coped in an informed and cohesive manner.

Hence, the importance of the study for an effective sustainable post occupancy evaluation model is timely and parallel with the current development in Klang

Valley/Greater KL. In the phase 1 Stakeholders Inclusion Approach process, experts were quest to opinion out their views on the proposed POEM for sustainable neighborhood development and to what level such model contents and extensiveness can fit within the current certified township/neighborhood development in Klang Valley/Greater KL. As illustrated in Figure 99, the finalized proposed POEM framework have attained a consensus and significantly emphasized by the experts as discussed in the chapter five for post occupancy evaluation in the Klang Valley/Greater KL and in Malaysia generally. They have confirmed that the implementation of such model will assessed and evaluated the current occupied certified neighborhood and its assessment criteria towards a more sustainable future and at the same time create awareness and education to all involved stakeholders related. This expert's consensus has certainly emphasized the validity of POEM framework.

Thus, in order to gain reliability and validity of the applicability of the proposed POEM, this study needs to conduct tests for the proposed POEM Handbook. This was achieved through POEM framework evaluation via on-site context of selected certified sustainable neighborhood in Klang Valley/Greater KL. For this purpose, three selected case studies namely Ken Rimba Development, Bandar Rimbayu and Sunway Resort City were selected and then were assessed and evaluated through the procedures of the proposed POEM Handbook.

6.1.2 Implementing On-Site Assessment of POEM Handbook

In order to assess the proposed POEM Handbook and apply it to the on-site case studies, three certified sustainable neighborhoods developments have been selected for this study. As discussed earlier in chapter 4: Case Studies, these three certified sustainable neighborhoods developments are Ken Rimba, Bandar Rimbayu and Sunway Resort City. These case studies present three certified green neighborhoods with different narratives of how sustainable urban development were developed in the Klang Valley/Greater KL currently. Figure 77 shown these three selected case studies locations.

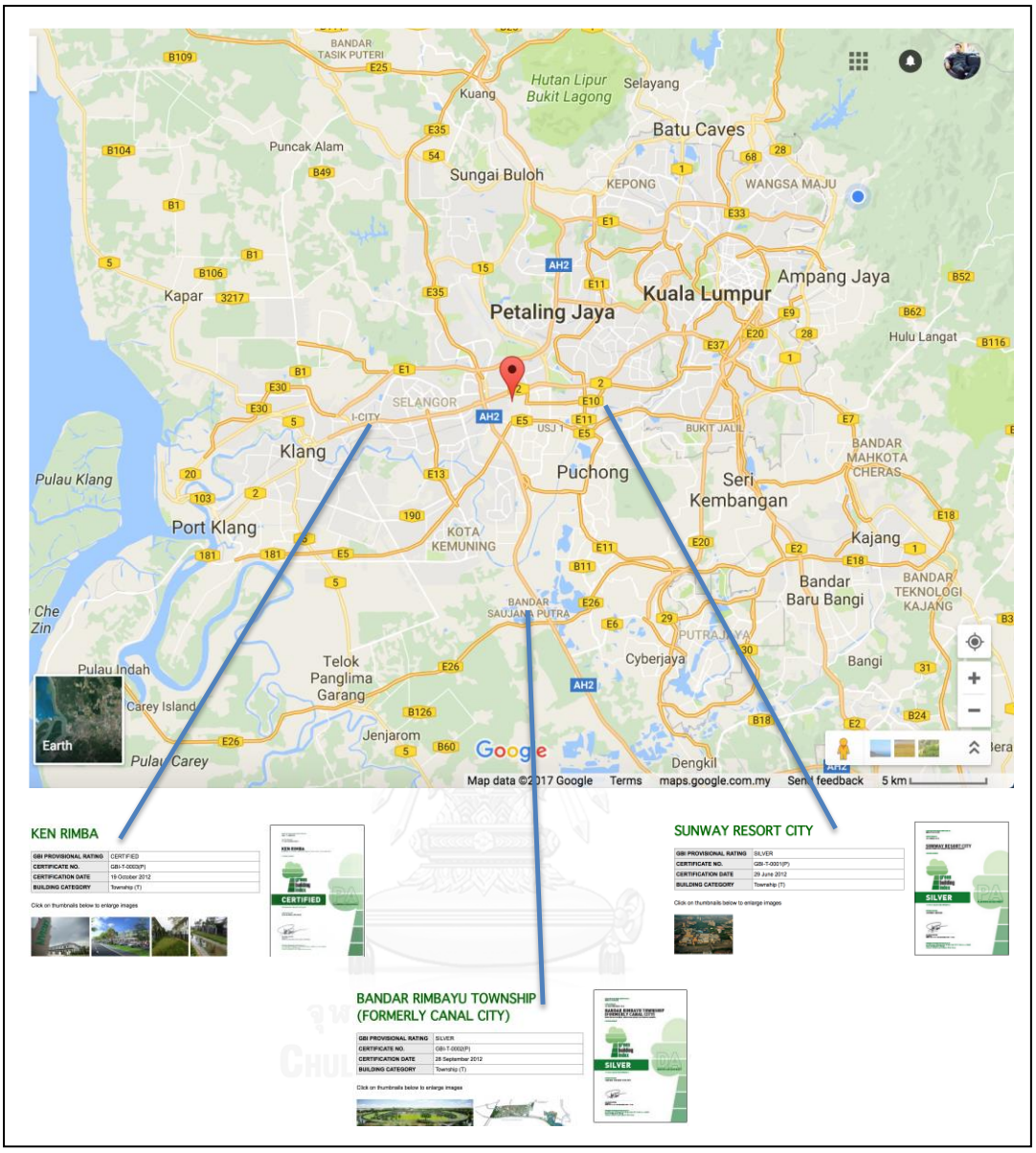


Figure77: Location of three selected case studies in the Klang Valley/Greater KL. Source: This Study (Maps from Google, 2017, Figures from GBI, 2016)

6.2 POEM Implementation (Test & Evaluation) Outcome

This sub-chapter will discuss the POEM implementation results based on the on-site test and evaluation at selected case studies discussed in Chapter 4.

6.2.1 POEM Handbook Findings of Ken Rimba Certified Green Neighborhood

The second process in Stakeholders-Inclusion Approach of POEM evaluation is gather information of selected case study. All related information to selected case study

particularly on the certification of green neighborhood is important as it will become the baseline comparison for the POEM end-users'/households' evaluation criteria findings outcome.

The gathered information required for the Ken Rimba is as listed below;

- Neighborhood Title and Address:
  Ken Rimba, Jalan Sungai Rasau, Rimba Jaya, 40200 Shah Alam, Selangor, Malaysia
- Neighborhood Description which summarize the general information especially description related to green features and facilities.
  KEN Rimba is the country's first green township. Utilizing many of KEN's building philosophies such as wind-flow orientation and breathable roof system, the properties are built for comfortable and energy efficient living. Successfully incorporating sustainable lifestyle into homes, the KEN Rimba properties have earned a host of local and regional awards in the green building arena. KEN Rimba is located in Shah Alam, and is easily accessible via the Federal Highway and the NKVE
- Contact Person details for evaluation process follow up
  - Not Available
- List of Professional Consultants involved in the development such as urban planners, architects, designers, landscape architects, engineers and other specialist such as EIA Consultant, Biodiversity Consultant, Horticulturalist and etc..
  - Not Available
- Local Approving Authority that approved and issued development order of the selected green neighborhood project.
  Majlis Bandaraya Shah Alam (Shah Alam City Council)
- Gross Development Area & Description which include percentage of different development category for example residential area, commercial area, industrial area, amenities and public facilities area, open greenspace and recreational area, utilities and infrastructure area and biodiversity reserved area.

-Not Available

- Certification Details, which describe the certification, body, certification category awards or rating scores, certification date and validity if available.

  Certification Achieved: Certified (PA)

  Certification Body: GBI Malaysia Sdn Bhd

  Certification Category: Township (GBI-T-0003(P)

  Certification Date: 19 October 2012

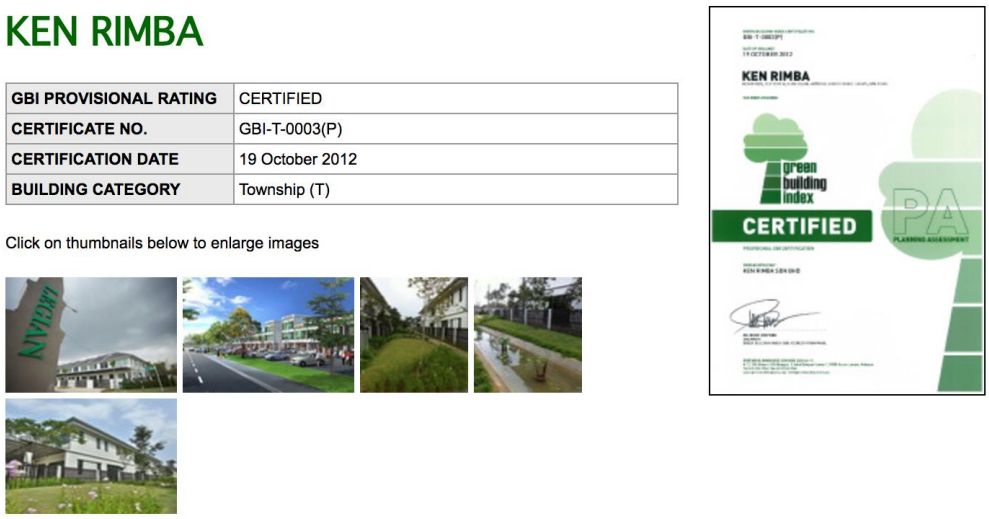


Figure78: Ken Rimba Neighborhood certification by GBI Malaysia.

Source: GBI, 2016

Respondent's Responses Information

Total Nos of Respondents: 122

Name: 122 Responses

Email Address: 90 Responses

Designation/Position: 118 Responses

Contact No.: 105 Responses

The POEM Handbook findings for End-Users/Households general opinion on SDP, Township Assessment Criteria and Certified Green Neighborhood is as shown in Figure 79 – Figure 85. For Q1, on the general understanding on sustainable / green neighborhood 60% of end-users/households do know or understand the subject

question, 38.5% think they are not sure and the balance of 1.5% didn't understand sustainable or green neighborhood (Figure 79).

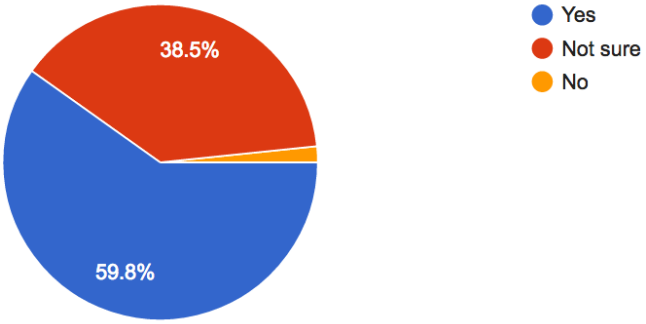


Figure79: POEM Handbook findings for Q1.

Source: Author

For Q2, on the awareness of sustainable dimension pillars (SDP), 35.2% of end-users/households do know or understand SDP, 57.4% think they are not sure what SDP is and the balance of 7.4% didn't know or aware of SDP (Figure 80).

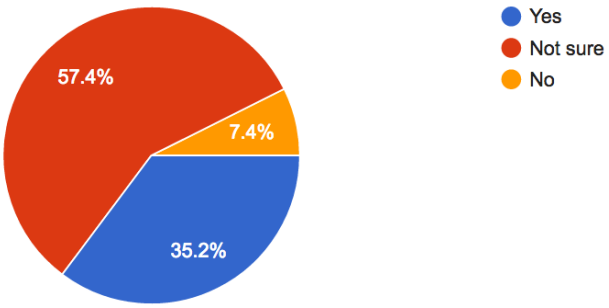


Figure80: POEM Handbook findings for Q2.

Source: Author

For Q3, end-users/households were ask whether they aware that the occupied neighborhood is certified as sustainable or green neighborhood, 38.1% of end-users/households know Ken Rimba is a certified neighborhood, 54.1% of respondents are not sure and the balance of 9.8% are not aware that their occupied neighborhood is a certified neighborhood (Figure 81).

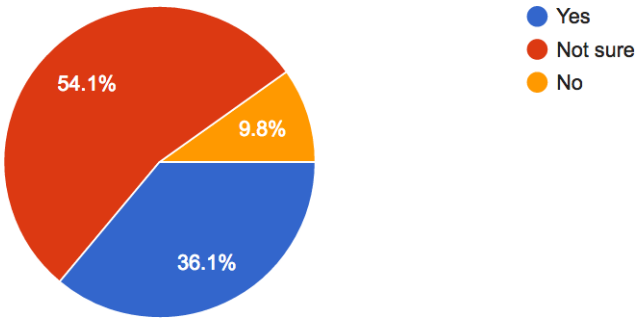


Figure81: POEM Handbook findings for Q3.

Source: Author

For Q4, end-users/households were ask whether they are the homeowner, or tenant, or workers in this neighborhood, 48.4% of end-users/households responses as a homeowner, 42.6% of respondents say that they are a tenant and the balance of 9% responded as a workers in the occupied neighborhood (Figure 82).

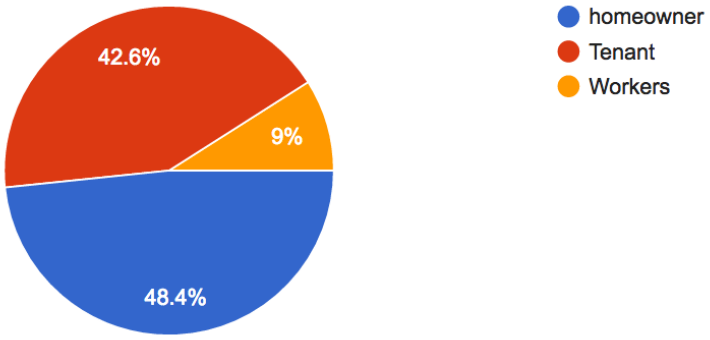


Figure82: POEM Handbook findings for Q4.

Source: Author

For Q5, end-users/households were ask on influences in their decision making on purchasing or staying on this neighborhood. For Q5 the respondents can choose more than one answer or write in other influences that the option given. The findings for Q5 shown that 84.4% of respondents think that location and accessibility is the main influence, followed by security 76.2%, price and cost 65.8%, sustainable/green label 46.7%, quality of the property 48.4%, amenities & facilities 47.5% and lastly design

appearance 45.9%. None of the respondents write in ‘other’ than the given option influences their decision making on purchasing or staying in this neighborhood (Figure 83).

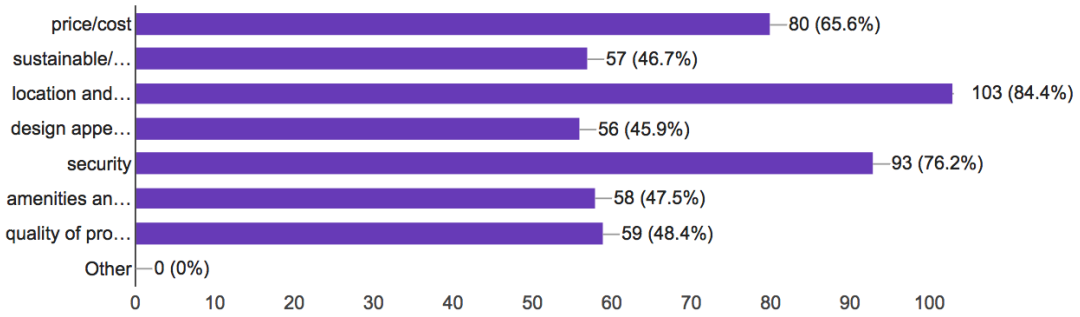


Figure83: POEM Handbook findings for Q5.

Source: Author

For Q6 and Q7, end-users/households were ask on their planning to stay for a long term/permanently in this neighborhood and ask to justify in Q7. For Q6 51.6% of respondents think that they will stay for a long-term/permanently in this neighborhood, 44.3% are not sure and the balance say they will not stay for long-term/permanently (Figure 84). For Q7 only 62 respondents answer this question, 15 respondents (12.3%) answer ‘not sure’, followed by because of the location and accessibility 5 respondents (5.1%), ‘yes’ 2 respondents (1.6%), ‘no” 2 respondents (1.6%), ‘not sure’ 2 respondents (1.6%) and the balance, each of 41 respondents (82.9%) justify the listed influences in Q5 as justification for staying in this neighborhood (Figure 85).

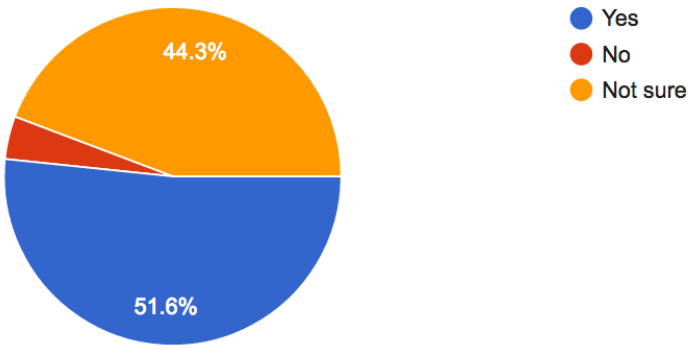


Figure84: POEM Handbook findings for Q6.

Source: Author

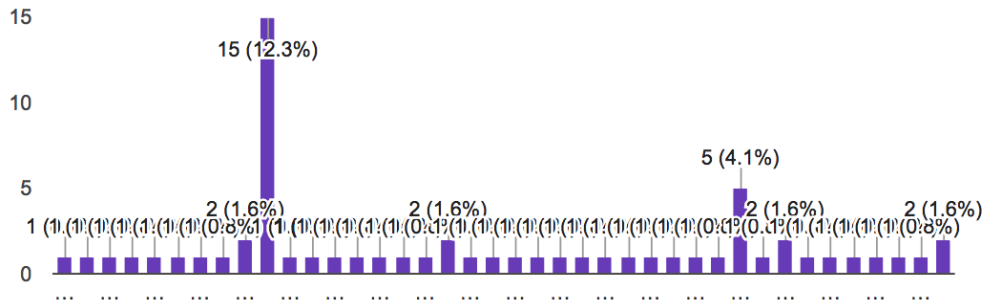


Figure85: POEM Handbook findings for Q7.

Source: Author

The POEM Handbook findings for End-Users/Households opinion on criteria for post-occupancy evaluation based on SDP dimensions is as shown in Table 38 –Table 40. Based on Table 41 the POEM evaluation criteria was categorized into three category, where Environment Dimension Pillar consist of 8 evaluation sub-criteria (EnP Q1- EnP Q8), Social Dimension Pillar consist of 8 evaluation sub-criteria (SoP Q1- SoP Q8) and Economic Dimension Pillar consist of 8 evaluation sub-criteria (EcP Q1- EcP Q8). The detail descriptions or the reference guide for each of these dimensions was discussed in earlier sub-sections. The final calculated score of environmental dimension for Ken Rimba neighborhood are based on the processes and procedures that were previously highlighted in Sub-chapter 5.2. Ken Rimba neighborhood has achieved 67.7% scored achieved. The dimension scored achieved of the environmental dimension pillar is presented in Table 38.

Based on Table 38, the certified sustainable neighborhood of Ken Rimba has one (1) low scored sub-criteria that related to environment dimension where EnP Q5 Bio-Diversity Reserved Availability (184/610) and EnP Flood/Drainage Clogging Experience Q6 (304/610) score is below 50% or failed to fulfilled POEM evaluation criteria. For certified score or 60% (305/610 to 396.5/610) of POEM Evaluation criteria, six (6) Ken Rimba environment dimension evaluation sub-criteria are within this range. These evaluation sub-criteria are EnP Q1 (311/610), EnP Q2 (316/610), EnP Q3 (315/610), EnP Q4 (319/610), EnP Q7 (368/610) and EnP Q8 (307/610). Meanwhile,

none of environment dimension sub-criteria is above certified or 60% (above 396.5/610).

This study argues that there is low consideration (based on EnP Q5 and EnP Q6 score) to the importance of bio-diversity and flood/drainage systems. Although this sub criteria represent high significance in Environment Dimension Pillar, there is low awareness in implementation by the developers in conserving or preserving bio-diversity and eco-system. In this POEM Handbook evaluation also find out that there is still a gap in improving green area, efficient public lighting, efficient energy & water practice and pollution control (based on EnP Q1, EnP Q2, EnP Q3, EnP Q4, EnP Q7 and EnP Q8 score).

Ken Rimba neighborhood development is lacking of bio-diversity reserved. There is none of the element mentioned in reference guide of EnP Q5 such as water bodies: -rivers, tributaries, streams, lake, ponds and reservoirs available or within this neighborhood. Even though there is greenery area in this neighborhood, but then it is not sufficient enough has been perceived by the end-users/households'. Another issue that required attention is hydrology management system, whereby this area is in the low area within the downstream of Klang River hence it is prone to flash flooding due to heavy precipitation.

Table 38: POEM Handbook EnP Dimension Score for Ken Rimba.
Source: Author

POEM Scoring Calculation EnP Dimension.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Environment Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EnP Q1	Sufficient Designated Green Area	610	311
2	EnP Q2	Sufficient Street Or Park Lighting	610	316
3	EnP Q3	Generate Or Use Renewable Energy	610	315
4	EnP Q4	Reduced Or Recycle Water Practice	610	319
5	EnP Q5	Bio-Diversity Reserved Availability	610	184
6	EnP Q6	Flood / Drainage Clogging Experience	610	304
7	EnP Q7	Infrastructure Services Efficiency	610	368
8	EnP Q8	Pollution Control & Experience	610	307
		Dimension Av-Cr / Sc-Cr	4880	2424
		EnP Dimension Scored Achieved		**49.6%**

In this POEM Handbook study, the social dimension evaluation was carried out in Ken Rimba neighborhood based on feedback from 122 respondents. This investigation was evaluated based on Social Dimension Pillar where 8 sub-criteria of this dimension were asked to end-users/households of this certified neighborhood. The dimension scored achieved of Social Dimension Pillar is presented in Table 39, where this certified sustainable neighborhood has obtained 66.1% of dimension scored achieved.

Based on Table 39, the certified sustainable neighborhood of Ken Rimba has none (0) score below 50% or failed to fulfilled POEM evaluation criteria in Social Dimension Pillar. Most of the score for Social Dimension Pillar is within certified score or 60% (305/610 to 396.5/610) of POEM Evaluation criteria. These sub-criteria are SoP Q1 (371/610), SoP Q3 (382/610), SoP Q4 (326/610), SoP Q5 (407/610) and SoP Q8 (365/610). There is three (3) evaluation sub-criteria in Social Dimension Pillar is above certified range of environment dimension evaluation sub-criteria are within this range (60% or 305/610 to 396.5/610). These evaluation sub-criteria are SoP Q2 Population Density & Development Level (410/610), SoP Q6 Recycling Facilities or Practice (357/610) and SoP Q7 Community Diversification (401/610).

Based on the end-users/households opinion for Social Dimension Pillar, the overall sub-criteria scored credit achieved is considered good or achieved since Ken Rimba neighborhood was awarded with ‘Certified’ certification by GBI Malaysia for sustainable township. In this POEM Handbook evaluation the findings suggested that there is still an improvement can be made on security and safety of the neighborhood (based on lowest score - SoP Q6 score). There is not enough preventive attempt was given in security and safety measure in the neighborhood and its community. Another evaluation sub-criteria that required further attention in Social Dimension Pillar is SoP Q6, this certified neighborhood need a bit more extra effort in improving recycling facilities and practices by the community of the neighborhood.

Table 39: POEM Handbook SoP Dimension Score for Ken Rimba.
Source: Author

POEM Scoring Calculation SoP Dimension.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Social Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	SoP Q1	Sufficient Communal Greenspaces	610	371
2	SoP Q2	Population Density & Development Level	610	410
3	SoP Q3	Universal Accessibility Availability	610	382
4	SoP Q4	Security And Safety Experience	610	326
5	SoP Q5	Public Health Concerns	610	407
6	SoP Q6	Recycling Facilities Or Practices	610	357
7	SoP Q7	Community Diversification	610	401
8	SoP Q8	Community Engagement & Management	610	365
		Dimension Av-Cr / Sc-Cr	4880	3019
		SoP Dimension Scored Achieved		**61.8%**

Regarding the economic dimension aspects, the achieved dimension score of Economic Dimension Pillar by Ken Rimba neighborhood is 59.6 %, as presented in Table 40. Economic Dimension Pillar concerns means of accessibility and connectivity in boosting the economic zones of the neighborhood; material and resources in maintaining economic sustainability; and availability of commercial amenities/facilities within this neighborhood in generating local economic growth.

Referred to Table 40, majority POEM evaluation criteria in Economic Dimension Pillar for certified sustainable neighborhood of Ken Rimba fulfilled the certified score or 60% (305/610 to 396.5/610) except two (2) sub-criteria is below 50% (below 305/610) or failed to fulfilled POEM evaluation criteria. Most of the score for Economic Dimension Pillar is within certified score or 60% (305/610 to 396.5/610) of POEM Evaluation criteria. These sub-criteria are EcP Q1 (317/610), EcP Q2 (321/610), EcP Q3 (317/610), EcP Q5 (315/610), EcP Q7 (395/610) and EcP Q8 (368/610). None of evaluation sub-criteria in Economic Dimension Pillar is above certified range (above 60% or above 396.5/610). The two (2) sub-criteria which below 50% (below 305/610) or failed to fulfilled POEM evaluation criteria is EcP Q4 Low Impact & Regional Materials (256/610) and EcP Q6 Construction waste & Sedimentation. (261/610).

Findings from the end-users/households view for Economic Dimension Pillar, the overall sub-criteria scored credit achieved is considered ‘achieved’ since Ken Rimba

neighborhood was awarded with 'Certified' certification by GBI Malaysia for sustainable township. Exception is EcP Q4 where this criteria is below 'Certified'. POEM Handbook evaluation findings for Economic Dimension Pillar suggested that there is lacking in optimizing low impact and regional materials in certified sustainable neighborhood of Ken Rimba (based on EcP Q4 score). Another lacking is in Construction Waste & Sedimentation. The practical features of 'Australian' louvered windows which allow controllable continuous air flow cross the internal space mentioned in Ken Rimba Neighborhood Pre-Occupancy Sustainable features is the example of out-bound or non-regional materials which was used in this development. Another measures can be stressed in promoting sustainable economic dimension is further considerations on sustainable transportation & connectivity; and sustainable materials & resources. More effort can be further highlighted in transportation & connectivity by improving pedestrian and cycling networks and more awareness on materials and resources by promoting construction waste management & sustainable construction.

Table 40: POEM Handbook EcP Dimension Score for Ken Rimba.
Source: Author

POEM Scoring Calculation EcP Dimension				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Economic Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EcP Q1	Distance To Community Amenities	610	317
2	EcP Q2	Public Transport Reliability	610	321
3	EcP Q3	Sufficient Pedestrian & Cycling Networks	610	317
4	EcP Q4	Low Impact & Regional Materials	610	210
5	EcP Q5	Promotion Of Sustainable Construction	610	315
6	EcP Q6	Construction Waste & Sedimentation	610	261
7	EcP Q7	Sufficient Commercial Amenities	610	395
8	EcP Q8	Innovative Development	610	368
		Dimension Av-Cr / Sc-Cr	4880	2504
		EcP Dimension Scored Achieved		**51.3%**

The total dimension scored achieved of the current certified sustainable neighborhood of Ken Rimba development, based on the proposed POEM Handbook for sustainable neighborhood development, has been ascertained as a total of the final dimension scored achieved of the three (3) dimension pillars deliberated above. As shown in Table 41 the post-occupancy evaluation of certified sustainable neighborhood of Ken Rimba

development has achieved 54.2 % of the total dimension score achieved of the proposed POEM Handbook evaluation criteria for sustainable neighborhood development. This total dimension score achieved has been obtained upon the comprehensive assessment of this neighborhood in regard to the three (3) Sustainable Dimension Pillars, criteria, and sub-criteria of the proposed POEM Handbook.

Grounded atop the scoring and rating method that was acquired within this POEM Handbook study particularly the rating benchmarking discussed previously in this chapter, this total dimension scored achieved means that the certified sustainable neighborhood of Ken Rimba is rated as “CERTIFIED” where the total scored achieved of the POEM is 54. This denotes that the certified sustainable neighborhood of Ken Rimba has **ACHIEVED** the sustainability level upon it’s occupancy or post-occupancy with the same score of sustainability level its’ achieved during planning and completion or during pre-occupancy assessments.

Table 41: POEM Handbook Total Dimension Score for Ken Rimba.
Source: Author

POEM Scoring Calculation Master Sheet.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Environment Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EnP Q1	Sufficient Designated Green Area	610	311
2	EnP Q2	Sufficient Street Or Park Lighting	610	316
3	EnP Q3	Generate Or Use Renewable Energy	610	315
4	EnP Q4	Reduced Or Recycle Water Practice	610	319
5	EnP Q5	Bio-Diversity Reserved Availability	610	184
6	EnP Q6	Flood / Drainage Clogging Experience	610	304
7	EnP Q7	Infrastructure Services Efficiency	610	368
8	EnP Q8	Pollution Control & Experience	610	307
		Dimension Av-Cr / Sc-Cr	4880	2424
		EnP Dimension Scored Achieved		49.6%
Social Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	SoP Q1	Sufficient Communal Greenspaces	610	371
2	SoP Q2	Population Density & Development Level	610	410
3	SoP Q3	Universal Accessibility Availability	610	382
4	SoP Q4	Security And Safety Experience	610	326
5	SoP Q5	Public Health Concerns	610	407
6	SoP Q6	Recycling Facilities Or Practices	610	357
7	SoP Q7	Community Diversification	610	401
8	SoP Q8	Community Engagement & Management	610	365
		Dimension Av-Cr / Sc-Cr	4880	3019
		SoP Dimension Scored Achieved		61.8%
Economic Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EcP Q1	Distance To Community Amenities	610	317
2	EcP Q2	Public Transport Reliability	610	321
3	EcP Q3	Sufficient Pedestrian & Cycling Networks	610	317
4	EcP Q4	Low Impact & Regional Materials	610	210
5	EcP Q5	Promotion Of Sustainable Construction	610	315
6	EcP Q6	Construction Waste & Sedimentation	610	261
7	EcP Q7	Sufficient Commercial Amenities	610	395
8	EcP Q8	Innovative Development	610	368
		Dimension Av-Cr / Sc-Cr	4880	2504
		EcP Dimension Scored Achieved		51.3%
		Total Dimension Av-Cr / Sc-Cr	14,640	7947
		Sc-Cr (72) / Av-Cr (120) x Weighting (100%)		54.2%
		Total Dimension Scored Achieved		**54**

6.2.2 POEM Handbook Findings of Bandar Rimbayu Certified Green Neighborhood

The second process in Stakeholders-Inclusion Approach of POEM evaluation is gather information of selected case study. All related information to selected case study particularly on the certification of green neighborhood is important as it will become the baseline comparison for the POEM end-users'/households' evaluation criteria findings outcome.

The required information of the selected case study is as listed below;

- Neighborhood Title and Address:

  BANDAR RIMBAYU
  BANDAR RIMBAYU SDN BHD (568093-K)
  No.1, Jalan Flora 3, Bandar Rimbayu
  42500 Telok Panglima Garang, Selangor Darul Ehsan

- Neighborhood Description which summarize the general information especially description related to green features and facilities.

  Bandar Rimbayu development is a premium project that inspired from nostalgia time where simple life and people are living close to nature, in a supportive and safe neighborhood / township. The development setting is a serene and tranquil surrounding of 1,879 acre site plot. The total development will take 25 years to complete. Bandar Rimbayu development is set to be an iconic mixed neighborhood development composed of integrated residential area, commercial hub, recreational center and parkland.

- Contact Person details for evaluation process follow up

  - Not Available

- List of Professional Consultants involved in the development such as urban planners, architects, designers, landscape architects, engineers and other specialist such as EIA Consultant, Biodiversity Consultant, Horticulturalist and etc..

  - Not Available

- Local Approving Authority that approved and issued development order of the

selected green neighborhood project.

Majlis Daerah Kuala Langat (Kuala Langat District Council)

- Gross Development Area & Description which include percentage of different development category for example residential area, commercial area, industrial area, amenities and public facilities area, open greenspace and recreational area, utilities and infrastructure area and biodiversity reserved area.

  -Not Available

- Certification Details, which describe the certification, body, certification category awards or rating scores, certification date and validity if available.

  Certification Achieved: Silver (DA)

  Certification Body: GBI Malaysia Sdn Bhd

  Certification Category: Township (GBI-T-0002(P)

  Certification Date: 26 September 2012

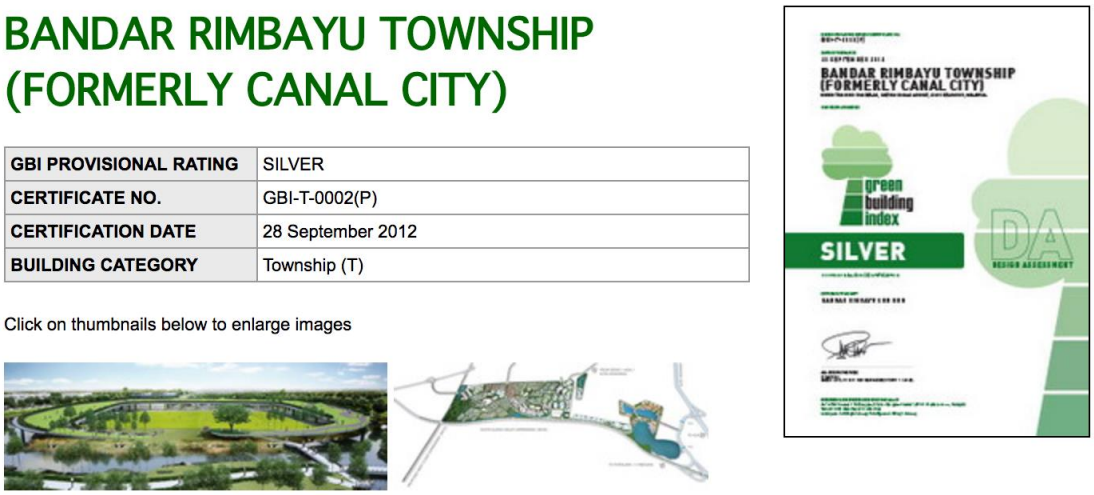


Figure86: Bandar Rimbayu certification by GBI Malaysia.

Source: GBI, 2016

Respondent's Responses Information

Total Nos of Respondents: 125 Responses

Name: 125 Responses

Email Address: 112 Responses

Designation/Position: 120 Responses

Contact No.: 117 Responses

The findings of POEM Handbook for end-users/households general opinion on SDP, Township Assessment Criteria and Certified Green Neighborhood is as illustrated in Figure 87 – Figure 121. For Q1, on the general understanding on sustainable / green neighborhood 95.2% of end-users/households do know or understand the subject question, 4% think they are not sure and the balance of 0.8% didn't understand sustainable or green neighborhood (Figure 87).

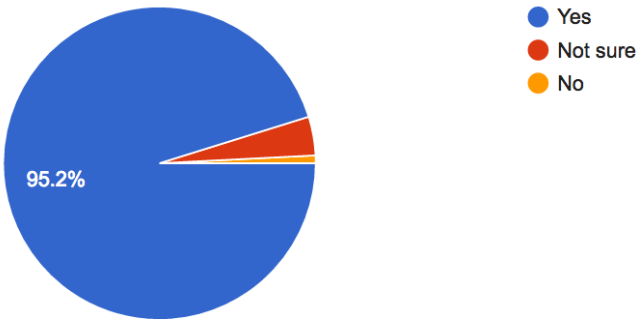


Figure87: POEM Handbook findings for Q1.

Source: Author

For Q2, respondents were asked on the awareness of sustainable dimension pillars (SDP), 51.2% of end-users/households do know or understand SDP, 44.8% think they are not sure what SDP is and the balance of 4% didn't know or aware of SDP (Figure 88).

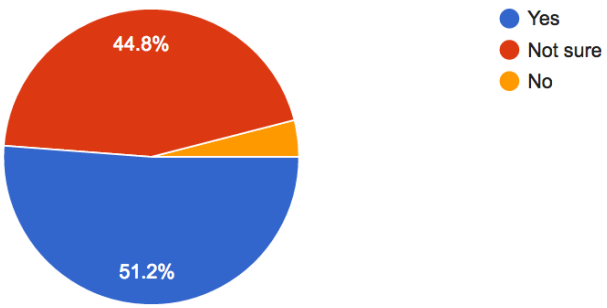


Figure88: POEM Handbook findings for Q2.

Source: Author

For Q3, end-users/households were ask whether they aware that the occupied neighborhood is certified as sustainable or green neighborhood, 77.6% of end-users/households know Ken Rimba is a certified neighborhood, 20.8% of respondents are not sure and the balance of 1.6% are not aware that their occupied neighborhood is a certified neighborhood (Figure 89).

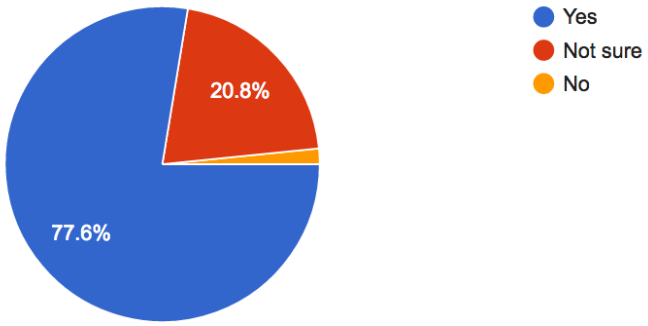


Figure89: POEM Handbook findings for Q3.

Source: Author

For Q4, end-users/households were ask whether they are the homeowner, or tenant, or workers in this neighborhood, 56.8% of end-users/households responses as a homeowner, 30.4% of respondents say that they are a tenant and the balance of 12.8% responded as a workers in the occupied neighborhood (Figure 90).

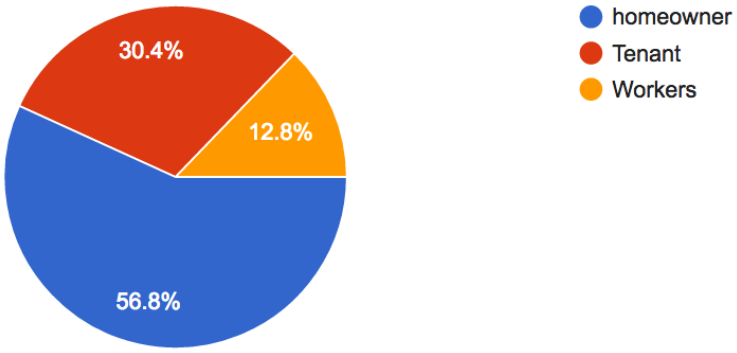


Figure90: POEM Handbook findings for Q4.

Source: Author

For Q5, end-users/households were ask on influences in their decision making on purchasing or staying on this neighborhood. For Q5 the respondents can choose more than one answer or write in other influences that the option given. The findings for Q5 shown that 78.4% of respondents think that security is the main influence, followed by design appearance 67.2%, location and accessibility 62.4%, price and cost 45.6%, amenities & facilities 43.2%, quality of the property & services 42.4%, and sustainable/green label 37.6%. None of the respondents write in 'other' than the given option influences their decision making on purchasing or staying in this neighborhood (Figure 91).

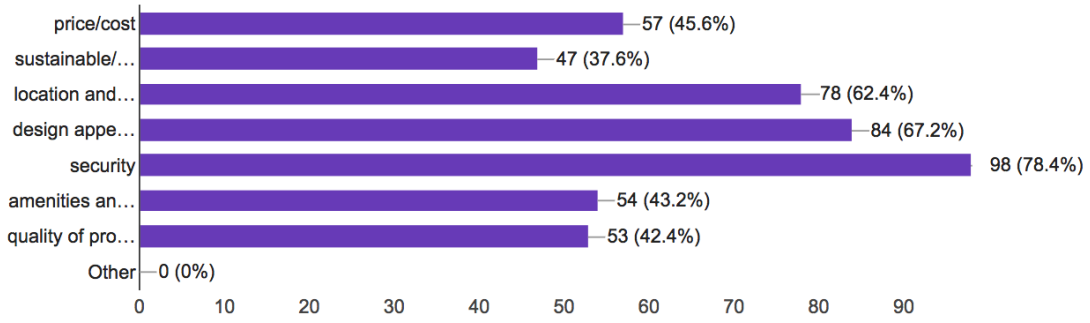


Figure91: POEM Handbook findings for Q5.

Source: Author

For Q6 and Q7, end-users/households were ask on their planning to stay for a long term/permanently in this neighborhood and ask to justify in Q7. For Q6 83.2% of respondents think that they will stay for a long-term/permanently in this neighborhood, 16% are not sure and the balance 0.8% say they will not stay for long-term/permanently (Figure 92). For Q7 only 62 respondents answer this question, 15 respondents (12.3%) answer 'not sure', followed by because of the location and accessibility 5 respondents (5.1%), 'yes' 2 respondents (1.6%), 'no" 2 respondents (1.6%), 'not sure' 2 respondents (1.6%) and the balance, each of 41 respondents (82.9%) justify the listed influences in Q5 as justification for staying in this neighborhood (Figure 93).

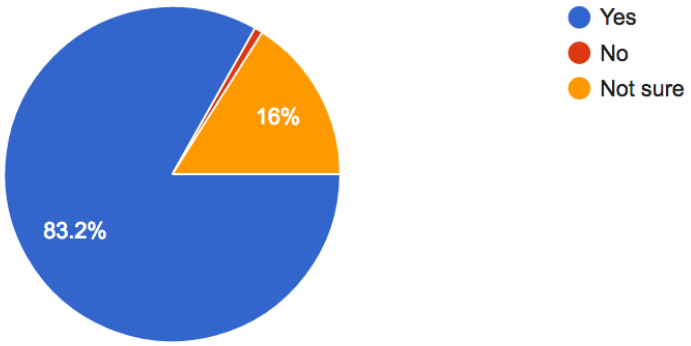


Figure92: POEM Handbook findings for Q6.

Source: Author

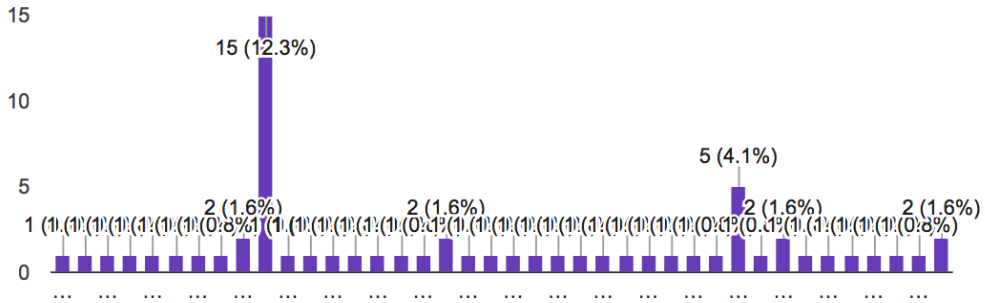


Figure93: POEM Handbook findings for Q7.

Source: Author

The POEM Handbook findings for End-Users/Households opinion on criteria for post-occupancy evaluation based on SDP dimensions is as shown in Table 42 –Table 44. Based on Table 45 the POEM evaluation criteria was categorized into three category, where Environment Dimension Pillar consist of 8 evaluation sub-criteria (EnP Q1- EnP Q8), Social Dimension Pillar consist of 8 evaluation sub-criteria (SoP Q1- SoP Q8) and Economic Dimension Pillar consist of 8 evaluation sub-criteria (EcP Q1- EcP Q8). The detail descriptions or the reference guide for each of these dimensions was discussed in earlier sub-sections.

The final calculated score of environmental dimension for Bandar Rimbayu neighborhood are based on the processes and procedures that were previously highlighted in Sub-chapter 5.2. Bandar Rimbayu neighborhood has achieved 55.5% scored achieved. The dimension scored achieved of the environmental dimension pillar is presented in Table 42.

Based on Table 42, the certified sustainable neighborhood of Bandar Rimbayu has three (3) low scored sub-criteria that related to environment dimension where EnP Q4 Reduced or Recycle Water Practice (303/625), EnP Q5 Bio-Diversity Reserved Availability (146/625) and EnP Q8 Pollution Control & Experience (276/625) score is below 50% or failed to fulfilled POEM evaluation criteria. For certified score or 60% (312.5/625 to 375/625) of POEM Evaluation criteria, two (2) Bandar Rimbayu environment dimension evaluation sub-criteria are within this range. These evaluation sub-criteria are EnP Q3 (327/625) and EnP Q6 (314/610). Meanwhile three (3) environment dimension sub-criteria is above certified or 60%, which are EnP Q1 (478/625), EnP Q2 (482/625) and EnP Q7 (450/625)

This study contends that there is low consideration (based on EnP Q4, EnP Q5 and EnP Q8 score) to the importance of water efficiency, bio-diversity/ecology preservation and pollution control sub-criteria. Although this sub criteria represent equally high significance in Environment Dimension Pillar, there is low awareness in implementation of water efficiency through water recycling systems; lack of considerations by the developers in conserving or preserving bio-diversity and eco-system; and not enough effort in controlling pollutions. In this POEM Handbook evaluation also find out that there is still a gap in improving energy efficiency and hydrology management system (based on EnP Q3, and EnP Q6 score).

Bandar Rimbayu neighborhood development is poor in water efficiency criteria, most of the end-users think that is not enough reduced or recycled water practiced being implemented in the neighborhood. The second lacking criteria is the availability of bio-diversity reserved. Even though the former name of the township is canal city, there is still insufficient bio-diversity reserved in this neighborhood. The percentage of water bodies and greenery in The ARC is still below end-users/households expectation compared to the total development gross area. The third poor scored sub-criteria is pollution control, the end-users/households think the neighborhood still not achieved the pollution control desired level. This is particularly true based on the current conditions whereby the neighborhood is not fully completed and certain phase is still under construction. This sub-criteria is further exacerbated with other neighboring township development also are still under construction stages.

Table 42: POEM Handbook EnP Dimension Score for Bandar Rimbayu.
Source: Author

POEM Scoring Calculation EnP Dimension.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Environment Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EnP Q1	Sufficient Designated Green Area	625	478
2	EnP Q2	Sufficient Street Or Park Lighting	625	482
3	EnP Q3	Generate Or Use Renewable Energy	625	327
4	EnP Q4	Reduced Or Recycle Water Practice	625	303
5	EnP Q5	Bio-Diversity Reserved Availability	625	146
6	EnP Q6	Flood / Drainage Clogging Experience	625	317
7	EnP Q7	Infrastructure Services Efficiency	625	450
8	EnP Q8	Pollution Control & Experience	625	276
		Dimension Av-Cr / Sc-Cr	5000	2779
Environment Dimension Scored Achieved				**55.5%**

In this POEM Handbook study, the social dimension evaluation was carried out in Bandar Rimbayu neighborhood based on feedback from 125 respondents. This investigation was evaluated based on Social Dimension Pillar where 8 sub-criteria of this dimension were asked to end-users/households of this certified neighborhood. The dimension scored achieved of Social Dimension Pillar is presented in Table 43, where this certified sustainable neighborhood has obtained 67.1% of dimension scored achieved.

Based on Table 43, the certified sustainable neighborhood of Bandar Rimbayu has only one (1) score below 50% (below 312.5/625) or failed to fulfilled POEM evaluation criteria in Social Dimension Pillar. Most of the score for Social Dimension Pillar is above certified score or 60% (312.5/625 to 375/625) of POEM Evaluation criteria. These sub-criteria are SoP Q1 (508/625), SoP Q2 (382/625), SoP Q4 (478/625), SoP Q5 (423/625), SoP Q6 (436/625), SoP Q7 (411/625) and SoP Q8 (411/625).

Based on the end-users/households opinion for Social Dimension Pillar, the overall sub-criteria scored credit achieved is considered good or equally achieved the pre-occupancy evaluation since Bandar Rimbayu neighborhood was awarded with 'Silver' certification by GBI Malaysia for sustainable township. Exception however to POEM evaluation sub-criteria SoP Q3 where it failed to meet POEM fulfilled requirement. Hence, in this POEM Handbook evaluation the findings suggested that there is significant gap on the absence of Universal Accessibility in this neighborhood

development (based on SoP Q3 score). There is not enough provision or measures was given in providing facilities to the disabled person.

Table 43: POEM Handbook SoP Dimension Score for Bandar Rimbayu, Source: Author

POEM Scoring Calculation SoP Dimension.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Social Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	SoP Q1	Sufficient Communal Greenspaces	625	508
2	SoP Q2	Population Density & Development Level	625	382
3	SoP Q3	Universal Accessibility Availability	625	310
4	SoP Q4	Security And Safety Experience	625	478
5	SoP Q5	Public Health Concerns	625	423
6	SoP Q6	Recycling Facilities Or Practices	625	436
7	SoP Q7	Community Diversification	625	411
8	SoP Q8	Community Engagement & Management	625	411
		Dimension Av-Cr / Sc-Cr	5000	3359
		Social Dimension Scored Achieved		**67.1%**

From the economic dimension aspects, the achieved dimension score of Economic Dimension Pillar by Bandar Rimbayu neighborhood is 57.3 %, as presented in Table 44. The Economic Dimension concerns with the means of accessibility and connectivity in enhancing the economic zones of the neighborhood; material and resources in maintaining economic sustainability; and availability of commercial amenities/facilities within this neighborhood in generating local economic growth.

As shown in Table 44, majority POEM evaluation criteria in Economic Dimension Pillar for certified sustainable neighborhood of Bandar Rimbayu fulfilled the certified score or 60% (312.5/625 to 375/625) except three (3) sub-criteria is below 50% (below 312.5/625) or failed to fulfilled POEM evaluation criteria. Most of the score for Economic Dimension Pillar is within or above certified score or 60% (312.5/625 to 375/625) of POEM Evaluation criteria. The score within certified level are two (2) sub-criteria which are EcP Q1 (326/625) and EcP Q3 (324/625). There is three (3) evaluation sub-criteria in Economic Dimension Pillar is above certified range (above 60% or above 375/625). These evaluation sub-criteria are EcP Q5 Promotion of Sustainable Construction (447/625), EcP Q7 Sufficient Commercial Amenities (432/625) and EcP Q8 Innovative Development (528/625). The three (3) POEM

evaluation sub-criteria which below 50% (below 305/625) or failed to fulfilled POEM evaluation criteria is EcP Q2 Public Transport Reliability (310/625) EcP Q4 Low Impact & Regional Materials (259/625) and EcP Q6 Construction Waste & Sedimentation (240/625).

Based on findings from the end-users/households view for Economic Dimension Pillar, the overall sub-criteria scored credit achieved is considered 'below achieved' since Bandar Rimbayu neighborhood was awarded with 'Silver' (66-75 score achieved) certification by GBI Malaysia for sustainable township. With three (3) POEM Economic Dimension evaluation criteria failed to fulfilled the rating benchmarking, this dimension is the lowest scored achieved compared to the other two (2) dimensions. POEM Handbook evaluation findings for Economic Dimension Pillar suggested that there is high lacking in reliability of public transportation in certified sustainable neighborhood of Bandar Rimbayu (based on EcP Q4 score). This neighborhood are simply lack of public transportation and its facilities. Since this case study is the most farthest from KL city center and newest developing area compared to another two case studies, it apparently resultant of very poor public transportation reliability. Another strong measures can be stressed in promoting sustainable economic dimension in this neighborhood is further considerations and more awareness on materials and resources by highlighting low impact and regional materials; and promoting construction waste management & sustainable construction;

Table 44: POEM Handbook EcP Dimension Score for Bandar Rimbayu.

Source: Author

POEM Scoring Calculation EcP Dimension.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Economic Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EcP Q1	Distance To Community Amenities	625	326
2	EcP Q2	Public Transport Reliability	625	310
3	EcP Q3	Sufficient Pedestrian & Cycling Networks	625	324
4	EcP Q4	Low Impact & Regional Materials	625	259
5	EcP Q5	Promotion Of Sustainable Construction	625	447
6	EcP Q6	Construction Waste & Sedimentation	625	240
7	EcP Q7	Sufficient Commercial Amenities	625	432
8	EcP Q8	Innovative Development	625	528
		Dimension Av-Cr / Sc-Cr	5000	2866
		Dimension Scored Achieved		57.3%

The total dimension scored achieved of the current certified sustainable neighborhood of Bandar Rimbayu development, based on the proposed POEM Handbook for sustainable neighborhood development, has been verified as a total of the final dimension scored achieved of the three (3) dimension pillars considered above. As shown in Table 45 the post-occupancy evaluation of certified sustainable neighborhood of Bandar Rimbayu development has achieved 60 % of the total dimension score achieved of the proposed POEM Handbook evaluation criteria for sustainable neighborhood development. This total dimension score achieved has been obtained upon the comprehensive assessment of this neighborhood in regard to the three (3) Sustainable Dimension Pillars, criteria, and sub-criteria of the proposed POEM Handbook.

Substantiated on the scoring and rating method that was acquired within this POEM Handbook study particularly the rating benchmarking discussed previously in this chapter, this total dimension scored achieved means that the certified sustainable neighborhood of Bandar Rimbayu is rated as “CERTIFIED” where the total scored achieved of the POEM is 60. This indicates that the certified sustainable neighborhood of Bandar Rimbayu has **NOT ACHIEVED** the sustainability level upon it’s occupancy or post-occupancy with the same score of sustainability level its’ achieved during planning and completion or during pre-occupancy assessments.

Table 45: POEM Handbook Total Dimension Score for Bandar Rimbayu.
Source: Author

POEM Scoring Calculation Master Sheet.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Environment Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EnP Q1	Sufficient Designated Green Area	625	478
2	EnP Q2	Sufficient Street Or Park Lighting	625	482
3	EnP Q3	Generate Or Use Renewable Energy	625	327
4	EnP Q4	Reduced Or Recycle Water Practice	625	303
5	EnP Q5	Bio-Diversity Reserved Availability	625	146
6	EnP Q6	Flood / Drainage Clogging Experience	625	317
7	EnP Q7	Infrastructure Services Efficiency	625	450
8	EnP Q8	Pollution Control & Experience	625	276
		Dimension Av-Cr / Sc-Cr	5000	2779
		Dimension Scored Achieved		55.5%
Social Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	SoP Q1	Sufficient Communal Greenspaces	625	508
2	SoP Q2	Population Density & Development Level	625	382
3	SoP Q3	Universal Accessibility Availability	625	310
4	SoP Q4	Security And Safety Experience	625	478
5	SoP Q5	Public Health Concerns	625	423
6	SoP Q6	Recycling Facilities Or Practices	625	436
7	SoP Q7	Community Diversification	625	411
8	SoP Q8	Community Engagement & Management	625	411
		Dimension Av-Cr / Sc-Cr	5000	3359
		Dimension Scored Achieved		67.1%
Economic Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EcP Q1	Distance To Community Amenities	625	326
2	EcP Q2	Public Transport Reliability	625	310
3	EcP Q3	Sufficient Pedestrian & Cycling Networks	625	324
4	EcP Q4	Low Impact & Regional Materials	625	259
5	EcP Q5	Promotion Of Sustainable Construction	625	447
6	EcP Q6	Construction Waste & Sedimentation	625	240
7	EcP Q7	Sufficient Commercial Amenities	625	432
8	EcP Q8	Innovative Development	625	528
		Dimension Av-Cr / Sc-Cr	5000	2866
		Dimension Scored Achieved		57.3%
		Total Dimension Av-Cr / Sc-Cr	15000	9004
		Sc-Cr (72) / Av-Cr (120) x Weighting (100%)		60%
		Total Dimension Scored Achieved		**60**

6.2.3 POEM Handbook Findings of Sunway Resort City Certified Green Neighborhood

The second process in Stakeholders-Inclusion Approach of POEM evaluation is gather information of selected case study. All related information to selected case study particularly on the certification of green neighborhood is important as it will become the baseline comparison for the POEM end-users'/households' evaluation criteria findings outcome.

The required information of the selected case study is as listed below;

- Neighborhood Title and Address:
  Sunway Resort City,
  Sunway Lagoon Sdn Bhd, 3, Jalan PJS 11/11, Bandar Sunway, 46150 Petaling Jaya, Selangor, Malaysia
- Neighborhood Description which summarize the general information especially description related to green features and facilities.
  Sunway Resort City development project by Sunway Property Bhd is the first fully integrated green town development awarded by the Green Building Index (GBI) Malaysia. The whole development spread across over 800 acres of land. Sunway Resort City annual visitation reach over 42 million visitors. This large township is also known as an education hub and homes to an approximate of half million residents within Bandar Sunway and its surrounding vicinity.
- Contact Person details for evaluation process follow up
  - Not Available
- List of Professional Consultants involved in the development such as urban planners, architects, designers, landscape architects, engineers and other specialist such as EIA Consultant, Biodiversity Consultant, Horticulturalist and etc..
  - Not Available
- Local Approving Authority that approved and issued development order of the

selected green neighborhood project.

Majlis Perbandaran Subang Jaya (Subang Jaya City Council)

- Gross Development Area & Description which include percentage of different development category for example residential area, commercial area, industrial area, amenities and public facilities area, open greenspace and recreational area, utilities and infrastructure area and biodiversity reserved area.

  -Not Available

- Certification Details, which describe the certification, body, certification category awards or rating scores, certification date and validity if available.

  Certification Achieved: Silver (PA)

  Certification Body: GBI Malaysia Sdn Bhd

  Certification Category: Township (GBI-T-0001(P)

  Certification Date: 29 June 2012

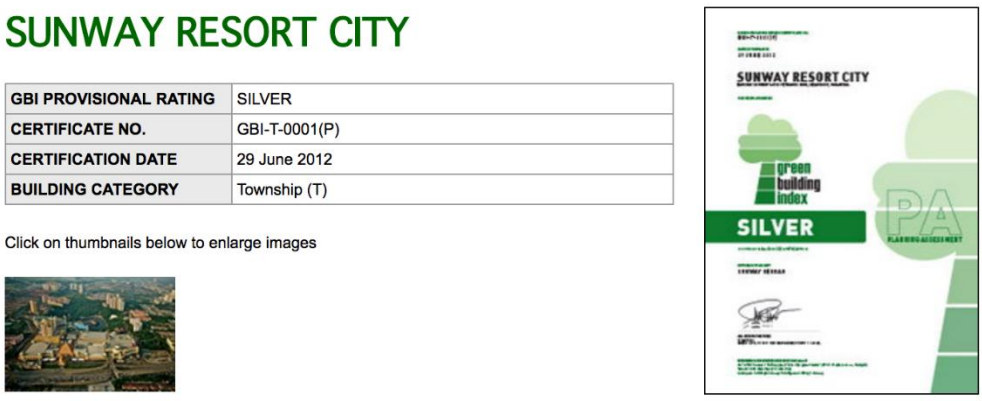


Figure94: Sunway Resort City Neighborhood certification by GBI Malaysia.

Source: GBI, 2016

Respondent's Responses Information

Total Nos of Respondents: 131 Responses

Name: 131 Responses

Email Address: 117 Responses

Designation/Position: 100 Responses

Contact No.: 96 Responses

The POEM Handbook findings for End-Users/Households general opinion on SDP, Township Assessment Criteria and Certified Green Neighborhood is as shown in Figure 95 – Figure 101. For Q1, on the general understanding on sustainable / green neighborhood 75.6% of end-users/households do know or understand the subject question, 22.9% think they are not sure and the balance of 1.5% didn't understand sustainable or green neighborhood (Figure 95).

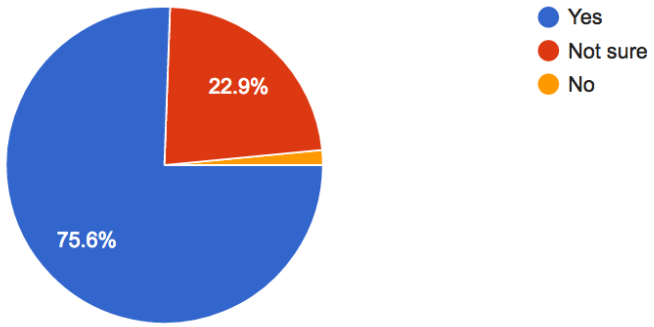


Figure95: POEM Handbook findings for Q1.

Source: Author

For Q2, on the awareness of sustainable dimension pillars (SDP), 39.7% of end-users/households do know or understand SDP, 50.4% think they are not sure what SDP is and the balance of 9.9% didn't know or aware of SDP (Figure 96).

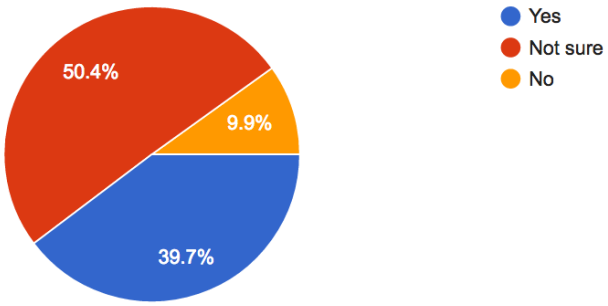


Figure96: POEM Handbook findings for Q2.

Source: Author

For Q3, end-users/households were ask whether they aware that the occupied neighborhood is certified as sustainable or green neighborhood, 46.6% of end-users/households know Sunway Resort City is a certified neighborhood, 43.5% of respondents are not sure and the balance of 9.9% are not aware that their occupied neighborhood is a certified neighborhood (Figure 97).

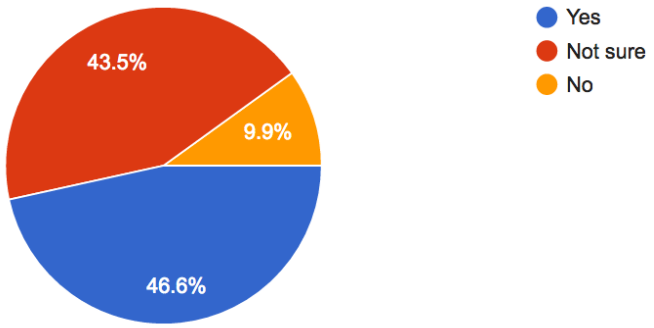


Figure97: POEM Handbook findings for Q3.

Source: Author

For Q4, end-users/households were ask whether they are the homeowner, or tenant, or workers in this neighborhood, 53.4% of end-users/households responses as a homeowner, 29.8% of respondents say that they are a tenant and the balance of 16.8% responded as a workers in the occupied neighborhood (Figure 98).

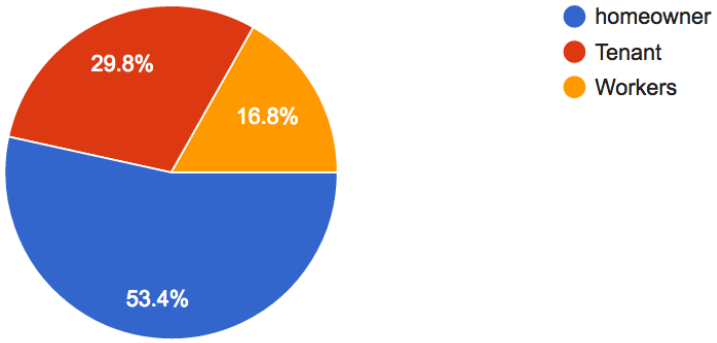


Figure98: POEM Handbook findings for Q4.

Source: Author

For Q5, end-users/households were ask on influences in their decision making on purchasing or staying on this neighborhood. For Q5 the respondents can choose more than one answer or write in other influences that the option given. The findings for Q5 shown that 86.3% of respondents think that location and accessibility is the main influence, followed by security 64.1%, price and cost 61.1%, design appearance 52.7%, amenities & facilities 51.9%, quality of the property 45.8%, and lastly sustainable/green label 42.7%. Only one (1) respondents (0.8%) write in ‘other’ than the given option

influences their decision making on purchasing or staying in this neighborhood (Figure 99).

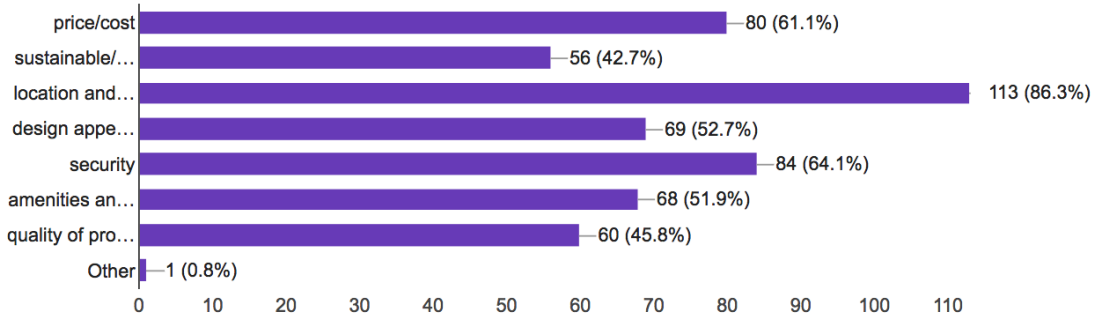


Figure99: POEM Handbook findings for Q5.

Source: Author

For Q6 and Q7, end-users/households were ask on their planning to stay for a long term/permanently in this neighborhood and ask to justify in Q7. For Q6 48.1% of respondents think that they will stay for a long-term/permanently in this neighborhood, 45.8% are not sure and the balance 6.1% say they will not stay for long-term/permanently (Figure 100). For Q7 only 52 respondents answer this question, 10+3+2 respondents (11%) answer 'not sure', followed by 'yes' 6 respondents (4.6%), and the balance, each of 32 respondents (84.4%) justify the listed influences in Q5 as justification for staying in this neighborhood (Figure 101).

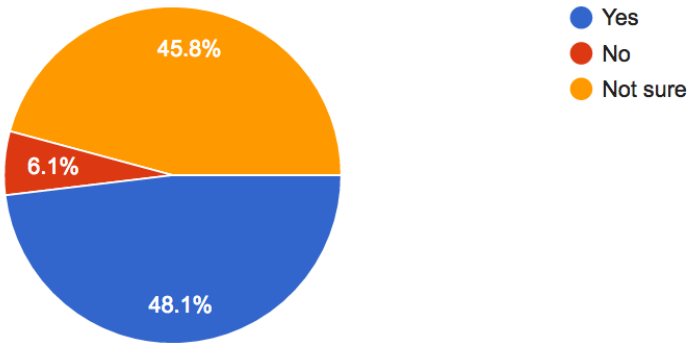


Figure100: POEM Handbook findings for Q6.

Source: Author

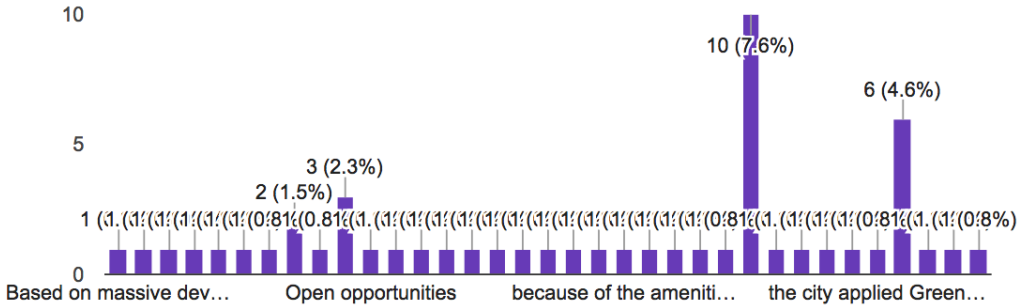


Figure101: POEM Handbook findings for Q7.

Source: Author

The POEM Handbook findings for End-Users/Households opinion on criteria for post-occupancy evaluation based on SDP dimensions is as shown in Table 46 –Table 48. Based on Table 49 the POEM evaluation criteria was categorized into three category, where Environment Dimension Pillar consist of 8 evaluation sub-criteria (EnP Q1- EnP Q8), Social Dimension Pillar consist of 8 evaluation sub-criteria (SoP Q1- SoP Q8) and Economic Dimension Pillar consist of 8 evaluation sub-criteria (EcP Q1- EcP Q8). The detail descriptions or the reference guide for each of these dimensions was discussed in earlier sub-sections.

The final calculated score of environmental dimension for Sunway Resort City neighborhood are based on the processes and procedures that were previously highlighted in Sub-chapter 5.2. Sunway Resort City neighborhood has achieved 67.7% scored achieved. The dimension scored achieved of the environmental dimension pillar is presented in Table 46.

Based on Table 46, the certified sustainable neighborhood of Sunway Resort City has one (1) low scored sub-criteria that related to environment dimension where EnP Q5 Bio-Diversity Reserved Availability (174/655) score is below 50% or failed to fulfilled POEM evaluation criteria. For certified score or 60% (327.5/655 to 393/655) of POEM Evaluation criteria, three (3) Sunway Resort City environment dimension evaluation sub-criteria are within this range. These evaluation sub-criteria are EnP Q3 (362/655), EnP Q6 (336/655) and EnP Q8 (333/655). Meanwhile four (4) environment dimension sub-criteria is above certified or 60%, which are EnP Q1 (420/655), EnP Q2 (414/655), EnP Q4 (412/655) and EnP Q7 (436/655)

This study argues that there is a very low consideration (based on EnP Q5 score)

towards the importance of bio-diversity and ecology sub-criteria. Although this sub criteria rather represent great implication in Environment Dimension Pillar, there is relatively lack of effort by the developers in maintaining the existing bio-diversity and eco-system in the development. In this POEM Handbook on-site test also find out that there is still a gap in implementing energy efficiency via renewable energy, hydrology management system, and further effort in pollution control (based on EnP Q3, EnP Q6, and EnP Q8 score).

Sunway Resort City neighborhood development is lacking of bio-diversity reserved. Even though the development area is develop from dilapidated tin mining which by right is a huge water body area, but this feature is only available at Sunway Lagoon Water Park, Sunway Hotel & Convention Center and Sunway Pyramid Shopping Center. Small percentage of water body area are public area, hence the end-users/households think there is not sufficient bio-diversity reserved in this area as described in this criteria reference guide previously.

Table 46: POEM Handbook EnP Dimension Scored for Sunway Resort City.
Source: Author

POEM Scoring Calculation EnP Dimension.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Environment Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EnP Q1	Sufficient Designated Green Area	655	420
2	EnP Q2	Sufficient Street Or Park Lighting	655	414
3	EnP Q3	Generate Or Use Renewable Energy	655	362
4	EnP Q4	Reduced Or Recycle Water Practice	655	412
5	EnP Q5	Bio-Diversity Reserved Availability	655	174
6	EnP Q6	Flood / Drainage Clogging Experience	655	336
7	EnP Q7	Infrastructure Services Efficiency	655	436
8	EnP Q8	Pollution Control & Experience	655	333
		Dimension Av-Cr / Sc-Cr	5240	2887
Environment Dimension Scored Achieved				**55%**

In this POEM Handbook study, the evaluation of social dimension was carried out in Sunway Resort City neighborhood based on feedback from 131 respondents. This investigation was evaluated based on Social Dimension Pillar where 8 sub-criteria of this dimension were asked to end-users/households of this certified neighborhood. The

dimension scored achieved of Social Dimension Pillar is presented in Table 47, where this certified sustainable neighborhood has obtained 63.3% of dimension scored achieved.

Based on Table 47, the certified sustainable neighborhood of Sunway Resort City has none (0) score below 50% or failed to fulfilled POEM evaluation criteria in Social Dimension Pillar. Most of the score for Social Dimension Pillar is above certified score or 60% (327.5/655 to 393/655) of POEM Evaluation criteria. These sub-criteria are SoP Q1 (461/655), SoP Q2 (465/655), SoP Q3 (432/655), SoP Q4 (407/655), SoP Q5 (416/655) and SoP Q6 (421/655). There is two (2) evaluation sub-criteria in Social Dimension Pillar is within certified range of environment dimension evaluation sub-criteria are within this range (60% or 327.5/655 to 393/655). These evaluation sub-criteria are SoP Q7 Community Diversification (377/655) and SoP Q8 Community Engagement & Management (339/655).

Based on the end-users/households opinion for Social Dimension Pillar, the overall sub-criteria scored credit achieved is considered ‘below achieved’ since Ken Rimba neighborhood was awarded with ‘Silver’ certification (66-75 score achieved) by GBI Malaysia for sustainable township. In this POEM Handbook evaluation the findings suggested that there is still an improvement can be made on community diversification criteria (based on SoP Q7 score). There is not enough measures in adopting socially equitability and community diversity through in mixed-use and affordable housing in certified sustainable neighborhood. Another evaluation sub-criteria that required further attention in Social Dimension Pillar is SoP Q8, this certified neighborhood require more concentrated endeavor in elevating community engagement and management.

Table 47: POEM Handbook SoP Dimension Scored for Sunway Resort City. Source: Author

POEM Scoring Calculation SoP Dimension.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Social Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	SoP Q1	Sufficient Communal Greenspaces	655	461
2	SoP Q2	Population Density & Development Level	655	465
3	SoP Q3	Universal Accessibility Availability	655	432
4	SoP Q4	Security And Safety Experience	655	407
5	SoP Q5	Public Health Concerns	655	416
6	SoP Q6	Recycling Facilities Or Practices	655	421
7	SoP Q7	Community Diversification	655	377
8	SoP Q8	Community Engagement & Management	655	339
		Dimension Av-Cr / Sc-Cr	5240	3318
		Social Dimension Scored Achieved		**63.3%**

For economic dimension aspects, the achieved dimension score of Economic Dimension Pillar by Sunway Resort City neighborhood is 57.8 %, as presented in Table 48. Economic Dimension Pillar concerns means of accessibility and connectivity in boosting the economic zones of the neighborhood; material and resources in maintaining economic sustainability; and availability of commercial amenities/facilities within this neighborhood in generating local economic growth.

Based on Table 48 outcome, most POEM evaluation criteria in Economic Dimension Pillar for certified sustainable neighborhood of Sunway Resort City fulfilled the certified score or 60% (327.5/655 to 393/655) except two (2) sub-criteria is below 50% (below 327.5/655) or failed to fulfilled POEM evaluation criteria. Two (2) of the score for Economic Dimension Pillar is within certified score or 60% (327.5/655 to 393/655) of POEM Evaluation criteria. These sub-criteria are EcP Q3 (370/655) and EcP Q6 (342/655). There is four (4) evaluation sub-criteria in Economic Dimension Pillar is above certified range (above 60% or above 393/655). These evaluation sub-criteria are EcP Q1 Distance to Community Amenities/Facilities (460/655), EcP Q2 Public Transportation Reliability (398/655), EcP Q7 Sufficient Commercial Amenities (482/655) and EcP Q8 Innovative Development (450/655). Meanwhile two (2) sub-criteria which below 50% (below 327.5/655) or failed to fulfilled POEM evaluation

criteria is EcP Q4 Low Impact & Regional Materials (313/655) and EcP Q5 Promotion of Sustainable Construction (218/655).

Findings from the end-users/households view for Economic Dimension Pillar, the overall sub-criteria scored credit achieved is considered 'below achieved' since Bandar Rimbayu neighborhood was awarded with 'Silver' (66-75 score achieved) certification by GBI Malaysia for sustainable township. Exception is EcP Q4 and EcP Q5 where this criteria is failed to fulfilled the POEM Rating Benchmark. POEM Handbook evaluation findings for Economic Dimension Pillar suggested that there is lacking in optimizing low impact & regional materials and promotion of sustainable construction in certified sustainable neighborhood of Sunway Resort City (based on EcP Q4 and EcP Q5 score).

Table 48: POEM Handbook EcP Dimension Scored for Sunway Resort City.
Source: Author

POEM Scoring Calculation EcP Dimension.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Economic Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EcP Q1	Distance To Community Amenities	655	460
2	EcP Q2	Public Transport Reliability	655	398
3	EcP Q3	Sufficient Pedestrian & Cycling Networks	655	370
4	EcP Q4	Low Impact & Regional Materials	655	218
5	EcP Q5	Promotion Of Sustainable Construction	655	313
6	EcP Q6	Construction Waste & Sedimentation	655	342
7	EcP Q7	Sufficient Commercial Amenities	655	482
8	EcP Q8	Innovative Development	655	450
		Dimension Av-Cr / Sc-Cr	5240	3033
		Economic Dimension Scored Achieved		**57.8%**

The total dimension scored achieved of the current certified sustainable neighborhood of Sunway Resort City development, based on the proposed POEM Handbook for sustainable neighborhood development, has been ascertained as a total of the final dimension scored achieved of the three (3) dimension pillars deliberated above. As shown in Table 49 the post-occupancy evaluation of certified sustainable neighborhood of Sunway Resort City has achieved 58.7 % of the total dimension score achieved of the proposed POEM Handbook evaluation criteria for sustainable neighborhood

development. This total dimension score achieved has been obtained upon the comprehensive assessment of this neighborhood in regard to the three (3) Sustainable Dimension Pillars, criteria, and sub-criteria of the proposed POEM Handbook.

Based upon the scoring and rating method that was acquired within this POEM Handbook study particularly the rating benchmarking discussed previously in this chapter, this total dimension scored achieved means that the certified sustainable neighborhood of Sunway Resort City is rated as “CERTIFIED” where the total scored achieved of the POEM is 59. This implies that the certified sustainable neighborhood of Sunway Resort City has **NOT ACHIEVED** the sustainability level upon it’s occupancy or post-occupancy with the same score of sustainability level its’ achieved during planning and completion or during pre-occupancy assessments.

Table 49: POEM Handbook Total Dimension Scored for Sunway Resort City.
Source: Author

POEM Scoring Calculation Master Sheet.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Environment Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EnP Q1	Sufficient Designated Green Area	655	420
2	EnP Q2	Sufficient Street Or Park Lighting	655	414
3	EnP Q3	Generate Or Use Renewable Energy	655	362
4	EnP Q4	Reduced Or Recycle Water Practice	655	412
5	EnP Q5	Bio-Diversity Reserved Availability	655	174
6	EnP Q6	Flood / Drainage Clogging Experience	655	336
7	EnP Q7	Infrastructure Services Efficiency	655	436
8	EnP Q8	Pollution Control & Experience	655	333
		Dimension Av-Cr / Sc-Cr	5240	2887
		Dimension Scored Achieved		55%
Social Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	SoP Q1	Sufficient Communal Greenspaces	655	461
2	SoP Q2	Population Density & Development Level	655	465
3	SoP Q3	Universal Accessibility Availability	655	432
4	SoP Q4	Security And Safety Experience	655	407
5	SoP Q5	Public Health Concerns	655	416
6	SoP Q6	Recycling Facilities Or Practices	655	421
7	SoP Q7	Community Diversification	655	377
8	SoP Q8	Community Engagement & Management	655	339
		Dimension Av-Cr / Sc-Cr	5240	3318
		Dimension Scored Achieved		63.3%
Economic Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EcP Q1	Distance To Community Amenities	655	460
2	EcP Q2	Public Transport Reliability	655	398
3	EcP Q3	Sufficient Pedestrian & Cycling Networks	655	370
4	EcP Q4	Low Impact & Regional Materials	655	218
5	EcP Q5	Promotion Of Sustainable Construction	655	313
6	EcP Q6	Construction Waste & Sedimentation	655	342
7	EcP Q7	Sufficient Commercial Amenities	655	482
8	EcP Q8	Innovative Development	655	450
		Dimension Av-Cr / Sc-Cr	5240	3033
		Dimension Scored Achieved		57.8%
		Total Dimension Av-Cr / Sc-Cr	15720	9238
		Sc-Cr (72) / Av-Cr (120) x Weighting (100%)		58.7%
		Total Dimension Scored Achieved		**59**

6.3 POEM Implementation Findings and Discussions

These three certified sustainable neighborhood case studies of Ken Rimba, Bandar

Rimbayu, and Sunway Resort City have presented three diverse narratives of how sustainable urban neighborhood / township development has been developed in the Klang Valley/Greater KL in the last half decades. The results derived from the previous on-site studies point out that the three selected certified sustainable neighborhood in particular have resultant a rather lower dimension score achieved in post-occupancy evaluation based on end-users/households opinion compared to pre-occupancy evaluation criteria during planning assessment or completion and verification assessment of sustainable neighborhood/township. This rather lower dimension score achieved in post-occupancy evaluation suggest the POEM evaluation criteria and theory is differ from pre-occupancy evaluation criteria and theory. Hence, the SDP adaptation method will improve the sustainability within the community's neighborhood context.

The obtained results have established that the certified sustainable neighborhood of Ken Rimba, Bandar Rimbayu, and Sunway Resort City has been evaluated with an adaptation gap and recognition of the three dimensions of the proposed POEM that include different SDP aspects of environmental, social, and economic. Different post-occupancy evaluation dimension score achieved occurred as an outcome of the pre-occupancy evaluation due to design and planning envisaged functionality are slightly dissimilar from end-users/households perception on the occupied space.

Regarding the bio-diversity reserved and ecological aspects of the environment, the findings signify that in all certified sustainable neighborhood case studies this evaluation criteria is not achievable or less targeted pre-occupancy evaluation targeted score due to several reason. The reason based on end-users/households justifications on the influences of purchasing or staying in sustainable neighborhood are not because of the sustainable/green label (or the least prefer influences) but mainly because of location accessibility and security of the certified neighborhood. Moreover, majority of the end-users/households are not aware that their occupied neighborhood is certified sustainable neighborhood. From developer point of view, of course the main reason is profit margin, more designated area for bio-diversity reserved means less built property unit. Furthermore, the pre-occupancy evaluation criteria is scored based evaluation and this bio-diversity reserved is not compulsory or carry high score. Another two POEM evaluation criteria that need further attention is reduced or recycle water practice and

pollution control. Based on general understanding on sustainability feedback by the end-users, awareness and understanding on sustainable dimension pillar are still rather low. Lack of awareness and understanding on sustainability will discouraged the end-users/households from implementing sustainable measures at community, household and individual level. More efforts and endeavors on sustainable education and awareness need to be instill and nurture in the community in order to continuously uphold the sustainable practices upon occupancy stage.

Findings from reviewing the social dimension post-occupancy evaluation criteria, the study would argue that community engagement participation and governance of sustainable practice issues such as active dialogue between the community residents and developer, and also existing surrounding or adjacent communities are still rather unsatisfactorily, hence required more effort. This will affect an inequality and unfairly access and distribution of opportunities and needs in social aspect. This issues without question has arisen due to the lack of community participation and engagement in the decision-making discourse in social dimension aspect of public concerns. The community thrust should not only limited within the resided neighborhood but should be extended beyond the resided certified sustainable neighborhood vicinity in maintaining and fostering sustainable practices agenda. Another community engagement and management shall also include an active Residents Association and it sustainable related activities such as community recycling programs, community food production allotments, community transportation pooling efforts and other sustainable related community initiatives. For community governance empowerment, measures and practices such as active community complaints unit for addressing local residents' issues, strengthening security measures and create cooperation with local police in maintaining neighborhood security and safety, and participate actively in any sustainable programs initiated by any local authority or government agencies.

Generally, POEM Handbook evaluation of economic dimension findings for the three selected certified sustainable neighborhoods argues that there are several number of evaluation criteria that need to be enhanced in achieving post-occupancy sustainable level. In this study, stressed were emphasized on economic dimension pillar concerns for necessitates of accessibility and connectivity in supporting the economic area of the studied neighborhood; material and resources in keeping local economic sustainability;

and availability of commercial amenities/facilities within this neighborhood in yielding local economic progression. Based on current sustainable neighborhood development, there are few critical post-occupancy economic dimension related issues faced by the certified sustainable neighborhood in the Klang Valley/Greater KL. One of the most unfulfilled POEM evaluation criteria is Low Impact and Regional Materials. The end-users/households responses for this related issues is relatively quite low, hence, suggesting the material used in building and infrastructures are not low impact (green or sustainable) and outbound materials. Thus, it's contradict that certified sustainable neighborhood development should use development materials with recycled content or low impact in order to optimize resources efficiency and good economy as a whole. On the non-regional materials, it is affecting local economic resources, increased transportation cost and carbon emission to the environment. All these issues will impact economic capability and capacity.

The overall POEM findings, for case study 1: the certified sustainable neighborhood of Ken Rimba sustainability level upon post occupancy evaluation is rated as **"CERTIFIED"** This denotes that the certified sustainable neighborhood of Ken Rimba has **ACHIEVED** the sustainability level upon it's occupancy or post-occupancy with the same score of sustainability level its' achieved during planning and completion or during pre-occupancy assessments. For case study 2: the certified sustainable neighborhood of Bandar Rimbayu is rated as **"CERTIFIED"** where the total scored achieved of the POEM is 60, the overall dimensions scored credit achieved is considered 'below achieved' since Bandar Rimbayu neighborhood was awarded with 'Silver' (66-75 score achieved) certification by GBI Malaysia for sustainable township. This indicates that the certified sustainable neighborhood of Bandar Rimbayu has **NOT ACHIEVED** the sustainability level upon it's occupancy or post-occupancy with the same score of sustainability level its' achieved during planning and completion or during pre-occupancy assessments. Finally, for case study 3: the certified sustainable neighborhood of Sunway Resort City is rated as **"CERTIFIED"** where the total scored achieved of the POEM is 59, the overall dimensions scored credit achieved is considered 'below achieved' since Sunway Resort City neighborhood was awarded with 'Silver' (66-75 score achieved) certification by GBI Malaysia for sustainable township. This implies that the certified sustainable neighborhood of Sunway Resort

City has **NOT ACHIEVED** the sustainability level upon it's occupancy or post-occupancy with the same score of sustainability level its' achieved during planning and completion or during pre-occupancy assessments. The total results achieved using this on-site testing process have emphasized that pre-occupancy assessment criteria and theory is differ from the post-occupancy evaluation criteria and theory. For regional POEM Handbook implementation in Thailand, the findings for Parinyada Village case study outcome is rated as **"CERTIFIED"** where the total score achieved of the POEM is 65. The overall score credit achieved considered as 'minimum achieved' even though Parinyada Village is not certified by any pre-occupancy assessment criteria. This regional POEM Handbook evaluation in Thailand also validated POEM implementation and workability based on appointed evaluator beside the selected case studies in Malaysia.

Therefore, the significance of having POEM evaluation criteria for sustainable neighborhood development is vital and important to take into account by all stakeholders, right from the experts and relevant authorities who developed & regulated assessment criteria, the professionals who implemented the criteria and down to the end-users/households who experienced and used it. Alas, in this chapter, the research argues that the manifestation and implementation of such POEM for SND in the form of POEM handbook would contribute substantial advantages not limited to the three (3) mentioned case studies but also to the different similar development within the Klang Valley/Greater KL or beyond other region with similar development phenomenon.

6.4 Conclusions of POEM Implementation - Summary of Analysis, Findings and Discussions for RO2, RQ2 and RQ4

The general intention of this chapter was to exemplify the testing procedures of the proposed POEM for sustainable neighborhood development in the Klang Valley/Greater KL using the POEM Handbook. The POEM Handbook procedures were implemented in on-site testing in order to verify the applicability and validity of this proposed POEM Handbook to the actual context of certified sustainable neighborhood. The on-site testing procedures and processes was mainly devised based on the result of Stakeholders-Inclusion Approach in addition to Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) analysis. The first half of this chapter

describes the POEM Handbook: its procedure and process of on-site testing; its evaluation criteria intent guide and demonstrated the techniques to conduct. The second half of this chapter deliberates the conducted on-site testing procedure of the proposed POEM Handbook by implementing this POEM for SND to three (3) selected certified sustainable neighborhoods of Ken Rimba Development, Bandar Rimbayu and Sunway Resort City.

To summarize, POEM for SND on-site testing findings from the three case studies should be acknowledged that perceived pre-occupancy assessment for sustainable township / neighborhood development sustainability level is differ from post-occupancy evaluation sustainability level perceived by the end-users/households. Thus, it is concluded that Post-Occupancy Evaluation Model (POEM) assessment criteria and theory would differ from the pre-occupied assessment criteria and theory. The findings suggested that related issues or criteria in this study context, affecting the sustainability agenda of the community as well as larger context of Klang Valley/Greater KL in various ways based on the environmental, social and economic dimension aspects. The identification of these issues through implemented POEM Handbook for certified sustainable neighborhood development will give an insight in remedying the root cause of post-occupancy sustainable practices. Hence, POEM for SND developed based on sustainable dimensions pillar method will improve the sustainability within the community's neighborhood context. Therefore, this study would argue that the application of POEM for SND in helping the enhancement and further development of sustainable township / neighborhood in the Klang Valley/Greater KL generally. The implementation of regional case study in Parinyada Village in Thailand also suggested and validated that POEM Handbook evaluation applicability and workability to the different similar development outside the Klang Valley/Greater KL or beyond other region with similar development phenomenon.

CHAPTER 7:

PRE-OCCUPANCY (GBI-TAC) THEORIES AND POST-OCCUPANCIES (POEM-SND) THEORIES COMPARISON

7.1. Pre-Occupancy and Post-Occupancy Evaluation Criteria Analysis

Introduction

This chapter will present the analysis, findings and discussion of the Research Objective 3 (RO3) and Research Question 3 (RQ3):

RO3: To evaluate similarity and discrepancy of post-occupancy evaluation theory and variables are differ from pre-occupancy assessment theory and variables.

RQ3: Would and Why theory of post-occupancy differ from pre-occupancy?

For this study, the SEM modeling consist of two phases of study which is the Phase 2: Stakeholders-Inclusion Approach – Professional Stakeholders Survey and Phase 3: Stakeholders-Inclusion Approach – End-use/Household Survey. This two sets of SEM modeling is because of different set of targeted aims, respondents and questionnaires. The Phase 2 aim is to analyze the professionals' opinion on SDP Adaptations of pre-occupancy Township Assessment Criteria (GBI-TAC) meanwhile for Phase 3 study is aim to analyze the end-users/households opinions on POEM for SND evaluation criteria of post-occupancy experiences in certified sustainable neighborhood development. Thus, this chapter will discussed the different phase study separately and will conclude both SEM model towards the end of the chapter.

This chapter is aim to present, verify and discuss empirical data findings of the Structural Equation Model (SEM) multi-variate study analysis. The outcome from preliminary data analysis and reliability data analysis for all the employed various constructs in this study are summarized in this chapter. Pertaining to this, the SEM path modeling is deliberated into three (3) discussion stages in this chapter. The first stage

is the complete measurement path model which denotes the relationship of every single exogenous factor and its observed endogenous variables. The second stage is the full structural path model which explicates the correlations and dependence relationships of exogenous factors and the endogenous dependent variable. And lastly, the significance tests for the POEM evaluation criteria are conducted in order to identify the most significant sustainable dimension pillar in Sustainable Neighborhood Development for Malaysia.

The Structural Equation Modelling (SEM) is a multi variate study analysis means engine (Marcoulides & Schumaker, 1996; Hill & Pawel, 2006) which can be employed to signify, estimate and assess a relationship network between several observable and latent variables (Bollen, 1989). According to Kaplan (1999), SEM is one of the most significant data analysis methodology for the last three decades in analyzing survey research, non-experimental research and quasi-experimental research data (Yuan & Tian, 2015). In the field of social science study, SEM has become increasingly important and a necessity for data analysis (Hooper et. Al., 2008).

7.2 Phase 2 Structural Equation Modeling

7.2.1 Preliminary Data Analysis

Preliminary data analysis is implemented before to the full executed measurement of SEM. It comprises of the total number of involved respondents and the test of reliability measurement in ensuring the consistency of the used data.

Profile of the Respondents

This Phase 2 study has gathered 61 valid professional respondents' opinions from various professional stakeholders who are involved in Sustainable Neighborhood Development projects. The respondents involved in this study are among professionals in mid and top management in the building and development industry, and also academicians who are related with sustainable development and actively involved in Malaysia Green Building Confederation (MGBC) programs or workshops. Among the

respondents, Professional Consultants recorded the largest number of study participations which total up for 63.93%. Total number of respondents from consultant sector is 39, from construction sector is 8 respondents, whilst the construction and other sector recorded the least number of respondents (7 respondents each sector) which tally at 11.5% of total respondents respectively. The justification for such composition is that consultants is the key actor in implementing and the decision making for sustainable development project, developer is the commissioner, while contactor is the executor and academician is the observers and critics. The detailed composition of the respondents is as shown in Table 50.

Table 50: Number of Respondents by Designation / Professionalism.
Source: Author

Des/Profess	No. Of Respondents	Percentage (%)
Architect	12	19.67%
Urban Planner	6	9.83%
Designer	8	13.11%
Landscape Architect	4	6.55%
Quantity Surveyors	4	6.55%
Engineers	5	8.19%
Total Consultant	**39**	**63.93%**
Dev. Executive	2	3.27%
Valuer/ E. Agent	5	8.19%
Total Developer	**7**	**11.47%**
Project Director	1	1.63%
C. Manager	7	8.19%
Total Contractor	**8**	**13.11%**
Researcher	1	1.63%
Conservator	1	1.63%
Academician	5	8.19%
Total Others	**7**	**11.47%**
Total	**61**	**100.00%**

7.2.2 Phase 2 CFA & SEM

The Framework of Research in this POEM for SND study for Phase 2: Stakeholders-Inclusion Approach - Professional Stakeholders Survey comprises of one latent exogenous construct which are SDP Adapt (SDP Adaptation), and six dependent variable of Climate, Energy & Water (CEW), Environment & Ecology (EEC), Community Planning & Design (CPD), Transportation & Connectivity (TRC), Building & Resources (BDR) and Business & Innovation (BSI). The theoretical relationship between the constructs is modeled and shown in Figure 102.

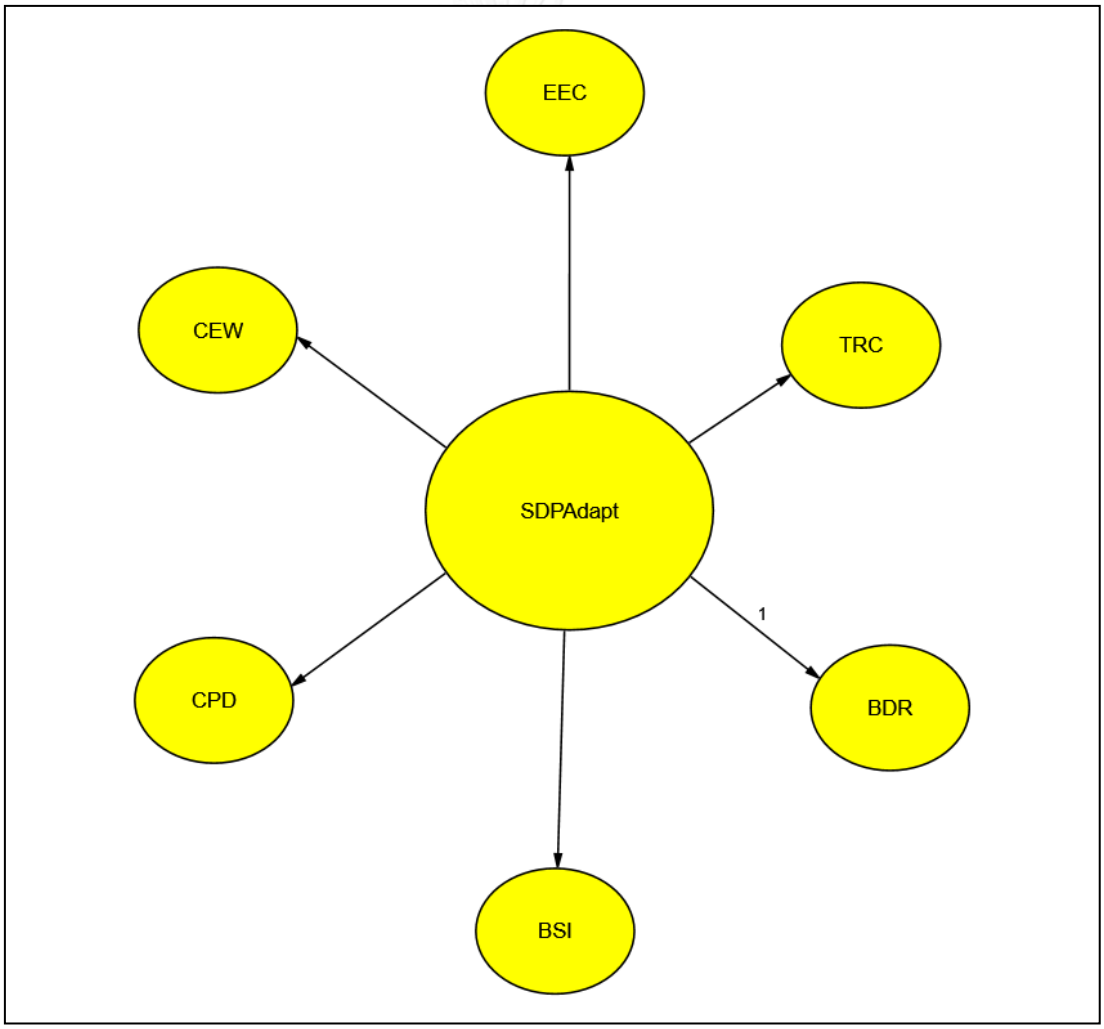


Figure102: The Theoretical Framework of Phase 2 study.

Source: Author

As presented in Figure 102, the latent construct is Sustainable Dimension Pillar Adaptation (SDPAdapt). The all observed variables in the study model are Climate, Energy & Water (CEW), Environment & Ecology (EEC), Community Planning & Design (CPD), Transportation & Connectivity (TRC), Building & Resources (BDR) and Business & Innovation (BSI).

The first listed exogenous construct is Climate, Energy & Water (CEW), contains of three (3) endogenous variables. The second listed exogenous construct is Environment & Ecology (EEC), contains of three (3) endogenous variables. The third listed exogenous construct is Community Planning & Design (CPD), consists of three (3) endogenous variables. The fourth listed exogenous construct is Transportation & Connectivity (TRC), contains of three (3) endogenous variables. The fifth listed exogenous construct is Building & Resources (BDR), consists of three (3) endogenous variables and the last exogenous construct is Business & Innovation (BSI) which also consists of three (3) endogenous variables.

All endogenous variables is assessed by means of an interval scale which vary between from 1 (Very Low Adaptation) to 5 (Very High Adaptation) with the given SDP adaptation statement of GBI Township / Neighborhood Assessment Criteria (GBI-TAC). Hence, the measurement of model for every exogenous construct is rather simplified. For this Phase 2: Stakeholders-Inclusion Approach - Professional Stakeholders Survey model of SDP Adaptation, the study could assess the CFA measurement within one model for all constructs to achieve the respective thresholds for validity and reliability (Awang, 2014; 2015; Awang et al., 2015; Kashif et al., 2015; 2016).

Thus, this Phase 2: Stakeholders-Inclusion Approach - Professional Stakeholders Survey model of SDP Adaptation study decided to conduct all-in a single CFA procedure for all exogenous construct. As stated by Awang (2012; 2013; 2014; 2015), Awang et al. (2015) and Kashif et al. (2015; 2016), prior to model the full structural model and implementing SEM, the study prerequisites to verify that all constructs in the theoretical model are discriminant of each other or it's are not highly correlated particularly amongst the exogenous constructs. If there are two or more exogenous constructs are highly correlated (correlation above than 0.85), then it will resultant of a significant problem called Multicollinearity. Table 51 below shows three (3) categories

of model fit indexes that the researcher requisites to measure the measurement model of latent construct through the Confirmatory Factor Analysis (CFA) procedure.

Table 51: The three categories of model fit and their level of acceptance.
Source: Awang, 2015

Name of category	Name of index	Level of acceptance
Absolute Fit Index	**RMSEA**	RMSEA < 0.08
	GFI	GFI > 0.90
Incremental Fit Index	**AGFI**	AGFI > 0.90
	CFI	CFI > 0.90
	TLI	TLI > 0.90
	NFI	NFI > 0.90
Parsimonious Fit Index	**Chisq/df**	Chi-Square/ df < 3.0

***The indexes in bold are recommended since they are frequently reported in literatures

7.2.3 Phase 2 Reliability Analysis

This Phase 2: Stakeholders-Inclusion Approach - Professional Stakeholders Survey model of SDP Adaptation construct consists of six exogenous constructs named as Climate, Energy & Water (CEW), Environment & Ecology (EEC), Community Planning & Design (CPD), Transportation & Connectivity (TRC), Building & Resources (BDR) and Business & Innovation (BSI). (Figure 6.2). Each exogenous constructs is measured using three (3) endogenous variables of SDP adaptation in the questionnaire which were Environment Dimension (EnP), Social Dimension (SoP) and Economic Dimension (EcP). The exogenous constructs and their respective endogenous variables were determined through the Phase 1: Stakeholders-Inclusion Approach – Expert's Semi-structure Interviews/Surveys procedure using expert's opinion findings. Figure 90 below show the conceptual path model of Phase 2 CFA analysis.

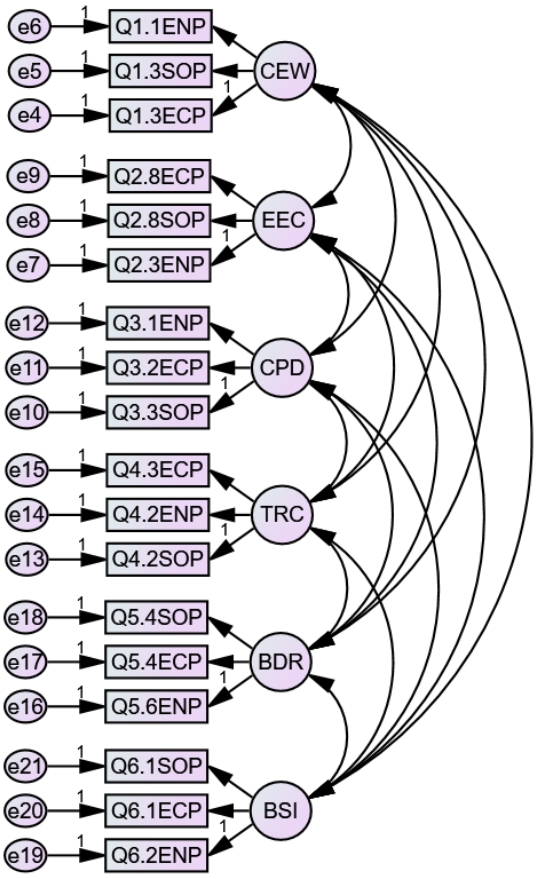


Figure103: The exogenous constructs and their measuring endogenous variables of SDP adaptation.

Source: Author

This sub-section will present the reliability analysis of the Phase 2 study's ranges. This Phase 2 study employed the internal consistency approach to assess the reliability using Cronbach's Alpha correlation-coefficient for evaluating internal consistency (Hair, 2010). It is commonly agreed that a standard Cronbach's Alpha is 0.70 or higher, however in the exploratory research study Cronbach's Alpha value can be lower up to 0.60 (Hair, 2010).

Considering the importance of Sustainable Dimension Pillars (SDP) and its adaptation in relationship with sustainable neighbourhood assessment criteria, a single latent construct (SDP Adaptations) has generated with these six most influence criteria factors as its endogenous variables. SDP Adaptations construct acted as the dependent variable. Each exogenous construct comprises of question items to which the respondents would denote based on a 5-scale point that suggest the extent to their

conformity or disconformity with each given assertion. Table 52 itemizes down the constructs, survey items and Cronbach's Alpha indexes employed in this Phase 2 study. The institution of the constructs was established upon underlying content analysis and literature reviews (Chapter 2) and Phase 1: Stakeholders-Inclusion Approach – Expert's Semi-structure Interviews/Surveys (Chapter 3 and 5) which were discussed in- detail in previous chapter.

Table 52: Measurement of the Variables of the Hypothesized Model.
Source: Author

Construct	Item	Survey questions	Mean	SD	Alpha
CEW (Climate, Energy & Water)	Q1.1ENP	Environment Dimension Adaptation	3.868	0.884	0.610
	Q1.3SOP	Social Dimension Adaptation	2.950	0.938	
	Q1.3ECP	Economic Dimension Adaptation	3.623	0.915	
EEC (Environment & Ecology)	Q2.3ENP	Environment Dimension Adaptation	3.803	1.029	0.792
	Q2.8SOP	Social Dimension Adaptation	3.590	1.054	
	Q2.8ECP	Economic Dimension Adaptation	3.688	1.041	
CPD (Community Planning & Design)	Q3.1ENP	Environment Dimension Adaptation	3.967	0.930	0.808
	Q3.3SOP	Social Dimension Adaptation	3.852	1.030	
	Q3.2ECP	Economic Dimension Adaptation	3.688	0.922	
TRC (Transportation & Connectivity)	Q4.2ENP	Environment Dimension Adaptation	3.442	1.057	0.884
	Q4.2SOP	Social Dimension Adaptation	3.803	1.137	
	Q4.3ECP	Economic Dimension Adaptation	3.655	1.093	
BDR (Building & Resources)	Q5.6ENP	Environment Dimension Adaptation	3.819	1.008	0.788
	Q5.4SOP	Social Dimension Adaptation	3.311	1.103	
	Q5.4ECP	Economic Dimension Adaptation	3.754	1.059	
BSI (Business & Innovation)	Q6.2ENP	Environment Dimension Adaptation	3.344	1.030	0.751
	Q6.1SOP	Social Dimension Adaptation	3.459	0.905	
	Q6.1ECP	Economic Dimension Adaptation	3.786	0.933	

7.2.4 Phase 2 Full Measurement of CFA

A full measurement path model is acquired by engaging the Confirmatory Factor Analysis (CFA) method on the applied endogenous variables scales. The measurement path model is established to investigate the level of the observed endogenous variables measure and the exogenous latent constructs. It indicates how the observable

endogenous variables capture the hypothetical exogenous latent constructs intended in this Phase 2 study. Confirmatory Factor Analysis (CFA) is applied to assess all the construct via the overall measurement of path model as shown in Figure 103 prior to full model measurement, the exogenous constructs (dependent variables) and their endogenous variables (independent variables) were selected corresponding to its underlying study theories. The factors denote exogenous constructs, and the supporting study questions denote their endogenous variables. Table 54 specifies the detail breakdown of CFA measurement of the listed constructs and variables.

In executing the full CFA model measurement, firstly, the appropriateness of fit for every measure was assessed in order to equate how adequate the model describes the data rationally. In this Phase 2 study, Chi-square (χ^2), RMSEA (Root Mean Square Error of Approximation) TLI (Tucker Lewis Index) and CFI (Comparative Fit Index) are applied to decide whether the model is acceptable. Measures of full CFA model fit indices employed in this Phase 2 study and its acceptance level are described in Table 53.

Table 53: Measures of Model Fit and Level of Acceptance.
Source: Author, based on Hair (2010); Hu and Bentler (1995)

Measures	Definition	Acceptance Level
P value	Probability value	Statistically significant at $P < 0.05$ and highly significant at $P < 0.001$ (***)
χ^2	Chi-square	$\chi 2$ /df≤3 (5.0 considered acceptable)
RMSEA	Root mean square error of approximation	RMSEA < 0.08 (acceptable)
TLI	Tucker-Lewis index	TLI ≥ 0.90 (acceptable)
CFI	Comparative fit index	CFI ≥ 0.90 (acceptable)
GFI	Goodness-of-fit index	GFI ≥ 0.90 (acceptable)
AGFI	Adjusted Goodness-of-fit index	AGFI ≥ 0.90 (acceptable)
NFI	Normed fit index	NFI ≥ 0.90 (acceptable)

Secondly, the estimated path model outcomes are assessed to identify transgressing estimates. This is referring to the results signs and the statistical significance of overall study estimated parameters, which are the regression weights, the standardized regression weights and the probability value (*P*-value). For instance, the standardized

regression weights are examined in order to value the relative significance of the measures. The suggested standardized loading factor estimates supposed to be at 0.5 value or above, and preferably at 0.7 value or higher value (Hair, 2010). Figures of probability value (*P*-value) specifies statistical significance of the co-efficient grounded on the study hypotheses. Proviso that the *P*-value is at 0.05 or lesser, the study co-efficient are significant. For this study IBM SPSS Amos 22 was employed, the full CFA measurement path model was designed and executed efficaciously which has produced the affirmative outcomes as presented in the Figure 104.

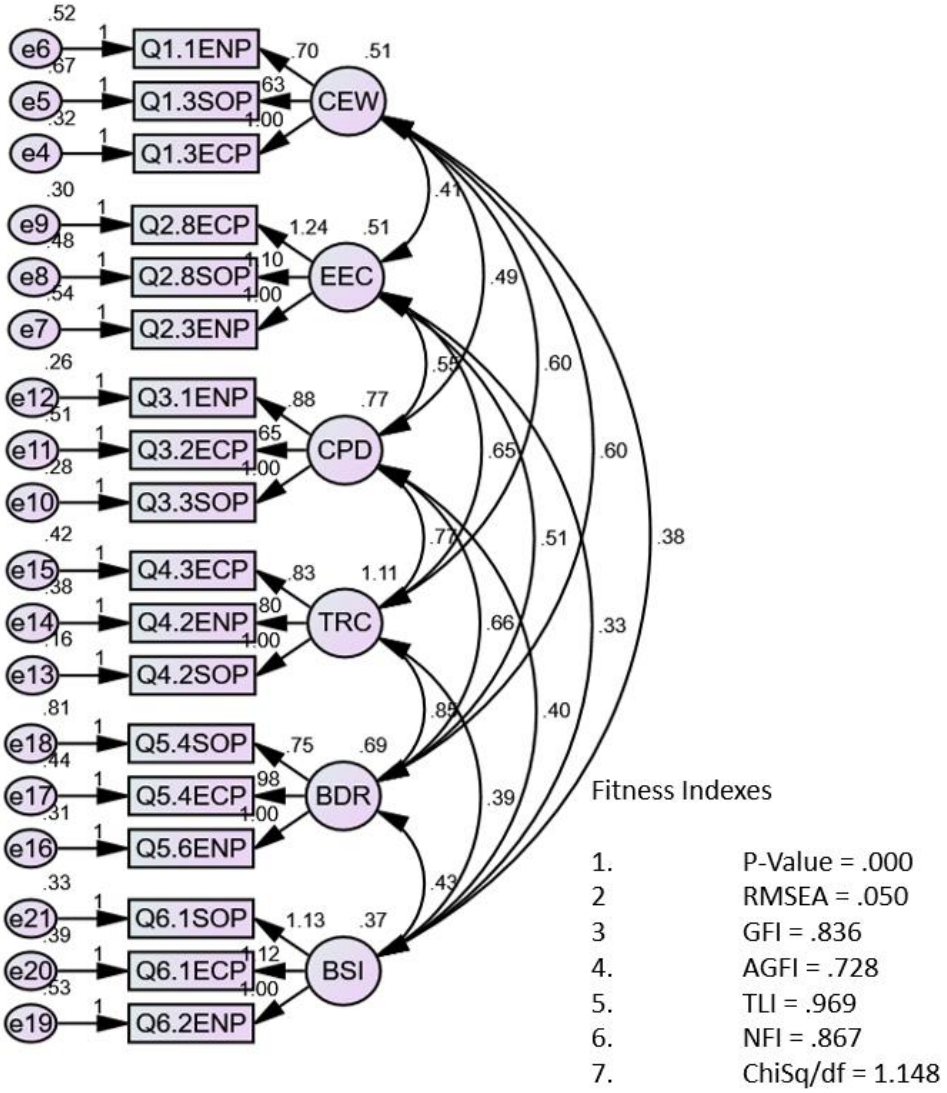


Figure104: Phase 2 output resulted from the Confirmatory Factor Analysis (CFA) procedure. Source: Author

Table 54: Parameter Estimates of Full Measurement Model.

Source: Author

Construct &Variables			(a)Unstd	(b)Std	S.E.	C.R.	*P*
Q1.3ECP	<---	CEW	1.000	.780			
Q1.3SOP	<---	CEW	.593	.459	.167	3.546	***
Q1.1ENP	<---	CEW	.727	.596	.158	4.597	***
Q2.3ENP	<---	EEC	1.000	.643			
Q2.8SOP	<---	EEC	1.291	.784	.237	5.454	***
Q2.8ECP	<---	EEC	1.427	.885	.230	6.195	***
Q3.3SOP	<---	CPD	1.000	.867			
Q3.2ECP	<---	CPD	.643	.625	.114	5.631	***
Q3.1ENP	<---	CPD	.849	.836	.101	8.379	***
Q4.2SOP	<---	TRC	1.000	.926			
Q4.2ENP	<---	TRC	.828	.832	.087	9.497	***
Q4.3ECP	<---	TRC	.855	.808	.092	9.283	***
Q5.6ENP	<---	BDR	1.000	.797			
Q5.4ECP	<---	BDR	.964	.733	.135	7.151	***
Q5.4SOP	<---	BDR	.774	.567	.155	4.988	***
Q6.2ENP	<---	BSI	1.000	.632			
Q6.1ECP	<---	BSI	1.168	.755	.228	5.113	***
Q6.1SOP	<---	BSI	1.140	.745	.228	5.007	***

Note:
(a) Estimated unstandardized regression co-efficient
(b) Standardized regression co-efficient
(c) Standard error of estimated unstandardized co-efficient.
(d) Probability of a t value equal to or greater than actual t value in a two-tailed test for significance of coefficient under the null hypothesis that the true value is zero. The symbol *** indicates that the null hypothesis is rejected at the .001 level of significance.

7.2.5 The Overall Measurement of CFA

The overall measurement of parameter estimates are shown in Table 54. The *P*-values of all specific parameter estimates are statistically significant at 0.001 (***) level amongst the construct. The affirmative co-efficient sign with *P*-value (***) means all hypothesized paths within the CFA model indicates a highly significant relationship, therefore, all hypotheses are supported.

The Confirmatory Factor Analysis (CFA) model generated the overall data (relative Chi-square = 1.148; RMSEA = 0.050; TLI = 0.969) which satisfied their critical outscores. The values of GFI (0.836), AGFI (0.728) and NFI (0.867) are acceptable for a satisfactory model although these are slightly less than the suggested condition level of 0.90 (Hair, 2010). Thus, the model justifies that the data were ideally well

represented as most of the indices yield acceptable values of standardized loading estimates.

Climate, Energy & Water (CEW)

CEW has three variables as indicated in Table 54. These variables consisted of information regarding sustainable dimension pillar adaptation (SDP Adaptation), which concerns on the environment dimension, social dimension and economic dimension. The *P*-values for all specific parameter estimates of Climate, Energy & Water Construct are statistically very significant value at 0.001 (***) level, signifying that the paths model created from the construct to all three variables are accepted. The standardized regression weights of the construct and variables are range in-between 0.459 to 0.750. The relationship between construct to Q1.3ECP (Economic Dimension) indicated an ideally significant value as indicated by Hair (2010), where the regression weights generated are above than 0.7.

It is distinctly indicated that Economic Dimension is significant and highly adapted in the Climate, Energy & Water core-criteria among the other two SDP adaptations of pre-occupancy GBI Green Township/Neighborhood Assessment Criteria (GBI-TAC). Nevertheless, the correlation concerning construct to Q1.3SOP (Social Dimension) and Q1.1ENP (Environment Dimension) denoted less significant but closed to the considerable level indicated by Hair (2010). These variables is concerned CEW sub-criteria of GBI-TAC which includes heat island design principles, efficient streetscape & greenspace lighting, on site energy generation, renewable energy, reduction in waste water and reduced water use.

Environment & Ecology (EEC)

EEC construct has three variables as presented in Table 54. These variables describe the SDP adaptations in the EEC sub-criteria of GBI-TAC with regards to augment biodiversity reserve, land reuse, ecology, flood management & avoidance, wetland & water body conservation, agricultural land preserve, hill slope development, sustainable storm water design & management, proximity to existing infrastructure services, services infrastructure provision and light pollution. The *P*-values of all specific individual parameter estimates for EEC Construct are statistically significant at 0.001

(***) value, representing that all three variables of the construct paths are accepted. The regression weights of the construct between the variables are range from 0.643 to 0.885 which is within the ideally significant level with two from three variables generated values higher than 0.7.

Common understanding for Environment & Ecology core-criteria for SDP adaptation is that Environment Dimension should has the highest adaptation, however, from the standardized loading estimates of CEE Construct, the Economic Dimension and Social Dimension portrays a substantial function in dealing with pre-occupancy assessment criteria (GBI-TAC). EEC --> Q2.8ECP and EEC--> Q2.8SOP signify the correlation between CEE Construct and the Economic and Social Dimension adaptation. The economic and social factors plays a major role in enhancing sustainable neighborhood in respect to the surrounding environment and native ecological systems as these Economic and Social Dimension variables generated above fulfilled regression weight score. Thus, as accordance to measurement concerned, the correlations between CEE Construct and its variables are significant and accepted.

Community Planning & Design (CPD)

CPD has three variables as shown in the Table 54. The *P*-values of all specific individual parameter estimates for CPD Construct are statistically significant at 0.001 (***) value. The hypothesized model paths shows significant correlation, thus hypotheses of variables are all supported. For all variables of CEE Construct, the relationship co-efficient are yielding from 0.625 to 0.867 in standardized regression weight, which on standard are ideally significant. Two from three variables generated the loading estimates above 0.7 value which are ideal regression weight (Hair, 2010). The two variables are Q3.3SOP (0.867) and Q3.1ENP (0.836) which related to Social Dimension and Environment Dimension in pre-occupancy CPD core-criteria of GBI-TAC. The only variables which is below 0.7 loading estimates is Q3.2ECP (0.625) which is Economic Dimension concerned.

All these variables are to represent SDP adaptations in GBI-TAC pre-occupancy assessment criteria for Sustainable Township/Neighborhood which are planned and designed for the advantage of the reside community. CPD are initiated using an integrated approach of master planning and best practice in urban design values by

emphasizing user-centered and greenspaces. The CPD pre-occupancy assessment criteria concerns greenspaces, compact development, amenities for communities, provision for universal accessibility, secure design, health in design, recycling facilities, community diversity, affordable housing, community thrust and governance.

Transportation & Connectivity (TRC)

TRC has three variables as presented in Table 54. The *P*-values for all specific individual parameter estimates intend for TRC Construct are statistically significant at 0.001 (***) value, suggesting that all model paths from the construct to all three variables are accepted. The standardized loading estimates of the construct yielding from 0.808 to 0.926 which are idyllically significant, whereby all three variables generating loading estimates beyond than accepted value of 0.7.

The variables included with the construct consist of the SDP adaptations in TRC core-criteria of GBI-TAC. The Sustainable Township/Neighborhood are well-connected places that have a broad range of transportation options, excellent accessibility, connectivity and are well linked to surrounding districts. The TRC pre-occupancy assessment sub-criteria includes green transport masterplan, availability and frequency of public transport, facilities for public transportation, pedestrian networks, cycling networks and alternative transport options. The importance of TRC as one of the influential pre-occupancy assessment factors can be seen when all the generated loading estimates is above acceptance level and probability values is significant. The results thus supported all the hypotheses.

Building & Resources (BDR)

BDR has three variables as indicated in Table 54. The *P*-values of all specific individual parameter estimates for BDR Construct are statistically significant at 0.001 (***) value, implying that the model paths from construct to all three variables are significant. The standardized loading estimates of the three construct shown the value ranging from 0.567 and 0.797 which are significant even though one of the loading estimates are below 0.7 as suggest acceptance. The variables attached in the construct suggest professional stakeholders opinion on SDP adaptation on pre-occupancy assessment sub-criteria which concerns low impact material (infrastructure), low

impact material (building & structures), regional material, quality in construction, construction waste management, site sedimentation and pollution control, sustainable construction practice and GBI certified building.

Based on standardized loading estimates, the highest significant level is Environment Dimension which mean high adaptation and followed by Economic Dimension and lastly Social Dimension. BDR core-criteria of Sustainable Township/Neighborhood imply a lower impact on resources – by applying the 'more from less' principle, emphasize the need to minimize the use of highly resource intensive materials by using a life cycle approach and it's also make effective use of local materials and resources for the construction of new communities.

Business & Innovation (BSI)

BSI also has three variables as suggested in Table 54. The *P*-values for all specific individual parameter estimates for BSI Construct are statistically significant at 0.001 (***) value, signifying that the model paths from construct to all three variables are accepted. The standardized loading estimates of the construct indicated the value ranging from 0.632 to 0.755 which are significant though one of the loading estimates are lower than 0.7. Two from three variables generated the loading estimates above 0.7 value which are ideal regression weight (Hair, 2010). The two variables are Q6.1SOP (0.745) and Q6.1ECP (0.755) which is Social Dimension and Economic Dimension respectively in pre-occupancy CPD core-criteria of GBI-TAC. The only variables which is below 0.7 loading estimates is Q6.2ENP (0.632) which is Environment Dimension concerned.

The BSI core-criteria in pre-occupancy GBI-TAC for Sustainable Township/Neighborhood are tailored to respond to local needs in creating business and employment whilst incorporating innovative solutions. It's also to provide employment opportunities for its residents to work closer to their homes, provide avenues for businesses to form and flourish, and demonstrate best practices through the implementation of innovative technologies and solutions at many different levels of the township.

CFA Result Summary

This sub-section assessed the full CFA measurement path model which showed that all exogenous constructs and their endogenous variables comprise a satisfactory fit with the analyzed data, therefore the measurement path model is prepared to be assessed in the SEM full structural model format.

7.2.6 Phase 2 Full Structural Model of SEM

A full structural model is the element of the general path model that commends the relationship between a proposed set of unobserved latent variables (Bollen 1989, Byrne 2001). In distinction with the measurement model (CFA), the full structural model (SEM) concerned of how the specific constructs (SDP Adapt factors) affect the latent construct (SDP Adapt) grounded on the underlying study theory. This sub-section presents the development progression of the Structural Equation Model (SEM), based the POEM for SND conceptual model (Figure 75) which was discussed in Chapter 3 and Chapter 6.

7.2.7 Phase 2 Conceptual Model of SEM

Figure 105 is the conceptual structural model of SDP Adaptations which was drawn according to the underlying conception of POEM for SND. The development of the conceptual model was based on GBI-TAC pre-occupancy assessment criteria and POEM for SND framework. It was discussed in detail in Chapter 2 (Literature Review), Chapter 3 (Research Methodology) and Chapter 5 (Data Analysis). Based on the content analysis and POEM for SND framework, six hypotheses were formulated. All these hypotheses are tested, the obtain outcomes are presented and discussed in the following sub-sections.

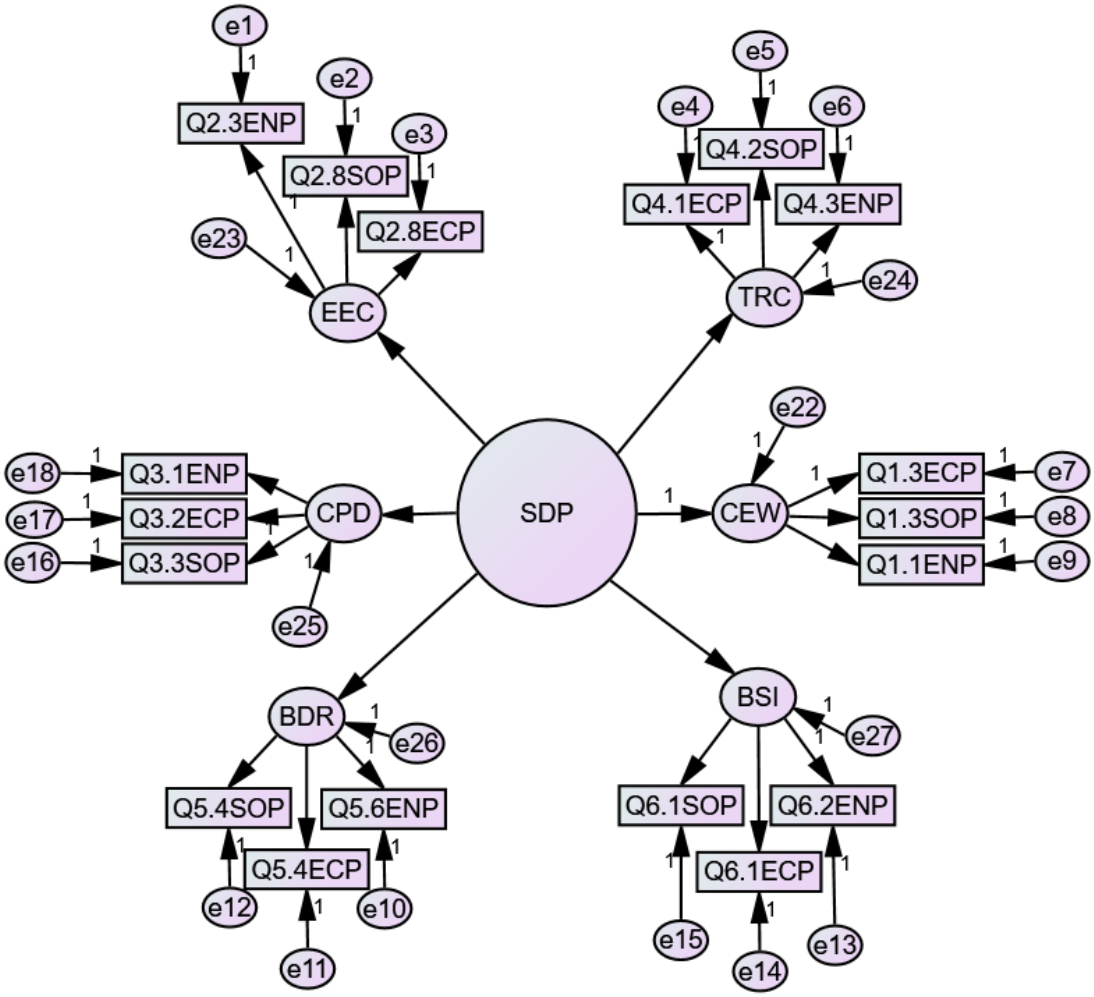


Figure105: Conceptual Structural Model of SDP Adaptations.

Source: Author

The six formulated hypotheses are as listed below:

Hypothesis 1: Climate, Energy & Water affects SDP Adaptations

Hypothesis 2: Environment & Ecology affect SDP Adaptations

Hypothesis 3: Community Planning & Design affects SDP Adaptations

Hypothesis 4: Transportation & Connectivity affects SDP Adaptations

Hypothesis 5: Building & Resources affects SDP Adaptations

Hypothesis 6: Business & Innovation affects SDP Adaptations

7.2.8 Phase 2 Full Measurement of SEM

The analyses of SDP adaptations in pre-occupancy sustainable township/neighborhood assessment criteria (GBI-TAC) are based on professional stakeholder's opinion in the Klang Valley/Greater KL. Since sustainable township/neighborhood is relatively new in Malaysia, most of the development and pool of professionals who implemented this sustainable guidelines are concentrated in this center region. Furthermore, the only available case studies of certified sustainable neighborhood development which was certified using GBI-TAC and occupied for more than one year is in the Klang Valley/Greater KL. Given there are six constructs to be analyzed, the analysis of structural equation models are particularly suited for this intention as it is to compare and distinct the outcomes in capturing the actual endogenous variables that affect the exogenous dependent variable. The SEM path model is applied to Phase 2: Stakeholders-Inclusion Approach – Professional Stakeholder Surveys set data. The fit indexes results reported in this SEM analysis is *P*-value, RMSEA, GFI, AGFI, TLI, NFI and ChiSq/df.

The analysis emphases on measuring the different dimension of SDP Adaptations and variation across the assessment core-criteria of GBI-TAC. In this context, for each sustainable dimension, there is a necessity for researcher to assess the complex relationships within the SDP Adaptations and to compare the value of constructs across the assessment core-criteria in terms of correlations. Figure 106 represents the full Structural Equation Model (SEM) for SDP Adaptation in pre-occupancy assessment criteria of GBI-TAC.

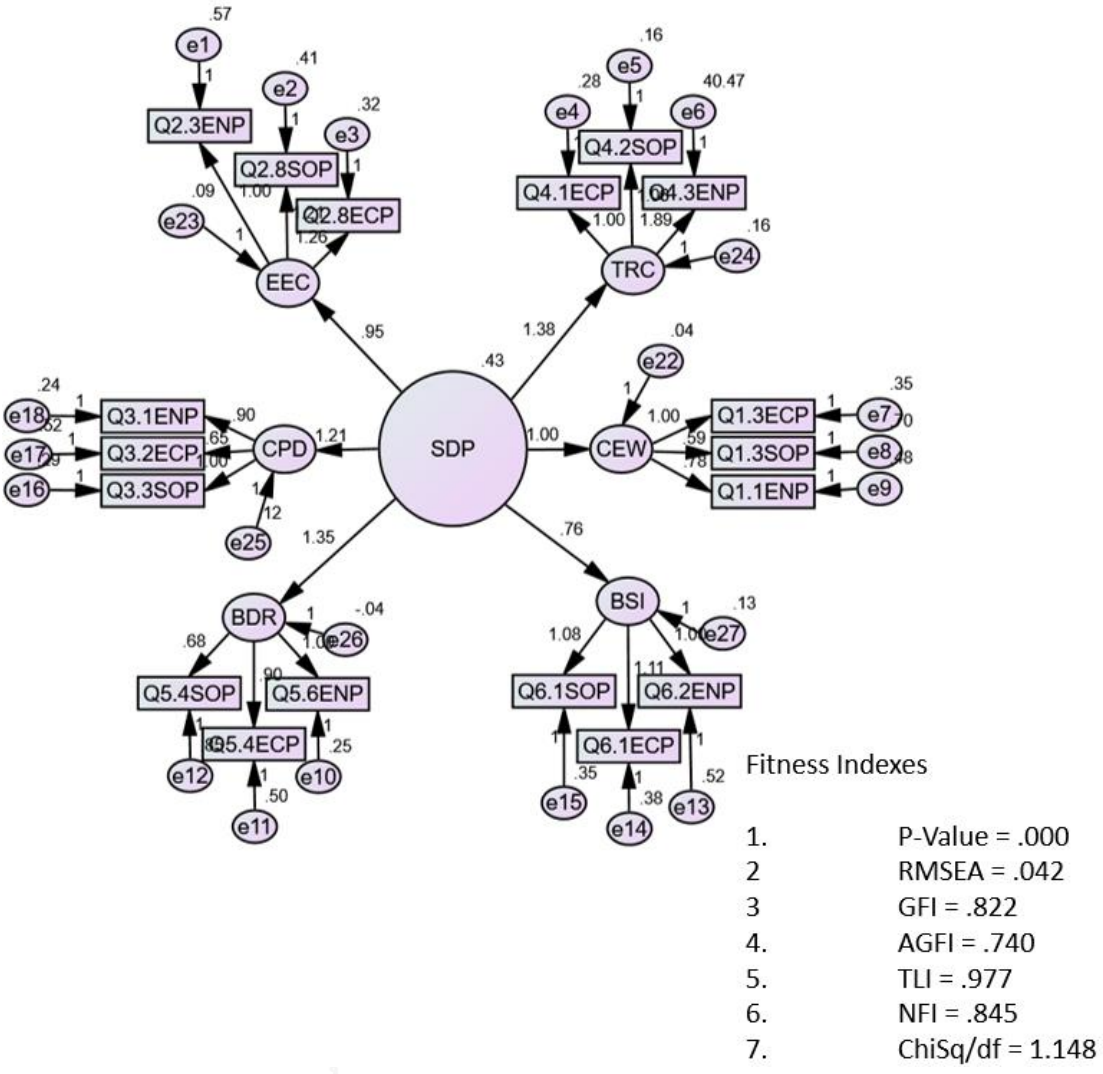


Figure106: The standardized coefficients of Full Structural Model for SDP Adaptations.

Source: Author

7.3 Phase 3 Structural Equation Modeling

7.3.1 Preliminary Data Analysis

Similar to Phase 2 procedure, in Phase 3 full measurement of SEM, preliminary data analysis is conducted prior to it. Preliminary data analysis involves the total number of end-users/household respondents and the conduct test of reliability measurement in ensuring the consistency of the applicable data.

Profile of the Respondents

This Phase 3 study sampling consist of end-user/household stakeholders. In this phase, a total 378 end-users/household respondents' opinions is collected from three (3) GBI Malaysia certified sustainable neighbourhood development in the Klang Valley/Greater KL. These certified sustainable neighbourhood is chosen based on the pre-condition that it being occupied for more than one (1) year. The three (3) selected case studies are Ken Rimba, Bandar Rimbayu and Sunway Resort City. The respondents involved in this study are among the homeowners, tenants or workers of the said neighbourhood. Among the respondents user type, homeowners recorded the largest number of this study participations which total up for 200 respondents or 63.93%. The total number of respondents who are tenants are 129 or 34.12% and total number of respondents as workers are 49 which sum up to 12.96% (Table 55).

Table 55: Number of Respondents by User Type.
Source: Author

User Type	No. Of Respondents	Percentage (%)
Homeowners	200	52.91%
Tenants	129	34.12%
Workers	49	12.96%
Total	**378**	**100.00%**

The tabulation of Phase 3 survey respondents is as shown in Table 56. The detail composition of the respondents based on case studies are Ken Rimba 122 respondents, where 59 respondents are homeowners (15.60%), 52 respondents are tenants (13.75%)

and 11 respondents are workers (2.91%). For Bandar Rimbayu case study, 71 respondents are homeowners (18.78%), 38 respondents are tenants (10.05%) and 16 respondents are workers (4.23%). The third or last case study is Sunway Resort City where 70 respondents are homeowners (18.51%), 39 respondents are tenants (10.31%) and 22 respondents are workers (5.82%). The description for such composition is that homeowners is the main type of users reside in the certified sustainable neighbourhood development. This is followed by tenants as the second type of users who occupied the chosen case studies and the balance is the workers. Since sustainable neighborhood development in the Klang Valley/Greater KL is a high-end property development, it is justifiable that most of the end-user respondents is the homeowners where they plan for permanent or long-term stay instead of tenants or workers.

Table 56: Number of Respondents by User Type / Neighborhood.
Source: Author

User/Neighborhood	No. Of Respondents	Percentage (%)
Homeowners	59	15.60%
Tenants	52	13.75%
Workers	11	2.91%
Ken Rimba	**122**	**32.27%**
Homeowners	71	18.78%
Tenants	38	10.05%
Workers	16	4.23%
Bandar Rimbayu	**125**	**33.06%**
Homeowners	70	18.51%
Tenants	39	10.31%
Workers	22	5.82%
Sunway Resort City	**131**	**34.65%**
Total	**378**	**100.00%**

7.3.2 Phase 3 CFA & SEM

The Framework of Research in this POEM for SND study for Phase 3: Stakeholders-Inclusion Approach – End-User/Household Survey comprises of one latent exogenous construct which is Post-Occupancy Evaluation Model for Sustainable Neighborhood Development (POEM for SND), and three dependent variable of Environment

Dimension Pillar (EnP), Social Dimension Pillar (EnP), and Economic Dimension Pillar (EnP). The theoretical relationship between the constructs is modeled and shown in Figure 107.

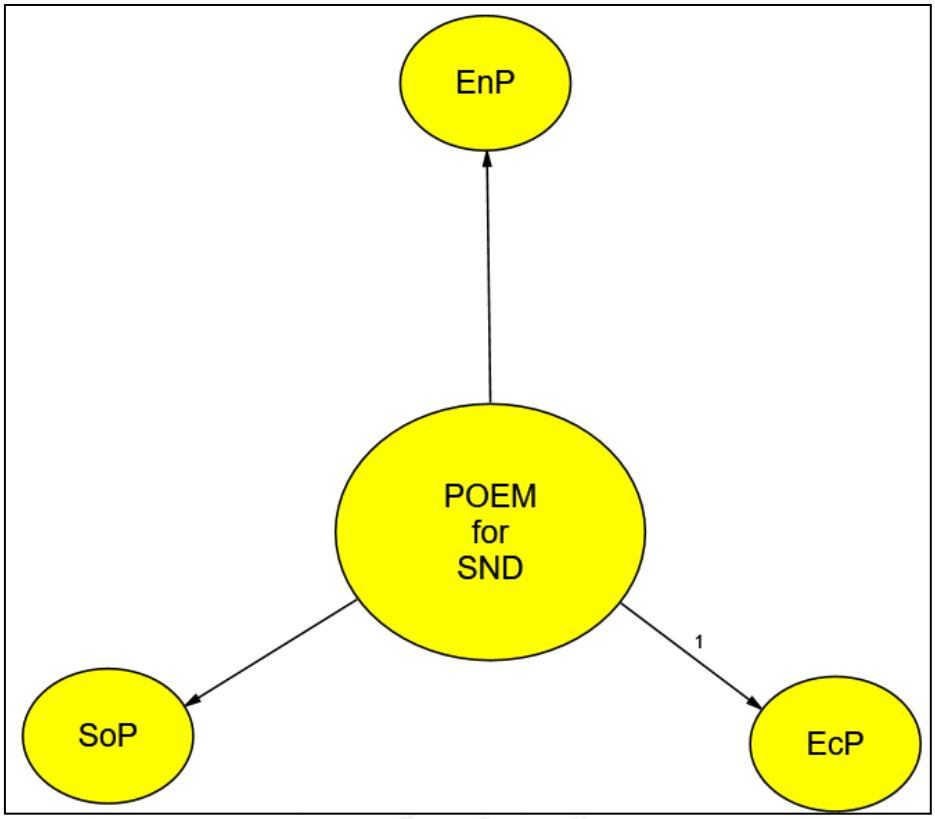


Figure107: The Theoretical Framework of Phase 3 study.
Source: Author

As presented in Figure 107, the latent construct is Post-Occupancy Evaluation Model for Sustainable Neighborhood Development (POEM for SND). The three (3) observed variables in the study model are Environment Dimension Pillar (EnP), Social Dimension Pillar (EnP), and Economic Dimension Pillar (EcP). The first exogenous construct is Environment Dimension Pillar (EnP) which consists of six (6) endogenous variables. The second listed exogenous construct is Social Dimension Pillar (EnP), which contains of eight (8) endogenous variables. The last or third listed exogenous construct is Economic Dimension Pillar (EcP) which consists of seven (7) endogenous variables.

All endogenous variables is assessed by means of an interval scale which vary between

from 1 (Very Low Sufficiency/Practice) to 5 (Very High Sufficiency/Practice) with the given end-user occupancy sustainable experience statement in POEM Handbook End-User/Household Assessment Criteria. The measurement of model for every exogenous construct in this Phase 3 is adapted and simplified from Phase 2 Study. For this Phase 3: Stakeholders-Inclusion Approach – End-User/Household Survey model of POEM for SND, the study could assess the CFA measurement using one model for all constructs in order to achieve the relevant thresholds for validity and reliability (Awang, 2014; 2015; Awang et al., 2015; Kashif et al., 2015; 2016).

Hence, in this Phase 3: Stakeholders-Inclusion Approach – End-User/Household Survey model of POEM for SND study decided to conduct a single CFA procedure for all exogenous construct. According to Awang (2012; 2013; 2014; 2015), Awang et al. (2015) and Kashif et al. (2015; 2016), the study prerequisites are to verify that all constructs in the theoretical model are discriminant of each other or it's are not highly correlated particularly amongst the exogenous constructs prior to model the full structural model and implementation of SEM. In the case where there are two or more exogenous constructs are highly correlated (correlation above than 0.85). Highly correlation will results of a significant problem called Multicollinearity. Table 51 in previous sub-section (Sub-section 7.2.2) shows three (3) categories of model fit indexes that prerequisites to measure the measurement model of latent construct through the Confirmatory Factor Analysis (CFA) modeling.

7.3.3 Phase 3 Reliability Analysis

This Phase 3: Stakeholders-Inclusion Approach – End-User/Household Survey model of POEM for SND study construct consists of three exogenous constructs named as Environment Dimension Pillar (EnP), Social Dimension Pillar (SoP) and Economic Dimension Pillar (EcP) (Figure 108). EnP exogenous construct is measured using six (6) endogenous variables of POEM for SND evaluation criteria in the questionnaire which were Sufficient Designated Green Area (Q8.1), Sufficient Street or Park Lighting (Q8.2), Generate or Use Renewable Energy (Q8.3), Reduced or Recycle Water Practice (Q8.4), Bio-diversity Reserved Availability (Q8.5) and Infrastructure Services Efficiency (Q8.7). SoP exogenous construct is measured using eight (8) endogenous

variables of POEM for SND evaluation criteria in the questionnaire which were Sufficient Communal Space (Q8.9), Population Density & Development Level (Q8.10), Universal Accessibility Availability (Q8.12), Security and Safety Experiences (Q8.13), Public Health Concerns (Q8.14), Recycling Facilities or Practices (Q8.15), Community Diversification (Q8.16) and Community Engagement & Management (Q8.17). Lastly, EcP exogenous construct is measured using seven (7) endogenous variables of POEM for SND evaluation criteria in the questionnaire which were Public Transport Reliability (Q8.19), Sufficient Pedestrian & Cycling Networks (Q8.20), Low Impact & Regional Materials (Q8.21), Promotion of Sustainable Construction (Q8.22), Construction Waste & Sedimentation (Q8.23), Sufficient Commercial Amenities (Q8.24) and Innovative Development (Q8.25). The exogenous constructs and their respective endogenous variables were determined through the Phase 1: Stakeholders-Inclusion Approach – Expert's Semi-structure Interviews/Surveys procedure using expert's opinion findings and Phase 2: Stakeholders-Inclusion Approach – Professional Stakeholder Surveys outcomes. Figure 108 below show the conceptual path model of Phase 3 CFA analysis.

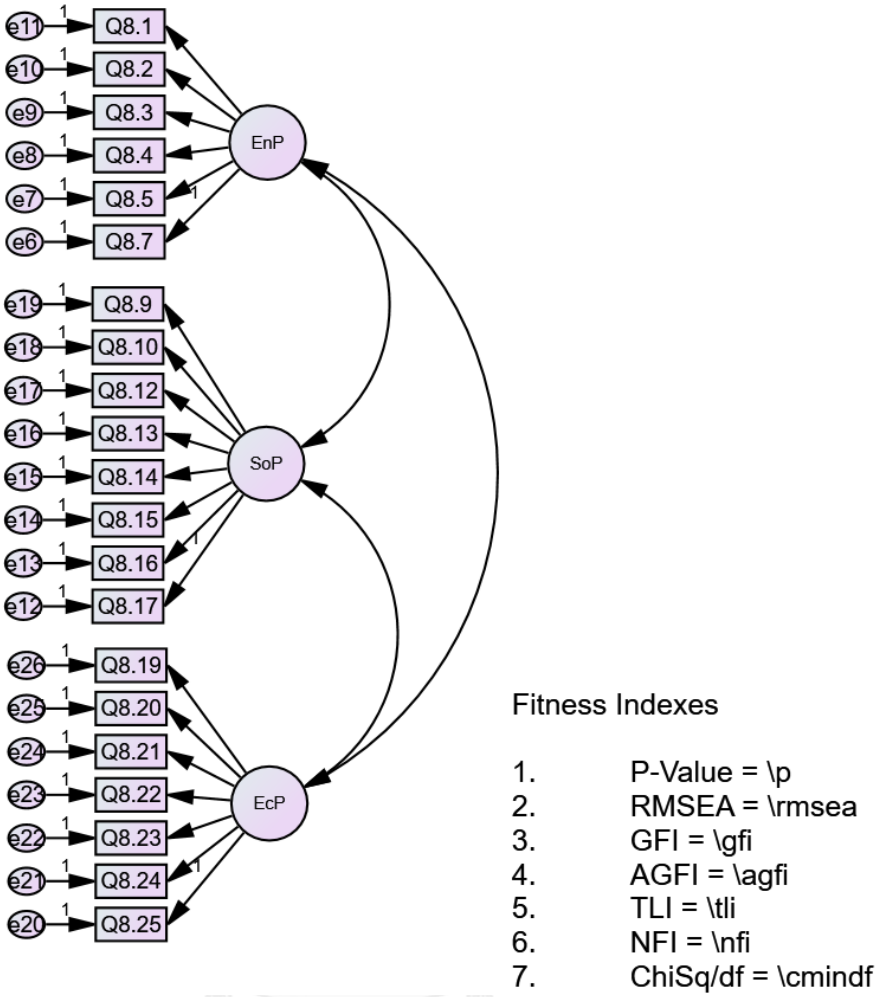


Figure108: The exogenous constructs and measuring endogenous variables of POEM - SND.
Source: Author

The second part of this sub-section will report the reliability analysis of the Phase 3 study's ranges. Similar to Phase 2, this Phase 3 study also employed the internal consistency approach in order to assess the reliability using Cronbach's Alpha correlation-coefficient for evaluating internal consistency. It is by standard agreement that a Cronbach's Alpha is 0.70 or higher, however, according to Hair (2010) in the exploratory research study Cronbach's Alpha value can be lower up to 0.60.

Considering the importance POEM for SND evaluation criteria and its Sustainable Dimension Pillars (SDP) adaptation in relationship with post-occupied certified sustainable neighbourhood, a single latent construct (POEM for SND) has generated with these three sustainable dimension pillars influence factors as its endogenous variables. POEM for SND construct acted as the dependent variable. Each exogenous

construct comprises of question items to which the respondents would opted their sustainable related experience based on a 5-scale point that suggest the extent to their conformity or disconformity with each given assertion. Table 57 details down the constructs, survey items and Cronbach's Alpha indexes employed in this Phase 3 study. The institution of the constructs was established upon simplifying the assessment criteria that underlying content analysis and literature reviews (Chapter 2), and Phase 1: Stakeholders-Inclusion Approach – Expert's Semi-structure Interviews/Surveys and Phase 2: Stakeholders-Inclusion Approach – Professional Stakeholder Surveys (Chapter 5) which were discussed in- detail in previous chapter.

Table 57: Measurement of the Variables of the Hypothesized Model.

Source: Author

Construct	Item	Survey questions	Mean	SD	Alph
EnP (Environment Dimension Pillar)	Q8.1	Sufficient Designated Green Area	3.751	.0740	0.533
	Q8.2	Sufficient Street or Park Lighting	3.791	0.736	
	Q8.3	Generate or Use Renewable Energy	2.822	0.914	
	Q8.4	Reduced or Recycle Water Practice	3.029	0.969	
	Q8.5	Bio-diversity Reserved Availability	4.148	1.263	
	Q8.7	Infrastructure Services Efficiency	3.624	0.575	
SoP (Social Dimension Pillar)	Q8.9	Sufficient Communal Space	3.825	0.754	0.725
	Q8.10	Population Density & Development Level	3.447	0.616	
	Q8.12	Universal Accessibility Availability	3.164	0.671	
	Q8.13	Security and Safety Experiences	3.695	0.651	
	Q8.14	Public Health Concerns	3.510	0.695	
	Q8.15	Recycling Facilities or Practices	3.343	0.957	
	Q8.16	Community Diversification	3.484	0.703	
	Q8.17	Community Engagement & Management	3.227	0.880	
EcP (Economic Dimension Pillar)	Q8.19	Public Transport Reliability	3.187	0.678	0.613
	Q8.20	Sufficient Pedestrian & Cycling Networks	2.735	1.417	
	Q8.21	Low Impact & Regional Materials	3.425	0.652	
	Q8.22	Promotion of Sustainable Construction	3.261	0.796	
	Q8.23	Construction Waste & Sedimentation	2.079	1.717	
	Q8.24	Sufficient Commercial Amenities	3.854	0.657	
	Q8.25	Innovative Development	3.957	0.838	

7.3.4 Phase 3 Full Measurement of CFA

Similar procedure as conducted in Phase 2 CFA, a full measurement path model is acquired by using the Confirmatory Factor Analysis (CFA) method on the applied endogenous variables scales. The measurement path of the model is determined to investigate the level of the observed endogenous variables measure and the exogenous latent constructs. It indicates how the observable endogenous variables capture the hypothetical exogenous latent constructs intended in this Phase 3 study. Confirmatory Factor Analysis (CFA) is applied to assess all the construct via the overall measurement of path model as shown in Figure 109. Prior to full model measurement, the exogenous constructs (dependent variables) and their endogenous variables (independent variables) were selected corresponding to its underlying study theories. The factors denote exogenous constructs, and the supporting study questions denote their endogenous variables. Table 58 specifies the detail breakdown of CFA measurement of the listed constructs and variables.

In executing the full CFA model measurement, firstly, the appropriateness of fit for every measure was assessed in order to equate how adequate the model describes the data rationally. In this Phase 3 study, Chi-square (χ^2), RMSEA (Root Mean Square Error of Approximation) TLI (Tucker Lewis Index) and CFI (Comparative Fit Index) are applied to decide whether the model is acceptable. Measures of full CFA model fit indices employed in this Phase 3 study similar to Phase 2 study and its acceptance level are described in Table 51 (Sub-section 7.2.2).

Secondly, the estimated path model outcomes are assessed to identify transgressing estimates. This is referring to the results signs and the statistical significance of overall study estimated parameters, which are the regression weights, the standardized regression weights and the probability value (*P*-value). All the threshold for overall study parameters are already discussed in detail earlier in Phase 2 CFA study, Sub-section 7.2.4 of this Chapter.

For this study IBM SPSS Amos 22 was used, the full CFA measurement path model was designed and executed efficaciously which has produced the affirmative outcomes as presented in the Figure 109.

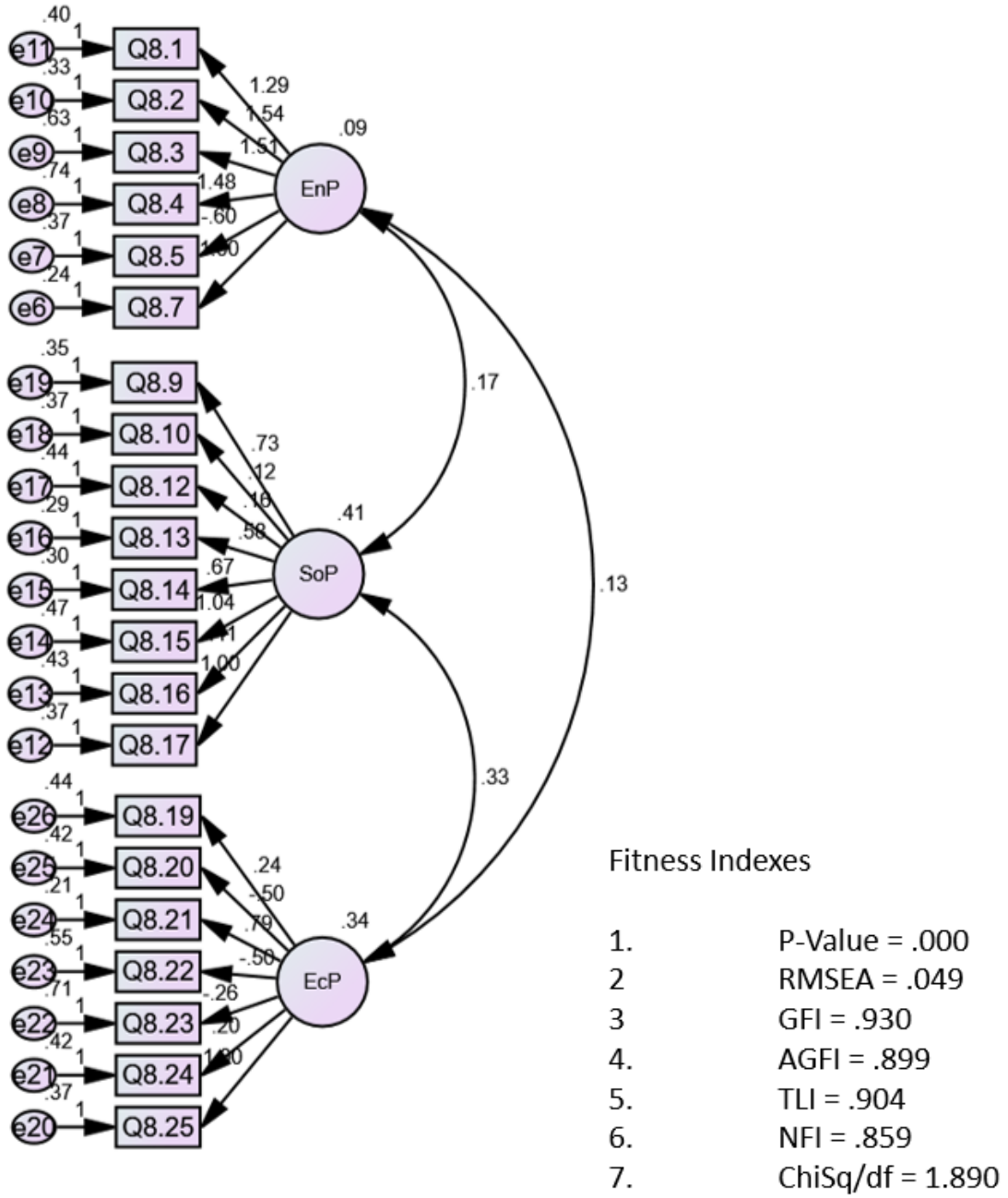


Figure109: Phase 3 output resulted from the Confirmatory Factor Analysis (CFA) procedure. Source: Author

Table 58: Parameter Estimates of Full Measurement Model.
Source: Author

Construct &Variables			(a)Unstd	(b)Std	S.E.	C.R.	*P*
Q8.7	<---	EnP	1.000	.545			
Q8.5	<---	EnP	-.714	-.354	.127	-5.639	***
Q8.4	<---	EnP	1.292	.421	.197	6.563	***
Q8.3	<---	EnP	1.310	.453	.190	6.881	***
Q8.2	<---	EnP	1.520	.646	.172	8.823	***
Q8.1	<---	EnP	1.218	.515	.160	7.635	***
Q8.17	<---	SoP	1.000	.721			
Q8.16	<---	SoP	.424	.383	.060	7.014	***
Q8.15	<---	SoP	1.018	.677	.084	12.141	***
Q8.14	<---	SoP	.622	.567	.061	10.233	***
Q8.13	<---	SoP	.577	.563	.057	10.144	***
Q8.12	<---	SoP	.193	.191	.060	3.239	.001
Q8.10	<---	SoP	.112	.116	.053	2.110	.035
Q8.9	<---	SoP	.740	.623	.066	11.283	***
Q8.25	<---	EcP	1.000	.711			
Q8.24	<---	EcP	.246	.222	.064	3.844	***
Q8.23	<---	EcP	-.250	-.174	.082	-3.044	.002
Q8.22	<---	EcP	-.491	-.367	.077	-6.372	***
Q8.21	<---	EcP	.749	.684	.066	11.325	***
Q8.20	<---	EcP	-.464	-.390	.069	-6.745	***
Q8.19	<---	EcP	.218	.191	.065	3.332	***

Note:
(a) Estimated unstandardized regression co-efficient
(b) Standardized regression co-efficient
(c) Standard error of estimated unstandardized co-efficient.
(d) Probability of a t value equal to or greater than actual t value in a two-tailed test for significance of coefficient under the null hypothesis that the true value is zero. The symbol *** indicates that the null hypothesis is rejected at the .001 level of significance.

7.3.5 The Overall Measurement of CFA

The overall measurement of parameter estimates are shown in Table 58. The *P*-values of all specific parameter estimates are highly significant where the value is at 0.001 (***) level amongst the construct except for Q8.10-->SoP and Q8.23-->EcP are statistically significant where the *P*-values are ≥ 0.001 but ≤ 0.05 (refer to Table 6.4). The affirmative co-efficient sign with highly significant *P*-value (***) and statistically significant *P*-value ≤ 0.05 means all hypothesized paths within the CFA model indicates a highly significant relationship, therefore, all hypotheses are supported.

The Confirmatory Factor Analysis (CFA) model generated the overall data (relative Chi-square = 1.890; RMSEA = 0.049; GFI = 0.930; TLI = 0.904) which fulfilled their significant outscores. The values of AGFI (0.899) and NFI (0.859) are acceptable for a satisfactory model although these are slightly less than the suggested condition level of 0.90 (Hair, 2010). Thus, the model justifies that the data were ideally well represented as most of the indices yield a fit values of standardized loading estimates.

Environment Dimension Pillar (EnP)

EnP has six variables as indicated in Table 58. These variables consisted of information regarding environment dimension pillar post-occupancy evaluation criteria, which concerns on Sufficient Designated Green Area (Q8.1), Sufficient Street or Park Lighting (Q8.2), Generate or Use Renewable Energy (Q8.3), Reduced or Recycle Water Practice (Q8.4), Bio-diversity Reserved Availability (Q8.5) and Infrastructure Services Efficiency (Q8.7). The *P*-values for all specific parameter estimates of Climate, Energy & Water Construct are statistically high significant value at 0.001 (***) level, signifying that the paths model created from the construct to all six (6) variables are accepted. The standardized regression weights of the construct and variables are range in-between -0.354 to 0.646. The relationship between construct to EnP (Environment Dimension Pillar) indicated less significant value as indicated by Hair (2010), where the regression weights generated are below than 0.7. Furthermore one of the construct indicated negative value at -0.354 (Q8.5) against EnP.

It is distinctly indicated that Environment Dimension Pillar is less significant and moderately sufficient or experienced by the end-users/households of the selected case studies of certified sustainable neighborhood in the Klang Valley/Greater KL. Nevertheless, the correlation concerning construct to Q8.1 (Sufficient Designated Green Area), Q8.2 (Sufficient Street or Park Lighting), Q8.3 (Generate or Use Renewable Energy), Q8.4 (Reduced or Recycle Water Practice), and Q8.7 (Infrastructure Services Efficiency) standardized regression weight (0.421 – 0.646) denoted less significant but closed to the considerable level indicated by Hair (2010). However for Q8.5 (Bio-diversity Reserved Availability), the correlation concerning construct is negative value (-0.354) indicated that this provision is not available or experiences by the end-users/household of the selected certified case studies.

Social Dimension Pillar (SoP)

SoP construct has eight (8) variables as presented in Table 58. These variables consisted of information regarding social dimension pillar post-occupancy evaluation criteria, which regards to fulfill sustainable community related criteria of Sufficient Communal Space (Q8.9), Population Density & Development Level (Q8.10), Universal Accessibility Availability (Q8.12), Security and Safety Experiences (Q8.13), Public Health Concerns (Q8.14), Recycling Facilities or Practices (Q8.15), Community Diversification (Q8.16) and Community Engagement & Management (Q8.17). The *P*-values of all specific individual parameter estimates for EEC Construct are highly significant at 0.001 (***) value and statistically significant at ≥ 0.001 but ≤ 0.05 (refer to Table 58), representing that all eight (8) variables of the construct paths are accepted. The regression weights of the construct between the variables are range from 0.116 to 0.721 which is less than significant level except for Q8.17 (Community Engagement & Management) variables is significant where the generated values higher than 0.7.

Economic Dimension Pillar (EcP)

EcP has seven variables as shown in the Table 58. These variables consisted of information regarding economic dimension pillar post-occupancy evaluation criteria, which concerns on Public Transport Reliability (Q8.19), Sufficient Pedestrian & Cycling Networks (Q8.20), Low Impact & Regional Materials (Q8.21), Promotion of Sustainable Construction (Q8.22), Construction Waste & Sedimentation (Q8.23), Sufficient Commercial Amenities (Q8.24) and Innovative Development (Q8.25). The *P*-values of all specific individual parameter estimates for EcP Construct are highly significant at 0.001 (***) value and statistically significant at 0.002 value (Q8.23). The hypothesized model paths shows significant correlation, thus hypotheses of variables are all supported. For all variables of EcP Construct, the relationship co-efficient are yielding from -0.390 to 0.711 in standardized regression weight, which on standard are less significant except for Q8.25 (0.711) where the value is above significant level. All these variables generated the loading estimates below 0.7 value which are less ideal regression weight (Hair, 2010). Three variables yielded negative standardized

regression weight value (Q8.20 at -0.390; Q8.22 at -0.367; and Q8.23 at -0.174). The balance three (3) variables yielded positive standardized regression weight value but below suggested acceptance level of above 0.7 value (Q8.19 at 0.191; Q8.21 at 0.684; Q8.24 at 0.222).

CFA Result Summary

This sub-section assessed the full CFA measurement path model which showed that all exogenous constructs and their endogenous variables comprise a satisfactory fit with the analyzed data, therefore the measurement path model is prepared to be assessed in the SEM full structural model format.

7.3.6 Phase 3 Full Structural Model of SEM

A full structural model of Structural Equation Modelling is the element of the general path model that commends the relationship between a proposed set of unobserved latent variables (Bollen 1989, Byrne 2001). In distinction with the measurement model (CFA), the full structural model (SEM) concerned the relationship between the latent construct (SDP evaluation criteria) and the specific construct (POEM for SND factors) grounded on the underlying study theory. This sub-section presents the development progression of the Structural Equation Model (SEM), based the POEM for SND conceptual model (Figure 75) which was discussed in Chapter 3 and Chapter 5.

7.3.7 Phase 3 Conceptual Model of SEM

Figure 110 is the conceptual structural model of Post-Occupancy Evaluation Criteria which was drawn according to the underlying conception of POEM for SND. The development of the conceptual model was based on Content Analysis, GBI-TAC and POEM for SND framework. The Phase 3 POEM for SND study was discussed in detail in Chapter 2 (Literature Review), Chapter 3 (Research Methodology) and Chapter 5 (Data Analysis). Based on the POEM for SND framework, three (3) hypotheses were formulated. All these hypotheses are tested, the obtained outcomes are presented and discussed in the following sub-sections.

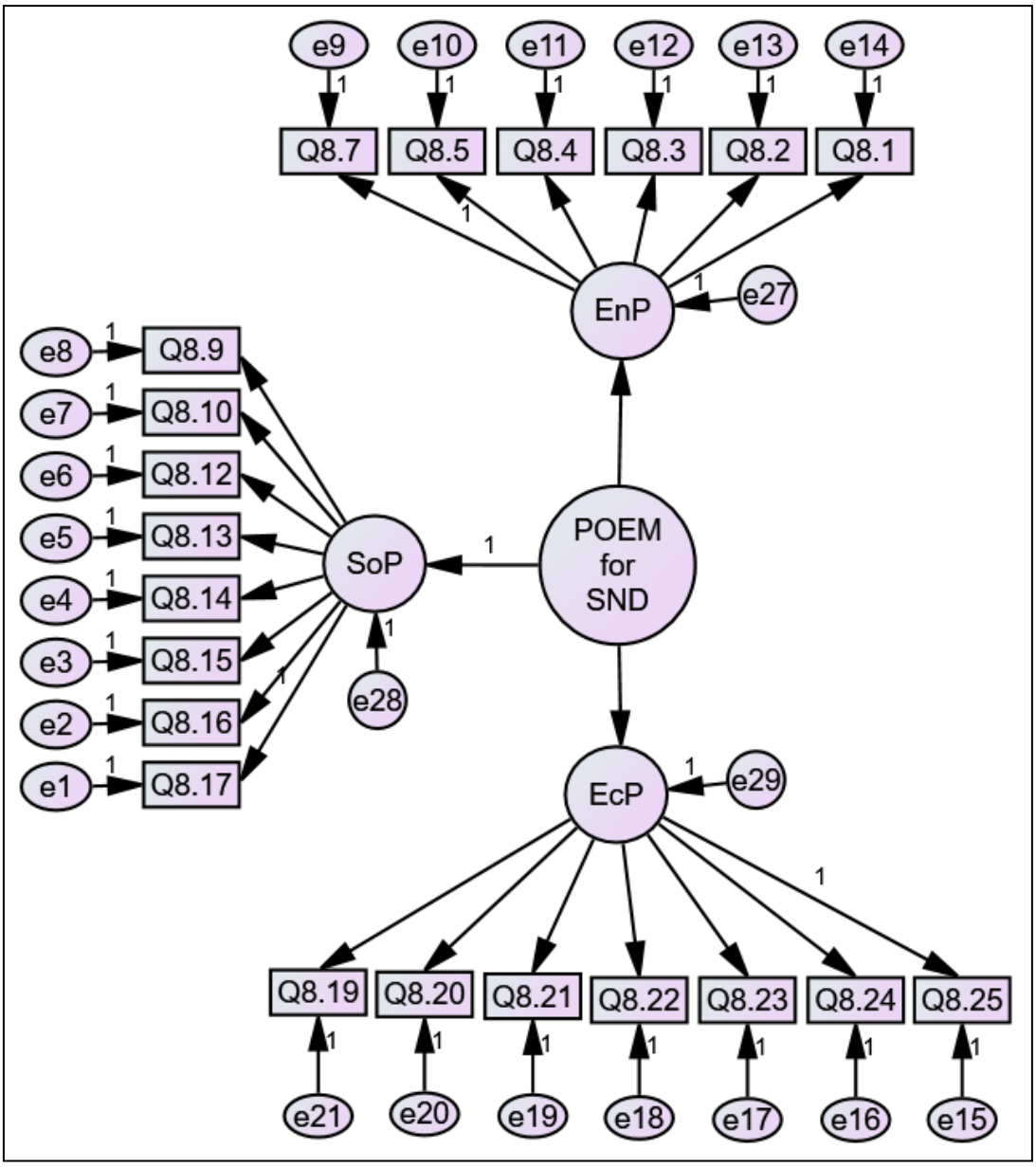


Figure110: Conceptual Structural Model of SDP Adaptations.

Source: Author

The six formulated hypotheses are as listed below:

Hypothesis 1: Environment Dimension Criteria (EnP) affects POEM for SND

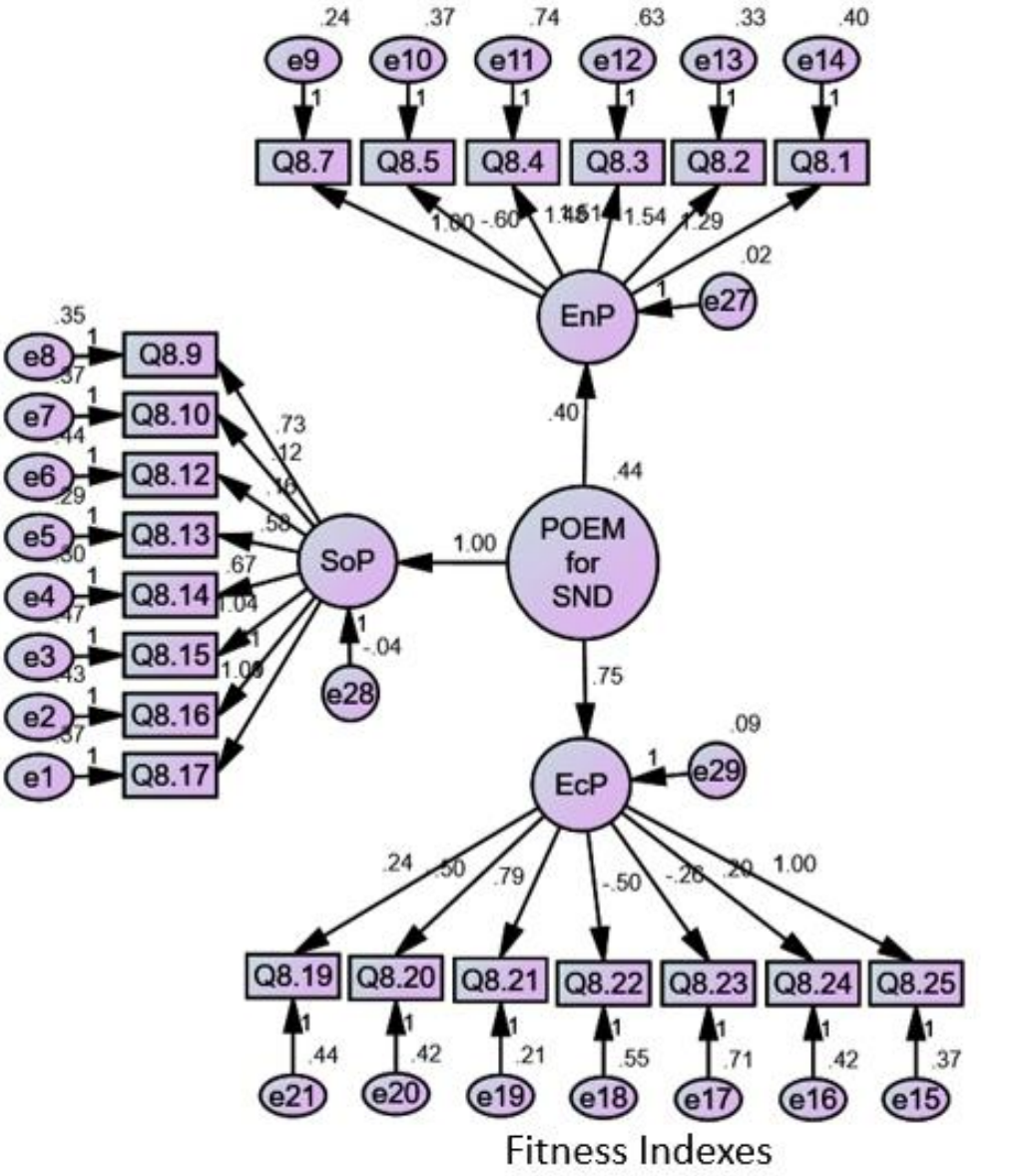
Hypothesis 2: Social Dimension Criteria (SoP) affect POEM for SND

Hypothesis 3: Economic Dimension Criteria (EcP) affects POEM for SND

7.3.8 Phase 3 Full Measurement of SEM

The analyses of POEM for SND evaluation criteria for certified sustainable township/neighborhood development are based on end-users/households opinion of the three (3) selected case-studies in the Klang Valley/Greater KL. Since sustainable township/neighborhood is relatively new in Malaysia, the only available GBI certified sustainable township/neighborhood and being occupied for more than one (1) year is Ken Rimba, Bandar Rimbayu and Sunway Resort City. Given there are three (3) constructs to be analyzed, the analysis of structural equation models are particularly suited for this intention as it is to compare and distinct the outcomes in capturing the actual endogenous variables that affect the exogenous dependent variable. The SEM path model is conducted to Phase 3: Stakeholders-Inclusion Approach – End-User/Household Surveys data set. The fit indexes results reported in this SEM analysis is *P*-value, RMSEA, GFI, AGFI, TLI, NFI and ChiSq/df.

The analysis emphases on measuring the three (3) different dimension of SDP which are Environment Dimension Pillar (EnP), Social Dimension Pillar (SoP) and Economic Dimension Pillar (EcP) and variation across the evaluation criteria of POEM for SND. In this context, for each sustainable dimension, there is a necessity for researcher to assess the complex relationships within the POEM for SND and to compare the value of constructs across the evaluation criteria in terms of correlations. Figure 111 represents the full Structural Equation Model (SEM) for POEM for SND evaluation criteria.



Fitness Indexes

1.	P-Value = .000
2	RMSEA = .049
3	GFI = .930
4.	AGFI = .900
5.	TLI = .904
6.	NFI = .857
7.	ChiSq/df = 1.887

Figure111: Full Structural Model of POEM for SND.

Source: Author

7.4 Pre-Occupancy and Post-Occupancy Evaluation Outcomes

7.4.1 Phase 2 (Pre-occupancy) SEM Analysis Results of SDP Adaptations

The Phase 2 SDP Adaptations data were analyzed using IBM SPSS Amos 22. The generated outcome result of full structured model yielded the *P*-value = .000, RMSEA = 0.042, TLI = .977 and ChiSq/df = 1.148 which highly fulfilled the threshold outscores. The other reported indexes values is GFI = .882, AGFI = .740 and NFI = .845 are tolerable for an acceptable path model even though the index values are lower than constraint level of 0.9 (GFI, AGFI and NFI) respectively and ≤ 5.0 (ChiSq/df). The full structured model describes the data are appropriate where all the given paths co-efficient (*P*-value) of the underlying structure were statistically highly significant at 0.001 (***) value and statistically significant at ≤ 0.05 value. Therefore, the parameter estimates of the hypothesized full structure model were free of any offending value. However, for Q4.3ENP <-- TRC that indicated only significant correlation between construct. The positive coefficient sign with P-value (0.042) in Q4.3ENP <-- TRC path is statistically significantly related. Therefore, all hypothesized paths of the full structured model show significant correlation implying that all hypotheses are supported. The positive co-efficient sign of *P*-value at (***) or ≤ 0.05 is due to the sufficient sample size of Phase 2: Stakeholders-Inclusion Approach – Professional Stakeholders Surveys which covers the main center region of Klang Valley/Greater KL as a study area. According to MacCallum et al. (1999) a structured model profiling such as sample size affects the parameter accuracy of estimates and model fit indexes. The structure model with larger sample size can generate lower values of RMSEA index. Table 59 renders the parameter estimates of the full structural model of Phase 2 SDP Adaptations.

Table 59: Parameter Estimates of the Full Structural Model of SDP Adaptations in GBI-TAC. Source: Author

Construct &Variables			(a)Unstd	(b)Std	S.E.	C.R.	*P*
TRC	<---	SDP	1.458	.931	.239	6.109	***
EEC	<---	SDP	1.003	.938	.209	4.809	***
CEW	<---	SDP	1.000	.863			
CPD	<---	SDP	1.225	.905	.213	5.759	***
BDR	<---	SDP	1.365	1.019	.214	6.376	***
BSI	<---	SDP	.798	.860	.185	4.317	***
Q2.3ENP	<---	EEC	1.000	.664			
Q2.8SOP	<---	EEC	1.271	.810	.225	5.648	***
Q2.8ECP	<---	EEC	1.328	.874	.215	6.176	***
Q4.1ECP	<---	TRC	1.000	.886			
Q4.2SOP	<---	TRC	1.054	.932	.095	11.044	***
Q4.3ENP	<---	TRC	1.756	.263	.864	2.031	.042
Q1.3ECP	<---	CEW	1.000	.799			
Q1.3SOP	<---	CEW	.560	.441	.172	3.258	.001
Q1.1ENP	<---	CEW	.745	.624	.161	4.627	***
Q5.6ENP	<---	BDR	1.000	.851			
Q5.4ECP	<---	BDR	.942	.755	.130	7.244	***
Q5.4SOP	<---	BDR	.720	.558	.148	4.874	***
Q6.2ENP	<---	BSI	1.000	.637			
Q6.1ECP	<---	BSI	1.149	.739	.238	4.832	***
Q6.1SOP	<---	BSI	1.099	.726	.233	4.710	***
Q3.3SOP	<---	CPD	1.000	.845			
Q3.2ECP	<---	CPD	.657	.618	.123	5.358	***
Q3.1ENP	<---	CPD	.866	.822	.112	7.758	***

Note:
(a) Estimated unstandardized regression coefficients
(b) Standard error of estimated unstandardized coefficient.
(c) Probability of a t value equal to or greater than actual t value in a two-tailed test for significance of coefficient under the null hypothesis that the true value is zero. The symbol *** indicates that the null hypothesis is rejected at the .001 level of significance.

Climate, Energy & Water (CEW)

The standardized (b) loading estimates of the endogenous construct (observed) yielded for Climate, Energy & Water (CEW) are as presented in Table 59 above. Economic Dimension (ECP) yields the highest significant value at .799 indicating that SDP Adaptations in this dimension is of importance or highly adapted. This is followed by Environment Dimension (ENP) with significant value at .624 and Social Dimension (SOP) with significant value at .441. CEW pre-occupancy assessment sub-criteria of GBI-TAC concerns heat island design principles, efficient streetscape & greenspace lighting, on site energy generation, renewable energy, reduction in waste water and reduced water use. Even though the CEW assessment sub-criteria seems to incline to

Environment Dimension, however, the loading estimates from Phase 2: Stakeholders-Inclusion Approach – Professional Stakeholder Surveys full structured SEM modeling indicating Economic Dimension is highly adapted or most significant in SDP Adaptations.

Environment & Ecology (EEC)

The Environment & Ecology (EEC) construct standardized loading estimates outcomes yielded are as indicated in Table 59. Overall, the outcomes imply that EEC is within the loading values level that suggest considerable SDP Adaptations in pre-occupancy GBI-TAC. Two out of three observable endogenous constructs yielded above significant loading value of regression weight. The full structured model standardized loading estimates for Economic Dimension (Q2.8ECP) is highly significant at .874 value, followed by Social Dimension (Q2.8SOP) which is also highly significant at .810 value and lastly the Environment Dimension (Q2.3ENP) which is less significant at .664 value. The SDP Adaptations in EEC sub-criteria of GBI-TAC concerns with the preservation of biodiversity reserve, land reuse strategy, ecology availability, flood management & avoidance, wetland & water body conservation, agricultural land preserve, hill slope development principles, sustainable storm water design & management, proximity to existing infrastructure services, services infrastructure provision and light pollution control. The less significant outcome in Environment Dimension is due to lack implementation of sustainable management and provision efforts of Environment & Ecology assessment sub-criteria in most of township/neighborhood development projects in Klang Valley/Greater KL.

All specific path co-efficient of the causal CEE full structure model are statistically significant at 0.001 (***) values, the parameter estimates of the hypothesized full structured model are also exempted from offending statistical values including the SDP Adapt ---> CEE path, therefore this hypotheses is supported. The less significant values yielded reveal that the Environment Dimension for pre-occupancy EEC assessment core-criteria of GBI-TAC sustainable projects implementation need improvement to further support the sustainable township/neighborhood development growth parallel with the nation's sustainable development agendas.

Community Planning & Design (CPD)

The standardized loading estimates generated for Community Planning & Design (CPD) Construct are as presented in Table 59. For CPD Construct, two out of three standardized loading estimates is above 0.7 significant level as suggested by Hair (2010). The Social Dimension (Q3.3SOP) obtained high significant value at .845 and Environment Dimension (Q3.1ENP) also yielded high significant value at .822. Only Economic Dimension (Q3.2ECP) generated less significant value but closed to acceptance level at 0.7 where the standardized loading estimates values is at .657. This outcomes suggest high SDP Adaptations in Social Dimension and Environment Dimension in pre-occupancy assessment criteria of GBI-TAC while least adaptation and consideration for Economic Dimension. Averagely, CPD Construct yielded at .774 value for standardized loading estimates which signifies significant.

The regression weight values vary among the designated sustainable dimension indicating that SDP adaptation differ in relative advantage as for the case of CPD core-criteria, Social Dimension and Environment Dimension appears to be the significant factor that brings the CPD assessment core-criteria towards an enhanced sustainable neighborhood development. The less significant regression weight value yielded for Economic Dimension shows that this dimension need improvement in SDP Adaptations to support sustainable growth and minimizing the CPD assessment core-criteria sustainable adaptation gap. This is due to lack of consideration in SDP Adaptations and implementation of Economic Dimension related factors in CPD pre-occupancy assessment sub-criteria which concerns greenspaces, compact development, amenities for communities, provision for universal accessibility, secure design, health in design, recycling facilities, community diversity, affordable housing, community thrust and governance.

Transportation & Connectivity (TRC)

The standardized loading estimates outcome for Transportation & Connectivity (TRC) construct are as presented in Table 59. The standardized average outcomes indicated that TRC has the slightly lower loading factor and satisfactory level of acceptance within the overall pre-occupancy assessment evaluation core-criteria of GBI-TAC. The standardized loading estimates for Environment Dimension is at .263 value, hence,

insignificant or has the lowest consideration in SDP Adaptation. However, the standardized loading estimates yielded for Social Dimension and Economic Dimension is highly significant where the estimates value at .932 (Q4.2SOP) and .889 (Q4.1ECP) respectively. On average, TRC construct standardized loading estimates yielded .693 value which indicates just significant or slightly below 0.7 value suggested for acceptance level by Hair (2010).

Pre-occupancy assessment sub-criteria of TRC construct concerns assessment sub-criteria that includes green transport masterplan, availability and frequency of public transport, facilities for public transportation, pedestrian networks, cycling networks and alternative transport options. The low standardized loading estimates for Environment Dimension is due to poor implementation of sustainable transportation masterplan and public transportation management and facilities. Another reason is due to minimum application of non-vehicular network systems and alternative options in the certified neighborhood development. Hence, the insignificant values yielded reveal that Environment Dimension is highly less adapted in SDP Adaptations of TRC construct. Its needs improvement in this said dimension to better facilitate and support the sustainable growth of township/neighborhood development and its pre-occupancy assessment criteria and certification.

Building & Resources (BDR)

The yielded standardized loading estimates of the construct for Building & Resources (BDR) are as indicated in Table 59. For BDR Construct standardized loading estimates, two sustainable dimension standardized loading estimates are above 0.7 significant level as suggested by Hair (2010). The Environment Dimension (Q5.6ENP) obtained high significant value at .851 and Economic Dimension (Q5.4ECP) also yielded high significant value at .755. Economic Dimension (Q5.4SOP) generated less significant value but closed to acceptance level at 0.7 where the standardized loading estimates values is at .558. This results imply high SDP Adaptations in Environment Dimension and Economic Dimension in pre-occupancy assessment criteria of GBI-TAC while least adaptation and consideration for Social Dimension. Averagely, BDR Construct yielded at .721 value for standardized loading estimates which denotes significant.

The variation of regression weight values within the defined sustainable dimension representing SDP adaptation priority concerns for BDR pre-occupancy assessment core-criteria. Environment Dimension and Economic Dimension shows the priority rank significant factor of the BDR assessment core-criteria in sustainable neighborhood development. The less significant regression weight value yielded for Social Dimension shows that this dimension least considered in SDP Adaptations in BDR pre-occupancy assessment criteria. This is due to less involvement or public participation thru Social Dimension related factors in BDR pre-occupancy assessment sub-criteria which concerns low impact material (building & infrastructure), regional material, quality in construction, construction waste management, site sedimentation and pollution control, sustainable construction practice and GBI certified building. The low standardized loading estimates for Social Dimension is due to indirect relationship of social participation in the implementation of sustainable construction management and practice. Another reason is due to minimum application of low impact material and regional material during the development stage. Thus, the less significant values yielded reveal that Social Dimension is less adapted in SDP Adaptations of BDR construct.

Business & Innovation (BSI)

Lastly, is the Business & Innovation (BSI) generated outcomes. The standardized loading estimates yielded for BSI is as shown in Table 59. Economic Dimension (ECP) yields the highest significant value at .739 (Q6.1ECP) indicating that SDP Adaptations in this dimension is of importance or highly adapted. This is followed by Social Dimension (SOP) with significant value at .624 (Q6.1SOP) and Environment Dimension (ENP) with significant value at .637 (Q6.2ENP). BSI has the least pre-occupancy assessment sub-criteria of GBI-TAC. The assessment sub-criteria of BSI concerns on business, innovation and GBI Facilitator. BSI assessment sub-criteria inclined to Economic Dimension and Social Dimension, hence, the loading estimates from Phase 2: Stakeholders-Inclusion Approach – Professional Stakeholder Surveys full structured SEM modeling indicating these two Dimension is highly adapted or most significant in SDP Adaptations while less significant in Environment Dimension.

The less significant regression weight value yielded for Environment Dimension shows that this dimension need improvement in SDP Adaptations to support sustainable

development growth and minimizing the BSI assessment core-criteria Environment Dimension adaptation gap. The lack of consideration in SDP Adaptations and implementation of Environment Dimension related factors in BSI pre-occupancy assessment sub-criteria should be improved in particular the innovation sub-criteria where there is wide avenue for this dimension further enhancement.

7.4.2 Phase 2 (Pre-occupancy) Summary of Full Structural Equation Model

Following the full structural model discussed above, and the hypotheses formulated as the base of the model, the following table summarized the hypothesized model in terms of its P-value. All path coefficients of the causal structure were statistically significant when the P-value indicated less than 0.001 (***), showing that the hypotheses are all supported. Table 60 presents the hypotheses results formulated for Phase 2 full structural model.

Table 60: Summary of Hypotheses.
Source: Author

Hypothesis	**Hypothesis Path**	**P-value**	**Results**
Hypothesis 1:	SDP Adapt --> CEW	***	Supported
Hypothesis 2:	SDP Adapt --> EEC	***	Supported
Hypothesis 3:	SDP Adapt --> CPD	***	Supported
Hypothesis 4:	SDP Adapt --> TRC	***	Supported
Hypothesis 5:	SDP Adapt --> BDR	***	Supported
Hypothesis 6:	SDP Adapt --> BSI	***	Supported

7.4.3 Phase 3 (Post-occupancy) SEM Analysis Results of POEM for SND

The Phase 3 POEM for SND data were analyzed using IBM SPSS Amos 22. The generated outcome result of full structured model yielded the *P*-value = .000, RMSEA = .049, GFI = .930, AGFI = .900, TLI = .904 and ChiSq/df = 1.887 which highly fulfilled the threshold outscores. The other reported indexes values is NFI = .857 are tolerable for an acceptable path model even though the index values are lower than constraint level of 0.9 (GFI, AGFI and NFI) respectively and ≤ 5.0 (ChiSq/df). The full

structured model describes the data are appropriate where all the given paths co-efficient (*P*-value) of the underlying structure were statistically highly significant at 0.001 (***) value and statistically significant at ≤ 0.05 value. Therefore, the parameter estimates of the hypothesized full structure model were free of any offending value. However, for Q8.10<-- SoP the generated value indicated only significant correlation between construct. The positive coefficient sign with P-value (0.027) in Q8.10<-- SoP path is statistically significantly related. Therefore, all hypothesized paths of the full structured model show significant correlation implying that all hypotheses are supported. The positive co-efficient sign of *P*-value at (***) or ≤ 0.05 is due to the sufficient sample size of Phase 3: Stakeholders-Inclusion Approach – End-User/Household Surveys which covers the only three (3) available case studies in the Klang Valley/Greater KL as a study area. According to MacCallum et al. (1999) a structured model profiling such as sample size affects the parameter accuracy of estimates and model fit indexes. The structure model with larger sample size can generate lower values of RMSEA index. Table 61 renders the parameter estimates of the full structural model of Phase 3 POEM for SND.

Table 61: Parameter Estimates of the Full Structural Model of POEM for SND.
Source: Author

Construct &Variables	(a)Unstd	(b)Std	S.E.	C.R.	*P*

EnP	<---	POEM	.404	.895	.046	8.813	***
EcP	<---	POEM	.737	.860	.070	10.531	***
SoP	<---	POEM	1.000	1.075			
Q8.17	<---	SoP	1.000	.725			
Q8.16	<---	SoP	.418	.381	.059	7.088	***
Q8.15	<---	SoP	1.014	.681	.080	12.638	***
Q8.14	<---	SoP	.616	.569	.059	10.517	***
Q8.13	<---	SoP	.564	.553	.055	10.260	***
Q8.12	<---	SoP	.217	.214	.057	3.802	***
Q8.10	<---	SoP	.115	.121	.052	2.218	.027
Q8.9	<---	SoP	.720	.612	.064	11.328	***
Q8.7	<---	EnP	1.000	.541			
Q8.5	<---	EnP	-.714	-.353	.126	-5.663	***
Q8.4	<---	EnP	1.278	.414	.195	6.563	***
Q8.3	<---	EnP	1.372	.469	.190	7.204	***
Q8.2	<---	EnP	1.484	.627	.169	8.789	***
Q8.1	<---	EnP	1.270	.534	.163	7.781	***
Q8.25	<---	EcP	1.000	.705			
Q8.24	<---	EcP	.245	.220	.064	3.827	***
Q8.23	<---	EcP	-.237	-.163	.082	-2.888	.004
Q8.22	<---	EcP	-.504	-.374	.077	-6.565	***
Q8.21	<---	EcP	.779	.706	.066	11.854	***
Q8.20	<---	EcP	-.460	-.384	.069	-6.697	***
Q8.19	<---	EcP	.323	.281	.075	4.318	***

Note:
(a) Estimated unstandardized regression coefficients
(b) Standard error of estimated unstandardized coefficient.
(c) Probability of a t value equal to or greater than actual t value in a two-tailed test for significance of coefficient under the null hypothesis that the true value is zero. The symbol *** indicates that the null hypothesis is rejected at the .001 level of significance.

Environment Dimension Pillar (EnP)

The standardized (b) loading estimates of the endogenous construct (observed) yielded for Environment Dimension Pillar (EnP) are as presented in Table 61 above. These variables consisted of information regarding environment dimension pillar post-occupancy evaluation criteria, which concerns on Sufficient Designated Green Area (Q8.1), Sufficient Street or Park Lighting (Q8.2), Generate or Use Renewable Energy (Q8.3), Reduced or Recycle Water Practice (Q8.4), Bio-diversity Reserved Availability (Q8.5) and Infrastructure Services Efficiency (Q8.7). Q8.2 yields the highest significant value at .627 indicating that Sufficient Street or Park Lighting in this dimension is the most sufficient and highly experience by the end-user upon occupancy. This is followed by Q8.7 (Infrastructure Services Efficiency) with significant value at

.541, Q8.1 (Sufficient Designated Green Area) with significant value at .534, Q8.3 (Generate or Use Renewable Energy) with significant value at .469, and Q8.4 (Reduced or Recycle Water Practice) with significant value at .414. However, only Q8.5 (Bio-diversity Reserved Availability) generated negative value at -.353.

The standardized (b) loading estimates yielded values suggested that among the analyzed POEM for SND evaluation criteria of Environment Dimension Pillar (EnP) in the three selected case studies of GBI certified sustainable neighborhood upon occupancy of minimum one (1) year resultants to less significant outcome where the value is below 0.7 as recommended by Hair (2010). Furthermore, one (1) out of six (6) evaluation criteria resultants to negative value. Based on POEM for SND evaluation criteria ranking, the most sufficient or adapted sustainable criteria upon post-occupancy as experienced by the end-users in their occupied neighborhood is sufficient street or park lighting, the second sustainable criteria is infrastructure services efficiency, the third criteria is sufficient designated green area, the fourth criteria is generate or use renewable energy, the fifth criteria is reduced or recycle water practice and the least sufficient or adapted sustainable criteria is Bio-diversity Reserved Availability. Even though all the three (3) selected case studies are GBI certified, however, the loading estimates from Phase 3: Stakeholders-Inclusion Approach – End-User/Household Surveys full structured SEM modeling indicated that Environment Dimension Pillar evaluation criteria average value is at .372 and below significant value (above 0.7). Hence, in Post-Occupancy Evaluation Assessment based on end-user/household opinion the sustainable environment dimension is not fulfilled or significantly experienced.

Social Dimension Pillar (SoP)

The standardized (b) loading estimates of the endogenous construct (observed) generated for Social Dimension Pillar (SoP) are as presented in Table 61. These variables consisted of information regarding social dimension pillar post-occupancy evaluation criteria, which concerns on Sufficient Communal Space (Q8.9), Population Density & Development Level (Q8.10), Universal Accessibility Availability (Q8.12), Security and Safety Experiences (Q8.13), Public Health Concerns (Q8.14), Recycling Facilities or Practices (Q8.15), Community Diversification (Q8.16) and Community

Engagement & Management (Q8.17). The positive co-efficient sign of *P*-value at (***) or ≤ 0.05 suggested that all SoP Construct specific individual parameter estimates are highly significant at 0.001 values (Q8.9; Q8.12 to Q8.17) and statistically significant at 0.027 value (Q8.10). The standardized regression weight highest significant value is .627 yielded from variables Q8.17 which indicating that Community Engagement & Management in this dimension is the most sufficient and highly experience by the end-user upon post-occupancy. This is followed by Q8.15 (Recycling Facilities or Practices) with standardized regression weight significant value at .541, Q8.9 (Sufficient Communal Space) with standardized regression weight significant value at .612, Q8.14 (Public Health Concerns) with standardized regression weight significant value at .569, Q8.13 (Security and Safety Experiences) with standardized regression weight significant value at .553, Q8.16 (Community Diversification) with standardized regression weight significant value at .381, Q8.12 (Universal Accessibility Availability) with standardized regression weight significant value at .217, and lastly, Q8.10 (Population Density & Development Level) with standardized regression weight significant value at .115.

The standardized (b) loading estimates yielded values suggested that among the analyzed POEM for SND evaluation criteria of Social Dimension Pillar (SoP) in the three selected case studies of GBI certified sustainable neighborhood upon occupancy of minimum one (1) year resultants to ideally significant outcome where the value is closed to 0.7 level as recommended by Hair (2010). Based on POEM for SND evaluation criteria ranking within Social Dimension Pillar, the most sufficient or significant sustainable criteria upon post-occupancy as experienced by the end-users in their occupied neighborhood is community engagement & management, the second sustainable criteria is recycling facilities or practices, the third criteria is sufficient communal space, the fourth criteria is public health concerns, the fifth criteria is security and safety experiences, the sixth criteria is community diversification, the seventh criteria is universal accessibility availability and the finally the eighth criteria is population density & development level. According to all three (3) selected case studies which are GBI certified, the loading estimates from Phase 3: Stakeholders-Inclusion Approach – End-User/Household Surveys full structured SEM modeling however indicated that Social Dimension Pillar evaluation criteria average value is at

.322 and below significant value (above 0.7). Hence, in Post-Occupancy Evaluation Assessment based on end-user/household opinion the sustainable social dimension is not fulfilled or experienced.

Economic Dimension Pillar (EcP)

The standardized (b) loading estimates of the endogenous construct (observed) yielded for Economic Dimension Pillar (EcP) are as shown in Table 61. These variables consisted of information regarding economic dimension pillar post-occupancy evaluation criteria, which concerns on Public Transport Reliability (Q8.19), Sufficient Pedestrian & Cycling Networks (Q8.20), Low Impact & Regional Materials (Q8.21), Promotion of Sustainable Construction (Q8.22), Construction Waste & Sedimentation (Q8.23), Sufficient Commercial Amenities (Q8.24) and Innovative Development (Q8.25). The positive co-efficient sign of *P*-value at (***) or ≤ 0.05 suggested that all EcP Construct specific individual parameter estimates are highly significant at 0.001 values (Q8.19 to Q8.22; and Q8.24 to Q8.25) and statistically significant at 0.004 value (Q8.23). Four (4) out of seven (7) variables in EcP Construct has a positive standardized regression weight while the other three (3) variables yielded a negative value. The highest standardized regression weight significant value is at .706 yielded from variables Q8.21 which indicating that Low Impact & Regional Materials in this dimension is the most sufficient and highly experience by the end-user upon post-occupancy. This is followed by Q8.25 (Innovative Development) with standardized regression weight significant value at .705, Q8.19 (Public Transport Reliability) with standardized regression weight significant value at .281, Q8.24 (Sufficient Commercial Amenities) with standardized regression weight significant value at .220. The three (3) variables that generated negative values are Q8.23 (Construction Waste & Sedimentation) with standardized regression weight negative significant value at -.163, followed by Q8.22 (Promotion of Sustainable Construction) with standardized regression weight negative significant value at -.374 and lastly Q8.20 (Sufficient Pedestrian & Cycling Networks) with standardized regression weight negative significant value at -.384.

The standardized (b) loading estimates yielded values suggested that among the analyzed POEM for SND evaluation criteria of Economic Dimension Pillar (EcP) in

the three selected case studies of GBI certified sustainable neighborhood upon occupancy of minimum one (1) year resultants to less significant outcome where the value is below 0.7 level as recommended by Hair (2010). Based on POEM for SND evaluation criteria ranking within Economic Dimension Pillar, the most sufficient or significant sustainable criteria upon post-occupancy as experienced by the end-users in their occupied neighborhood is low impact & regional materials, the second sustainable criteria is innovative development, the third criteria is public transport reliability, the fourth criteria is sufficient commercial amenities. The insignificant or negative sustainable criteria are construction waste & sedimentation, promotion of sustainable construction and sufficient pedestrian & cycling networks. Based on the all three (3) selected case studies which are GBI certified, the loading estimates from Phase 3: Stakeholders-Inclusion Approach – End-User/Household Surveys full structured SEM modeling however indicated that Economic Dimension Pillar evaluation criteria average value is at .132 and below significant value (above 0.7). Hence, in Post-Occupancy Evaluation Assessment based on end-user/household opinion the sustainable social dimension is not fulfilled or experienced.

7.4.4 Phase 3 (Post-occupancy) Summary of Full Structural Equation Model

Following the full structural model discussed above, and the hypotheses formulated as the base of the model, the following table summarized the hypothesized model in terms of its P-value. All path coefficients of the causal structure were statistically significant when the P-value indicated less than 0.001 (***), showing that the hypotheses are all supported. Table 62 presents the hypotheses results formulated for Phase 3 full structured SEM Model.

Table 62: Summary of Hypotheses.
Source: Author

Hypothesis	Hypothesis Path	P-value	Results
Hypothesis 1:	POEM for SND --> EnP	***	Supported
Hypothesis 2:	POEM for SND --> SoP	***	Supported

Hypothesis 3:	POEM for SND --> EcP	***	Supported

7.5 Pre-Occupancy and Post-Occupancy Evaluation Findings and Discussions

Both Phase 2 SDP Adaptations and Phase 3 POEM for SND data were analyzed using IBM SPSS Amos 22. The generated outcome result of full structured model yielded value is as shown in Table 63 below. The full structured model of both SEM analyses describes the data are appropriate where all the given paths co-efficient (*P*-value) of the underlying structure were statistically highly significant at 0.001 (***) value and statistically significant at ≤ 0.05 value. Thus, all hypothesized paths of the full structured model for both Phase 2 and Phase 3 study show significant correlation implying that all hypotheses are supported.

Table 63: The comparative Phase 2 and Phase 3 model fit and their level of acceptance. Source: Awang, 2015

Study Phases	Name of index	Yielded Value	Level of acceptance
Phase 2	RMSEA	0.042	RMSEA < 0.08
	GFI	0.882	GFI > 0.90
	AGFI	0.740	AGFI > 0.90
	CFI	0.982	CFI > 0.90
	TLI	0.977	TLI > 0.90
	NFI	0.845	NFI > 0.90
	ChiSq/df	1.148	Chi-Square/ df < 3.0
Phase 3	RMSEA	0.049	RMSEA < 0.08
	GFI	0.930	GFI > 0.90
	AGFI	0.900	AGFI > 0.90
	CFI	0.925	CFI > 0.90
	TLI	0.904	TLI > 0.90
	NFI	0.857	NFI > 0.90
	ChiSq/df	1.887	Chi-Square/ df < 3.0

For Phase 2: Stakeholders-Inclusion Approach – Professional Stakeholder Surveys full structured SEM modeling, six constructs are tested. The standardized (b) loading estimates for CEW suggested that Economic Dimension (ECP) yields the highest significant value, indicating that SDP Adaptations in this dimension is of importance or highly adapted. The loading estimates from Phase 2 indicated that Economic

Dimension is highly adapted or most significant in SDP Adaptations. The overall outcomes for EEC construct imply that it is within the loading values level that suggest considerable SDP Adaptations in pre-occupancy GBI-TAC. All specific path co-efficient of the causal CEE full structure model are statistically significant at 0.001 (***) values, the parameter estimates of the hypothesized full structured model are also exempted from offending statistical values including the SDP Adapt ---> CEE path, therefore this hypotheses is supported. For CPD Construct, **t**he regression weight values vary among the designated sustainable dimension indicating that SDP adaptation differ in relative advantage as for the case of CPD core-criteria, Social Dimension and Environment Dimension appears to be the significant factor that brings the CPD assessment core-criteria towards an enhanced sustainable neighborhood development. The standardized average outcomes indicated that TRC has the slightly lower loading factor and satisfactory level of acceptance within the overall pre-occupancy assessment evaluation core-criteria of GBI-TAC. For BDR Construct standardized loading estimates, the results imply that high SDP Adaptations in Environment Dimension and Economic Dimension in pre-occupancy assessment criteria of GBI-TAC while least adaptation and consideration for Social Dimension. Lastly, is the Business & Innovation (BSI) generated outcomes. The standardized loading estimates yielded for BSI from Phase 2 full structured SEM modeling indicating Economic Dimension and Social Dimension is highly adapted or most significant in SDP Adaptations while less significant in Environment Dimension.

For Phase 3: Stakeholders-Inclusion Approach – End-User/Household Surveys full structured SEM modeling, three constructs are tested. The standardized loading estimates yielded values suggested that among the analyzed POEM for SND evaluation criteria of Environment Dimension Pillar (EnP) resultants to less significant outcome where the value is below 0.7 as recommended by Hair (2010). Based on POEM for SND evaluation criteria ranking, the most sufficient or adapted sustainable criteria upon post-occupancy as experienced by the end-users sufficient street or park lighting, the least sufficient or adapted sustainable criteria is Bio-diversity Reserved Availability. The loading estimates from Phase 3 full structured SEM modeling indicated that Environment Dimension Pillar evaluation criteria average value is at .372 and below significant value (above 0.7). Hence, in Post-Occupancy Evaluation Assessment based

on end-user/household opinion the sustainable environment dimension is not fulfilled or significantly experienced. For Social Dimension Pillar (SoP) standardized loading estimates resultants to ideally significant outcome where the value is closed to 0.7 level. Based on POEM for SND evaluation criteria ranking within Social Dimension Pillar, the most sufficient or significant sustainable criteria upon post-occupancy as experienced by the end-users in their occupied neighborhood is community engagement & management while the least value outscore is population density & development level. According to the loading estimates from Phase 3 full structured SEM modeling indicated that Social Dimension Pillar evaluation criteria average value is at .322 and below significant value (above 0.7). Hence, in Post-Occupancy Evaluation Assessment based on end-user/household opinion the sustainable social dimension is not fulfilled or experienced. The standardized (b) loading estimates yielded values of Economic Dimension Pillar (EcP) resultants to less significant outcome where the value is below 0.7 level. Based on criteria ranking within Economic Dimension Pillar, the most sufficient or significant sustainable criteria upon post-occupancy as experienced by the end-users in their occupied neighborhood is low impact & regional materials and insignificant or negative sustainable criteria are construction waste & sedimentation, promotion of sustainable construction and sufficient pedestrian & cycling networks. Based on Phase 3 full structured SEM modeling indicated that Economic Dimension Pillar evaluation criteria average value is at .132 and below significant value (above 0.7). Hence, in Post-Occupancy Evaluation Assessment based on end-user/household opinion the sustainable social dimension is not fulfilled or experienced.

7.4 Conclusion of Pre-Occupancy and Post-Occupancy Evaluation - Summary of Analysis, Findings and Discussions for RO3 & RQ3

Following the full structural model of both phases of study and as discussed in previous sub-sections, and the hypotheses formulated as the base of the both model, the following table summarized the hypothesized models in terms of its P-value. All path coefficients of the causal structure were statistically significant when the P-value indicated less than 0.001 (***), showing that all the hypotheses are all supported. Table

64 presents the hypotheses results formulated for Phase 2 and Phase 3 full structured SEM Model.

Table 64: Summary of Hypotheses for both Phases Study.
Source: Author

Study Phases	Hypothesis	Hypothesis Path	P-value	Results
Phase 2	Hypothesis 1:	SDP Adapt --> CEW	***	Supported
	Hypothesis 2:	SDP Adapt --> EEC	***	Supported
	Hypothesis 3:	SDP Adapt --> CPD	***	Supported
	Hypothesis 4:	SDP Adapt --> TRC	***	Supported
	Hypothesis 5:	SDP Adapt --> BDR	***	Supported
	Hypothesis 6:	SDP Adapt --> BSI	***	Supported
Phase 3	Hypothesis 1:	POEM for SND --> EnP	***	Supported
	Hypothesis 2:	POEM for SND --> SoP	***	Supported
	Hypothesis 3:	POEM for SND --> EcP	***	Supported

For research main hypotheses which was discussed earlier in chapter 1 and chapter 5, the findings of both phases of SEM modeling (Table 65) suggested that both model are supported or significant where the P-value is 0.001 (***) and the average coefficients standardized regression weight between Constructs is above significant level of 0.7 (Phase 2 at .919 and Phase 3 at .943), hence, both SEM models is highly significant. However, for average estimated regression coefficients between Constructs and Variables (Pre-Occupancy Criteria for Phase 2 and Post-Occupancy Criteria for Phase 3) are comparatively yielded a different values. For Phase 2 the average value is highly significant at .802 value while for Phase 3 is low significant value at .377, hence, suggested a SDP gap in pre-occupancy and post-occupancy evaluation criteria and also its theory. The conclusion is as summarized below;

Table 65: Parameter Estimates of the Full Structural Model of SDP Adaptations in GBI-TAC.
Source: Author

Study Phases	Average Std (C)	Average Std (V)	*P*	*Results*
Phase 2	.919	.802	***	Supported
Phase 3	.943	.337	***	Supported

Note:
Average Std (C): Average estimated standardized regression coefficients between Constructs

Average Std (V): Average estimated standardized regression coefficients between Constructs and Variables

Research Hypothesis 1:

H1. Sustainable pillar dimensions method will improve the sustainability within the community's neighborhood context,

The SEM modeling findings suggested that there is a SDP gap in evaluation criteria between Phase 2 (Pre-Occupancy) and Phase 3 (Pre-Occupancy), therefore there is a room for improvement and enhancement upon post-occupancy within the community's neighborhood context. Hence, SDP method will improve sustainability and this hypothesis is supported.

Research Hypothesis 2:

H2. Post-occupancy evaluation model (POEM) assessment criteria and theory would differ from the pre-occupancy assessment criteria and theory.

The SEM modeling findings suggested that there is a distinct value outscore generated in Average Std (V), Phase 2 pre-occupancy standardized regression weight value is highly significant while Phase 3 post-occupancy standardized regression weight value is below significant level. Therefore post-occupancy evaluation model (POEM) assessment criteria and theory would differ from the pre-occupancy assessment criteria and theory. Thus, this hypothesis is supported.

CHAPTER 8:

POEM ADAPTATION AND RECOMMENDATIONS

8.1. Current Status of Pre-Occupancy and Post-Occupancy Evaluation in ASEAN Region - Analysis of RO4

The Table 66 below described the current status Pre-Occupancy Certification and POEM implementation of Sustainable Townships / Neighborhood Development in ASEAN region. For **RO4: To recommend the adaptation of POEM findings** to similar development phenomenon in the region and country throughout the world. The findings suggest there is lack of Pre-Occupancy Evaluation Criteria and Certified SND in the region.

Table 66: Status of Pre-Occupancy Certification and POEM implementation of Sustainable Townships / Neighborhood Development in the ASEAN region
Source: Author

Country	Pre-Occupancy		Post-Occupancy		Remarks
	Assessment Criteria	SND Certification	Assessment Criteria	Test & Evaluation	
Malaysia Institution: Malaysia Green Building Confederation (MGBC)	GBI Township Assessment Criteria	8 Townships / Neighborhoods - Sunway Resort City - Bandar Rimbayu - Ken Rimba - Bandar Serai - Leisure Farm Resort – Central Spine - Nusajaya TechPark - Gamuda Cove Core Business District - Bukit Bintang City Center - Marvelane Home by The Districts - Tun Razak Exchange (TRX)	POEM for SND	3 Townships / Neighborhoods - Sunway Resort City - Bandar Rimbayu - Ken Rimba	Launch in 2011 GBI-TAC Version 1.0

Country	Pre-Occupancy		Post-Occupancy		Remarks
	Assessment Criteria	SND Certification	Assessment Criteria	Test & Evaluation	
Thailand Institution: Thailand Green Building Institute (TGBI)	-Not Available	-Not Available	POEM for SND	1 Township / Neighborhood - Parinyada Village, Bangkok	NO Sustainable rating criteria for Townships / TREES Rating System
Singapore Institution: Singapore Green Building Council (SGBC)	Greenmark for Districts V2.0	4 Government Land Sales Sites - Jurong Lake Districts – GM Gold Plus - Kallang Riverside – GM Gold Plus - Paya Lebar Central– GM Gold Plus - City Centre – GM Platinum/Gold Plus	-Not Available	-Not Available	Launch in 2009 GM for Districts Version 2.0
Indonesia Institution: Indonesia Green Building Council (GBC Indonesia)	Greenship Neighborhood	-Not Available	-Not Available	-Not Available	Green Neighborhood Tools – but no available data on certification
Vietnam Institution: Vietnam Green Building Council (VGBC)	-Not Available	-Not Available	-Not Available	-Not Available	NO Sustainable rating criteria for Townships / Neighborhood Adapting LOTUS Rating Systems
Philippines Institution: Philippines Green Building Council (PHILGBC)	-Not Available	-Not Available	-Not Available	-Not Available	NO Sustainable rating criteria for Townships BERDE Tools

Country	Pre-Occupancy		Post-Occupancy		Remarks
	Assessment Criteria	SND Certification	Assessment Criteria	Test & Evaluation	
Cambodia Institution: Cambodia Green Building Council (CamGBC)	-Not Available	-Not Available	-Not Available	-Not Available	NO Sustainable rating criteria for Townships Adopting LEED US tools
Laos Institution: No data available	-Not Available	-Not Available	-Not Available	-Not Available	NO Sustainable rating criteria for Townships No data
Myanmar Institution: No data available	-Not Available	-Not Available	-Not Available	-Not Available	NO Sustainable rating criteria for Townships No data
Brunei Institution: Green Building Council Brunei (GBC Brunei)	-Not Available	-Not Available	-Not Available	-Not Available	NO Sustainable rating criteria for Townships Currently adopting Greenmark Singapore, LEED US & GBI Malaysia

Data source from GBC/GBI website.

Out of 10 ASEAN Nations only Malaysia and Singapore have Certified Sustainable Neighborhood Development. Meanwhile for Pre-Occupancy Evaluation Criteria only Malaysia, Singapore and Indonesia have their own Townships/Neighborhood Assessment Criteria. Most of the ASEAN Nations beside these 3 countries adopted a more popular LEED-ND Evaluation Criteria from the United States of America. The Pre-Occupancy Evaluation Criteria are commonly made-up of the following core-criteria:

- CEW – Energy & Water Efficiency
- EEC – Environment & Ecology Conservation
- CPD – Community Thrust

- TRC – Transportation & Connectivity Efficiency
- BDR – Material & Resources Efficiency
- BSI – Business & Innovatively

For Post-Occupancy Evaluation Criteria, based on data source from ASEAN Nations GBC / GBI website of respected country institution, only Malaysia and Thailand have implemented Post-Occupancy Evaluation. The Post-Occupancy Evaluation Criteria implemented in Malaysia and Thailand is POEM Evaluation Criteria which based on the following sustainable dimension pillars:

- EnP (Environment) – Conservation & Preservation
- SoP (Social) – Equity & Justice
- EcP (Economic) – Innovation & Efficiency

8.2 POEM Implementation (Test & Evaluation) of Regional Case Study in Parinyada Village, Bangkok, Thailand

8.2.1 POEM Handbook Findings of Parinyada Village Green Neighborhood

The second process in Stakeholders-Inclusion Approach of POEM evaluation is gather information of selected case study. All related information to selected case study particularly on the green neighborhood is important as it will become the baseline comparison for the POEM end-users'/households' evaluation criteria findings outcome.

The required information of the selected case study is as listed below;

- Neighborhood Title and Address:
  PARINYADA VILLAGE
  19/12, Parinyada Village
  Bangkhae, Bangkok
  Thailand 10160
- Neighborhood Description which summarize the general information especially description related to green features and facilities.
  Parinyada Village development is a housing project outskirt of Bangkok downtown and located in Bangkhae District. The development presents a premium neighborhood development which consist of three types housing setting. The village is fill with lush greeneries, gated facilities and centralized recreational communities' clubhouse with pool and Green Park. The development setting is a serene and tranquil surrounding of total 54 rai of site plot; Parinyada 43 rai and Parinlak 11 rai. The development was completed 15 years ago. Parinyada Village development is set as a green lush mixed neighborhood development composed of residential area, commercial area and enclaved recreational facilities.
- Contact Person details for evaluation process follow up
  - Kespanerai Kokchang
- List of Professional Consultants involved in the development such as urban planners, architects, designers, landscape architects, engineers and other

specialist such as EIA Consultant, Biodiversity Consultant, Horticulturalist and etc..

- Not Available

- Local Approving Authority that approved and issued development order of the selected green neighborhood project.

  Bangkhae District Office

- Gross Development Area & Description which include percentage of different development category for example residential area, commercial area, industrial area, amenities and public facilities area, open greenspace and recreational area, utilities and infrastructure area and biodiversity reserved area.

  -Not Available

- Certification Details, which describe the certification, body, certification category awards or rating scores, certification date and validity if available.

  -Not Available

Respondent's Responses Information

Total Nos of Respondents: 31 Responses

Name: 31 Responses

Email Address: 12 Responses

Designation/Position: 3 Responses

Contact No.: 1 Responses

The findings of POEM Handbook for end-users/households general opinion on SDP, Township Assessment Criteria and Regional Thai Case Study is as illustrated in Figure 112 – Figure 117. For Q1, on the general understanding on sustainable / green neighborhood 74.2% of end-users/households do know or understand the subject question, 22.6% think they are not sure and the balance of 3.2% didn't understand sustainable or green neighborhood (Figure 112).

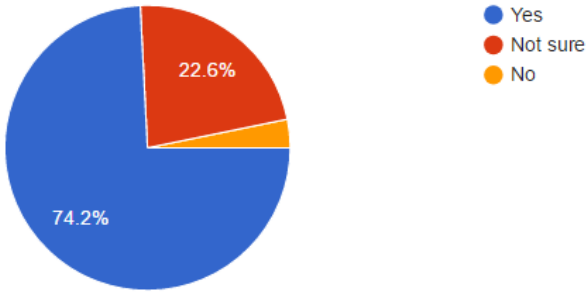


Figure 112: POEM Handbook findings for Q1.
Source: Author

For Q2, respondents were asked on the awareness of sustainable dimension pillars (SDP), 51.6% of end-users/households do know or understand SDP, 45.2% think they are not sure what SDP is and the balance of 3.2% didn't know or aware of SDP (Figure 113).

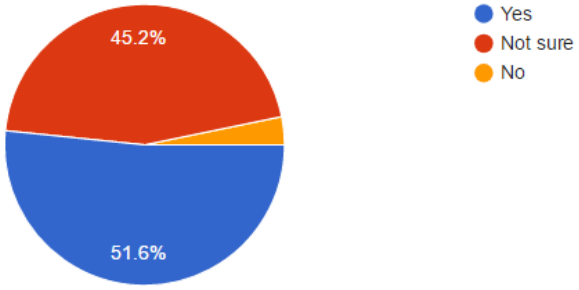


Figure 113: POEM Handbook findings for Q2.
Source: Author

For Q3, end-users/households were ask whether they aware that the occupied neighborhood is certified as sustainable or green neighborhood, 12.9% of end-users/households know Parinyada Village is a certified neighborhood, 38.7% of respondents are not sure and the balance of 48.4% are not aware that their occupied neighborhood is a certified neighborhood (Figure 114).

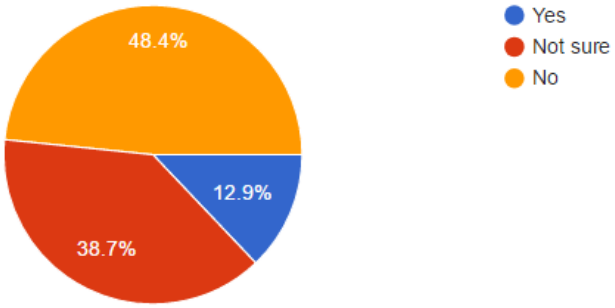


Figure 114: POEM Handbook findings for Q3.

Source: Author

For Q4, end-users/households were ask whether they are the homeowner, or tenant, or workers in this neighborhood, 80.6% of end-users/households responses as a homeowner, 6.5% of respondents say that they are a tenant and the balance of 12.9% responded as a workers in the occupied neighborhood (Figure 115).

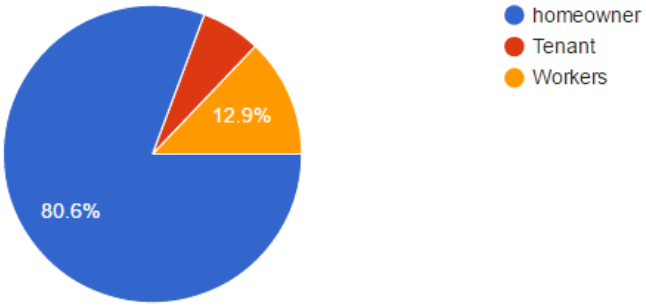


Figure 115: POEM Handbook findings for Q4.

Source: Author

For Q5, end-users/households were ask on influences in their decision making on purchasing or staying on this neighborhood. For Q5 the respondents can choose more than one answer or write in other influences that the option given. The findings for Q5 shown that 96.8% of respondents think that location and accessibility and security is the main influence, followed by design appearance 41.9%, sustainable/green label 38.7%, price and cost 32.3%, quality of the property & services 29%, amenities & facilities 25.8%, and two of the respondents (6.5%) write in 'other' than the given option influences their decision making on purchasing or staying in this neighborhood (Figure 116).

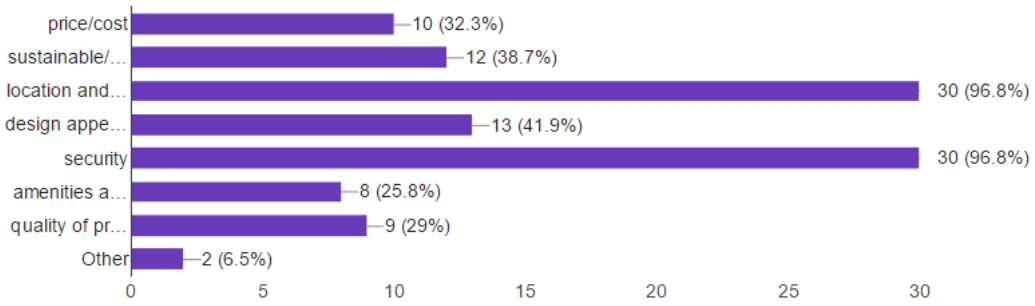


Figure 116: POEM Handbook findings for Q5.

Source: Author

For Q6 and Q7, end-users/households were ask on their planning to stay for a long term/permanently in this neighborhood and ask to justify in Q7. For Q6 93.5% of respondents think that they will stay for a long-term/permanently in this neighborhood, 6.5% are not sure and none of respondent say they will not stay for long-term/permanently (Figure 117). For Q7 only 8 respondents answer this question, each respondent justify their planning of stay in this neighborhood as indicated in figure 118.

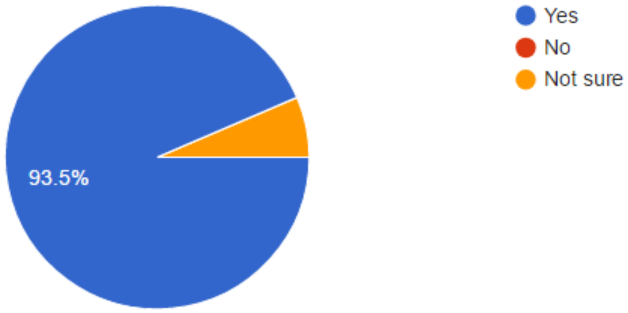


Figure 117: POEM Handbook findings for Q6.

Source: Author

The POEM Handbook findings for End-Users/Households opinion on criteria for post-occupancy evaluation based on SDP dimensions is as shown in Table 67 –Table 69. Based on Table 7o the POEM evaluation criteria was categorized into three category, where Environment Dimension Pillar consist of 8 evaluation sub-criteria (EnP Q1- EnP Q8), Social Dimension Pillar consist of 8 evaluation sub-criteria (SoP Q1- SoP Q8) and Economic Dimension Pillar consist of 8 evaluation sub-criteria (EcP Q1- EcP Q8). The

detail descriptions or the reference guide for each of these dimensions was discussed in earlier sub-sections.

The final calculated score of environmental dimension for Parinyada Village neighborhood are based on the processes and procedures that were previously highlighted in Sub-chapter 5.2. Parinyada Village neighborhood has achieved 67.4% scored achieved. The dimension scored achieved of the environmental dimension pillar is presented in Table 67.

Based on Table 67, the neighborhood of Parinyada Village has two (2) low scored sub-criteria that related to environment dimension where EnP Q3 Generate or Use Renewable Energy (65/155) and EnP Q5 Bio-Diversity Reserved Availability (57/155) score is below 50% or failed to fulfill POEM evaluation criteria. For certified score, from 50% to 60% (77.5/155 to 93/155) of POEM Evaluation criteria, one (1) Parinyada Village environment dimension evaluation sub-criteria are within this range. This evaluation sub-criteria are EnP Q4 (86/155). Meanwhile five (5) environment dimension sub-criteria is above certified or 60%, which are EnP Q1 (112/155), EnP Q2 (129/155), EnP Q6 (126/155), EnP Q7 (129/155) and EnP Q7 (132/155)

This study contends that there is low consideration (based on EnP Q5, EnP Q3 and EnP Q4 score) to the importance of bio-diversity/ecology preservation, energy efficiency and water efficiency sub-criteria. Although this sub criteria represent equally high significance in Environment Dimension Pillar, there is lack of considerations by the developers in conserving or preserving bio-diversity and eco-system; low awareness in implementation of energy efficiency by generating and using renewable energy; and not enough effort taken in water efficiency through water recycling systems. Parinyada Village neighborhood development is lacking in the availability of bio-diversity reserved. The second low score criteria is poor in energy efficiency, the findings from most of the end-users suggest lacking in generating on-site energy sources and also lacking in the use of renewable energy. The third criteria which need to be address is the water efficiency criteria, most of the end-users think that is not enough reduced or recycled water practiced being implemented in the neighborhood. Based on this environmental dimensions findings, to improve the neighborhood sustainable level efforts need to be augmented in particular to provide bio-diversity and eco-system within the neighborhood, consideration also should be taken in energy efficiency by

implementing rooftop solar PV and improved water efficiency by practicing water recycling and implement rain-harvesting method.

Table 67: POEM Handbook EnP Dimension Scored for Parinyada Village.
Source: Author

POEM Scoring Calculation EnP Dimension.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Environment Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EnP Q1	Sufficient Designated Green Area	155	112
2	EnP Q2	Sufficient Street Or Park Lighting	155	129
3	EnP Q3	Generate Or Use Renewable Energy	155	65
4	EnP Q4	Reduced Or Recycle Water Practice	155	86
5	EnP Q5	Bio-Diversity Reserved Availability	155	57
6	EnP Q6	Flood / Drainage Clogging Experience	155	126
7	EnP Q7	Infrastructure Services Efficiency	155	129
8	EnP Q8	Pollution Control & Experience	155	132
		Dimension Av-Cr / Sc-Cr	1240	836
Environment Dimension Scored Achieved				**67.4%**

In this POEM Handbook regional case study, the social dimension evaluation was carried out in Parinyada Village neighborhood based on feedback from 31 respondents. This investigation was evaluated based on Social Dimension Pillar where 8 sub-criteria of this dimension were asked to end-users/households of this certified neighborhood. The dimension scored achieved of Social Dimension Pillar is presented in Table 68, where this neighborhood has obtained 57.5% of dimension scored achieved.

Based on Table 68, the neighborhood of Parinyada Village has only three (3) score below 50% (below 77.5/155) or failed to fulfill POEM evaluation criteria in Social Dimension Pillar. This sub-criteria is SoP Q2 Population Density & Development Level (76/155), SoP Q3 Universal Accessibility (63/155) and SoP Q6 Recycling Facilities or

Practices (77/155). The findings for Social Dimension Pillar at certified score from 50% to 60% (77.5/155 to 93/155) of POEM Evaluation criteria is three (3) sub-criteria. These sub-criteria are SoP Q1 (84/155), SoP Q7 (78/155) and SoP Q8 (91/155). The balance two (2) sub-criteria score above certified level (above 93/155). These two (2) sub-criteria is SoP Q4 Security & Safety Experience (141/155) and SoP Q5 Public Health Concerns (104/155).

Based on the end-users/households opinion for Social Dimension Pillar, the overall sub-criteria scored credit achieved is considered fulfilled minimum POEM Handbook evaluation criteria or certified with 57.5 score achieved. Exception however to POEM evaluation sub-criteria SoP Q2, SoP Q3 and SoP Q6where it failed to meet POEM fulfilled requirement. Hence, in this POEM Handbook evaluation the findings suggested that there is significant gap on the absence of Universal Accessibility in this neighborhood development (based on SoP Q3 score), Population Density & Development Level (based on SoP Q2 score) and Recycling Facilities & Practices (based on SoP Q6 score). There is not enough provision or measures was given in providing facilities to the disabled person, lack of community diversification and poor in recycling facilities and practices efforts. Hence, for improvement prior to study outcome, these three (3) sub-criteria need to be further addressed in elevating the social dimension criteria score of this neighborhood development.

Table 68: POEM Handbook SoP Dimension Scored for Parinyada Village.
Source: Author

POEM Scoring Calculation SoP Dimension.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Social Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	SoP Q1	Sufficient Communal Greenspaces	155	84
2	SoP Q2	Population Density & Development Level	155	76
3	SoP Q3	Universal Accessibility Availability	155	63
4	SoP Q4	Security And Safety Experience	155	141
5	SoP Q5	Public Health Concerns	155	104
6	SoP Q6	Recycling Facilities Or Practices	155	77
7	SoP Q7	Community Diversification	155	78
8	SoP Q8	Community Engagement & Management	155	91
		Dimension Av-Cr / Sc-Cr	1240	714
		Social Dimension Scored Achieved		**57.5%**

From the economic dimension aspects, the achieved dimension score of Economic Dimension Pillar by Parinyada Village neighborhood is 69.1%, as presented in Table 69 below. The Economic Dimension concerns with the means of accessibility and connectivity in enhancing the economic zones of the neighborhood; material and resources in maintaining economic sustainability; and availability of commercial amenities/facilities within this neighborhood in generating local economic growth.

As shown in Table 69, majority POEM evaluation criteria in Economic Dimension Pillar for neighborhood of Parinyada Village above the certified score or above 60% (above 93/155) except one (1) sub-criteria is below 60% (below 93/155) or only fulfilled POEM evaluation criteria. This criteria (within certified score level) is sub-criteria for EcP Q2 Public Transport Reliability (90/155). Most of the score for Economic Dimension Pillar is above certified score or 60% (above 93/155) of POEM Evaluation criteria. These sub-criteria are EcP Q1 Distance to Commercial Amenities (109/155), EcP Q3 Sufficient Pedestrian & Cycling Networks (100/155), EcP Q4 Low Impact & Regional Materials (111/155) EcP Q5 Promotion of Sustainable Construction (95/155), EcP Q6 Construction Waste & Sedimentation (125/155), EcP Q7 Sufficient Commercial Amenities (116/155) and EcP Q8 Innovative Development (112/155).

Based on findings from the end-users/households view for Economic Dimension Pillar, the overall sub-criteria scored credit achieved is considered the highest among the sustainable dimensions. Only one (1) POEM Economic Dimension evaluation criteria below the certified rating benchmark, thus, this dimension is the highest dimension score achieved compared to the other two (2) dimensions. POEM Handbook evaluation findings for Economic Dimension Pillar suggested that there is lacking in reliability of public transportation in the neighborhood of Parinyada Village (based on EcP Q2 score). This neighborhood are simply lack of public transportation and its facilities. Since this case study is outside downtown Bangkok city center, it apparently resultant of very poor public transportation reliability. Another strong measures can be stressed in promoting sustainable economic dimension in this neighborhood is further considerations and more awareness on materials and resources by highlighting low impact and regional materials; and promoting construction waste management & sustainable construction.

Table 69: POEM Handbook EcP Dimension Scored for Parinyada Village.
Source: Author

POEM Scoring Calculation EcP Dimension.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Economic Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EcP Q1	Distance To Community Amenities	155	109
2	EcP Q2	Public Transport Reliability	155	90
3	EcP Q3	Sufficient Pedestrian & Cycling Networks	155	100
4	EcP Q4	Low Impact & Regional Materials	155	111
5	EcP Q5	Promotion Of Sustainable Construction	155	95
6	EcP Q6	Construction Waste & Sedimentation	155	125
7	EcP Q7	Sufficient Commercial Amenities	155	116
8	EcP Q8	Innovative Development	155	112
		Dimension Av-Cr / Sc-Cr	1240	858
		Dimension Scored Achieved		69.1%

The total dimension scored achieved of the current certified sustainable neighborhood of Parinyada Village development, based on the proposed POEM Handbook for sustainable neighborhood development, has been verified as a total of the final dimension scored achieved of the three (3) dimension pillars considered above. As shown in Table 70 the post-occupancy evaluation of Parinyada Village development has achieved 60 % of the total dimension score achieved of the proposed POEM Handbook evaluation criteria for sustainable neighborhood development. This total dimension score achieved has been obtained upon the comprehensive assessment of this neighborhood in regard to the three (3) Sustainable Dimension Pillars, criteria, and sub-criteria of the proposed POEM Handbook.

Substantiated on the scoring and rating method that was acquired within this POEM

Handbook study particularly the rating benchmarking discussed previously in this chapter, this total dimension scored achieved means that the neighborhood of Parinyada Village is rated as "CERTIFIED" where the total scored achieved of the POEM is **65**. Prior to this study outcome, in order to achieve higher POEM evaluation criteria score, more efforts and measured to be taken towards continuing sustainable neighborhood agenda of this neighborhood by improving sub-criteria score in particular the Social Dimension Criteria and Environmental Dimension Criteria.

Table 70: POEM Handbook Total Dimension Scored for Parinyada Village.
Source: Author

POEM Scoring Calculation Master Sheet.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Environment Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EnP Q1	Sufficient Designated Green Area	155	112
2	EnP Q2	Sufficient Street Or Park Lighting	155	129
3	EnP Q3	Generate Or Use Renewable Energy	155	65
4	EnP Q4	Reduced Or Recycle Water Practice	155	86
5	EnP Q5	Bio-Diversity Reserved Availability	155	57
6	EnP Q6	Flood / Drainage Clogging Experience	155	126
7	EnP Q7	Infrastructure Services Efficiency	155	129
8	EnP Q8	Pollution Control & Experience	155	132
		Dimension Av-Cr / Sc-Cr	1240	836
		Dimension Scored Achieved		57.5%
Social Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	SoP Q1	Sufficient Communal Greenspaces	155	84
2	SoP Q2	Population Density & Development Level	155	76
3	SoP Q3	Universal Accessibility Availability	155	63
4	SoP Q4	Security And Safety Experience	155	141
5	SoP Q5	Public Health Concerns	155	104
6	SoP Q6	Recycling Facilities Or Practices	155	77
7	SoP Q7	Community Diversification	155	78
8	SoP Q8	Community Engagement & Management	155	91
		Dimension Av-Cr / Sc-Cr	1240	714
		Dimension Scored Achieved		67.1%
Economic Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EcP Q1	Distance To Community Amenities	155	109
2	EcP Q2	Public Transport Reliability	155	90
3	EcP Q3	Sufficient Pedestrian & Cycling Networks	155	100
4	EcP Q4	Low Impact & Regional Materials	155	111
5	EcP Q5	Promotion Of Sustainable Construction	155	95
6	EcP Q6	Construction Waste & Sedimentation	155	125

7	EcP Q7	Sufficient Commercial Amenities	155	116
8	EcP Q8	Innovative Development	155	112
		Dimension Av-Cr / Sc-Cr	1240	858
		Dimension Scored Achieved		69.1%
		Total Dimension Av-Cr / Sc-Cr	3720	2408
		Sc-Cr (72) / Av-Cr (120) x Weighting (100%)		64.6%
		Total Dimension Scored Achieved		**65**

8.3 Recommendation of POEM for ASEAN Region.

The overall findings by end-users/households stakeholders demonstrated that SDP should be taken into account equally on the same level of the importance in order to achieve post occupancy sustainability for SND. The average ratings of from One way ANOVA analysis concluded that POEM criteria was significant, which means that there is consensus agreement between the respondents participated in this study. For testing the workability and implementation through neighborhood development project, this adapted criteria in POEM Handbook was applied to actual on-site testing of three selected sustainable neighborhood development of Ken Rimba, Bandar Rimbayu and Sunway Resort City neighborhood. Thus, the POEM Handbook on-site testing have demonstrated and validated on how these POEM criteria can be adapted on the workability and implemented through neighborhood development project including Regional Case Study in Bangkok. The empirical data in Table 66 also suggest lack of pre-occupancy evaluation criteria among the ASEAN Nations and only Case Studies in this research have implement post-occupancy evaluation criteria.

Therefore, the author would like to recommend POEM for SND under this research as the implementation of POEM will benefit:

- Continuing SD Agenda – Pre-Occupancy to Post-Occupancy stage and beyond
- Nurturing Sustainable Practice at all Level- Conurbation to Township to Neighborhood to Community to Individual
- Specific Sustainable Dimension Criteria & sub-criteria
- Simplified & easily comprehend at all level
- Applicable to any post urban neighborhood development

CHAPTER 9:

CONCLUSION AND RECOMMENDATIONS

9.1 Introduction

The intent of this chapter is to describe the summarized conclusion of the key findings attained throughout the study. It is to present an answer to the research questions, justification to the problem statement and hypotheses that were mentioned and highlighted in Chapter 1. These answer and justification will be mainly based on the overall obtained findings from the whole study. The aims of this chapter is to give general recommendations and theoretical supposition for the development and implementation of the proposed POEM for sustainable neighborhood development (SND) in the Klang Valley/Greater KL, and recommendations to improve future sustainable neighborhood development. Moreover, the chapter also outlines the limitation of research that challenges the researcher during the study and emphasizes certain recommendations for further investigation and exploration.

Therefore, the chapter is presented into five main sub-chapters. The first sub-chapter delivers the answers to the subjected research questions founded upon the results throughout this study. The second sub-chapter presents the justifications of the problem statement and hypotheses based on POEM Handbook on-site implementation and Structural Equation Modeling analysis. The third sub-chapter expounds general recommendations for the implementation of proposed POEM for SND developed in this study for the certified neighborhood development. The fourth sub-chapter discusses the main limitations of this study. The final sub-chapter proposes and highlights recommendations for further research.

9.2 Research Conclusion

The intention of this study is to investigate, develop and examine the POEM for SND based on SDP for certified sustainable neighborhood development in Klang Valley/Greater KL in particular and generally for similar development phenomenon in the region. The study concerns a series of fundamental phases in order to derive this

intention. A content analysis review on the conception of a sustainable township/neighborhood development notions is carried out at the preliminary phase of this study (Chapter 2) in order to institute studies theoretical background, and distinguish the capabilities and limitations of the currently adapted frameworks for sustainable township/neighborhood development. A background study of the urbanization development process in the Klang Valley/Greater KL and sustainable features for selected certified sustainable neighborhood development is discussed (in Chapter 4) in order to examine the different sustainable dimension pillar strategies and outlines that have been adapted and affected the sustainable neighborhood upon occupancy.

As explained in the Chapter 1, this study is to address the following study statements and questions: whether the existing Township/Neighborhood Assessment Criteria and certified sustainable neighborhood development fulfilled the performance, effectiveness and sustainability level according to dimension pillars of sustainability? Thus, it leads to study hypotheses: H1. Sustainable pillar dimensions method will improve the sustainability within the community's neighborhood context, and H2. Post-occupancy evaluation model (POEM) assessment criteria and theory would differ from the pre-occupancy assessment criteria and theory. From study statement of problem and hypotheses the research is motivated by several driving questions:

- How can the POEM framework be successfully developed and implemented?
- What are most significant POEM sustainable urban framework criteria?
- How can these POEM criteria be adapted on the workability and implemented through neighborhood development project?
- Would and Why theory of post-occupancy differ from pre-occupancy?

The study statement of problem, hypotheses and research questions has been justified and answered throughout six (6) main stages of this research conduct. The first stage is regarded as a theoretical phase; meanwhile, the other five stages are considered as the practical stage. The first stage, deemed as a theoretical phase, focused on the content analysis and related literature study. It is to comprehend the study subjects and establish an inclusive embodiment of sustainable development approaches and to review varies sustainable township/neighborhood development current frameworks. The second stage is a practical phase, which utilized the Phase 1: Stakeholders-Inclusion Approach

– Expert's Semi-Structured Interviews/Surveys technique in order to evaluate the proposed POEM for SND based on expert's views who developed and regulated the township/neighborhood assessment criteria. The third stage is using the Phase 2: Stakeholders-Inclusion Approach – Professional's Stakeholder Surveys in order to gain opinion from professional stakeholders who implemented the sustainable criteria. The fourth stage is via the Phase 3: Stakeholders-Inclusion Approach – End-user/Household Surveys in order to gain end-users/households opinion on POEM evaluation criteria by their experiences occupying certified sustainable neighborhood.

The fifth stage emphasized on the evaluation criteria factor confirmatory and proposed structural model validity through the application of Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) in order to give relationship reliability for each dimension, criteria and sub-criteria of the proposed POEM for SND. The sixth stage is the POEM Handbook on-site testing process, which was conducted in order to confirm and to appraise the applicability of the proposed POEM for SND to the actual on-site context of the selected certified sustainable neighborhood. The following next section of the paragraphs will discuss and justify the study problem statement, hypotheses and research questions separately.

Research Statement of Problem:

whether the existing Township/Neighborhood Assessment Criteria and certified sustainable neighborhood development fulfilled the post-occupancy performance, effectiveness and sustainability level according to dimension pillars of sustainability?

The research statement of problem was answered by the findings from the two (2) practical stages: the Phase 3: Stakeholders-Inclusion Approach technique (4th. Stage) and the on-site POEM Handbook testing procedure (6th Stage). Through the Stakeholders-Inclusion Approach - End-User/Household Surveys process and Phase four (4) on-site POEM Handbook testing for three selected certified sustainable neighborhood case studies of 378 respondents, the findings suggested that for case study 1: the certified sustainable neighborhood of Ken Rimba sustainability level upon post occupancy evaluation is rated as **"CERTIFIED"** This denotes that the certified sustainable neighborhood of Ken Rimba has **ACHIEVED** the sustainability level upon

its occupancy or post-occupancy with the same score of sustainability level achieved during planning and completion or during pre-occupancy assessments. For case study 2: the certified sustainable neighborhood of Bandar Rimbayu is rated as **"CERTIFIED"** where the total score achieved of the POEM is 60. The overall dimensions scored credit achieved is considered 'below achieved' since Bandar Rimbayu neighborhood was awarded with 'Silver' (66-75 score achieved) certification by GBI Malaysia for sustainable township. This indicates that the certified sustainable neighborhood of Bandar Rimbayu has **NOT ACHIEVED** the sustainability level upon its occupancy or post-occupancy with the same score of sustainability level achieved during planning and completion or during pre-occupancy assessments. Finally, for case study 3: the certified sustainable neighborhood of Sunway Resort City is rated as **"CERTIFIED"** where the total score achieved of the POEM is 59. The overall dimensions scored credit achieved is considered 'below achieved' since Sunway Resort City neighborhood was awarded with 'Silver' (66-75 score achieved) certification by GBI Malaysia for sustainable township. This implies that the certified sustainable neighborhood of Sunway Resort City has **NOT ACHIEVED** the sustainability level upon its occupancy or post-occupancy with the same score of sustainability level achieved during planning and completion or during pre-occupancy assessments.

Therefore, based on the findings from these selected case studies through end-users/households' opinions, the study concluded that the existing Township/Neighborhood Assessment Criteria and certified sustainable neighborhood development **DO NOT FULFILL** the post-occupancy performance, effectiveness and sustainability level according to dimension pillars of sustainability

Research Hypothesis 1:

H1. Sustainable pillar dimensions method will improve the sustainability within the community's neighborhood context,

The research hypothesis 1 was justified by the findings from the three (3) practical phases: the Stakeholders-Inclusion Approach technique, the Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM), and the on-site POEM Handbook testing procedure phase.

Throughout POEM Handbook on-site testing to the total of 378 respondents from the three selected case studies in Ken Rimba, Bandar Rimbayu and Sunway Resort City neighborhood, the findings concluded that Post-Occupancy Evaluation Model (POEM) assessment criteria and theory would differ from the pre-occupied assessment criteria and theory. The findings suggested that related issues or criteria in this study context, affect the sustainability agenda of the community as well as larger context of Klang Valley/Greater KL in various ways based on the environmental, social and economic dimension aspects. The identification of these issues through implemented POEM Handbook for certified sustainable neighborhood development will give an insight in remedying the root cause of post-occupancy sustainable practices. Hence, POEM for SND developed based on sustainable dimensions pillar method will improve the sustainability within the community's neighborhood context. Therefore, this study would argue that the application of POEM for SND would help the enhancement and further development of sustainable township / neighborhood in the Klang Valley/Greater KL generally.

The SEM modeling findings (Table 6.14 in Chapter 6) suggested that there is a SDP gap in evaluation criteria between Phase 2 (Pre-Occupancy) and Phase 3 (Pre-Occupancy); therefore, there is a room for improvement and enhancement upon post-occupancy within the community's neighborhood context. Hence, SDP method will improve sustainability and in supporting this hypothesis.

Research Hypothesis 2:

H2. Post-occupancy evaluation model (POEM) assessment criteria and theory would differ from the pre-occupancy assessment criteria and theory.

The research hypothesis 2 was justified by the findings from the two (2) practical stages: the Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM), and the on-site POEM Handbook testing procedure phase.

The POEM Handbook procedures were implemented in on-site testing in order to verify the applicability and validity of this proposed POEM Handbook to the actual context of certified sustainable neighborhood. The second half of this chapter deliberated the conducted on-site testing procedure of the proposed POEM Handbook by implementing

this POEM for SND to three (3) selected certified sustainable neighborhood of Ken Rimba Development, Bandar Rimbayu and Sunway Resort City. Based on 378 respondents' feedback, the total results achieved using this on-site testing process have emphasized that pre-occupancy assessment criteria and theory differ from the post-occupancy evaluation criteria and theory. The findings of the POEM Handbook on-site testing for Ken Rimba is rated as **"CERTIFIED",** hence**,** denotes that the certified sustainable neighborhood of Ken Rimba has **ACHIEVED** (54 Score**)** the sustainability level upon its occupancy or post-occupancy with the same score of sustainability level achieved during pre-occupancy assessments. Meanwhile, the results for the other two case studies are Bandar Rimbayu rated as **'CERTIFIED'** where the total scored achieved of the POEM is 60 and Sunway Resort City also rated as **'CERTIFIED'** where the total score of POEM is 59. Thus the overall dimensions scored credit achieved is considered 'below achieved' since Bandar Rimbayu and Sunway Resort City were awarded with 'Silver' (66-75 score achieved) certification by GBI Malaysia for sustainable township. This indicates that the certified sustainable neighborhood of Bandar Rimbayu has **NOT ACHIEVED** the sustainability level upon its occupancy or post-occupancy with the same score of sustainability level achieved during planning and completion or during pre-occupancy assessments.

The SEM modeling findings (Table 6.14 in Chapter 6) suggested that there is a SDP gap in evaluation criteria between Phase 2 (Pre-Occupancy) and Phase 3 (Pre-Occupancy). Therefore, there is room for improvement and enhancement upon post-occupancy within the community's neighborhood context. Hence, SDP method will improve sustainability to support this hypothesis.

To conclude, POEM for SND on-site testing findings from the three case studies should be acknowledged such that perceived pre-occupancy assessment for sustainable township / neighborhood development sustainability level differs from post-occupancy evaluation sustainability level perceived by the end-users/households. Thus, it is concluded that Post-Occupancy Evaluation Model (POEM) assessment criteria and theory would differ from the pre-occupied assessment criteria and theory.

Research Question 1:

How can the POEM framework be successfully developed and implemented?

The research Question 1 was answered by the results from the three (3) practical stages: the Phase 1: Stakeholders-Inclusion Approach – Experts' Semi-Structured Interviews/Surveys, Phase 2: Stakeholders-Inclusion Approach – Professionals' Stakeholders Surveys, Phase 3: Stakeholders-Inclusion Approach – End-User/Household Surveys and the on-site POEM Handbook testing procedure phase. For Phase 1 study, 31 experts who are the Board Members and Technical Team from Malaysia Green Building Confederation (MGBC), Representatives from Department of Urban & Town Planning Malaysia and Academicians were asked to view out the current sustainable neighborhood development and to determine the significance of the proposed POEM. The findings suggest majority of experts' consent that SND in Klang Valley/Greater KL is progressive but requires enhancement. Hence, this finding accord to the problem statement of the study, whereby, is timely to assess and gauge the current SND and GBI –TAC. The experts' also opined that SND and GBI-TAC fulfilled SDP in general but there is a considerable gap in SDP fulfilment that needs to be addressed. On the proposed POEM for SND, the findings suggest all experts are in agreement with the contents, criteria and factor loadings. The descriptive statistics analysis of POEM for SND resultant in high mean value concluded expert's agreement with the contents of the proposed POEM for SND and standard deviations are below 1 value meaning the experts are at congruence and consensus on the proposed POEM for SND.

For Phase 2 study, 61 'professionals' stakeholders in this phase are basically an individuals or representatives from sustainable building industry related professional institutions were ask on SDP adaptations balance of the pre-occupancy sustainable township assessment criteria. The Phase 2: Stakeholders-Inclusion Approach – Professionals' Stakeholders Survey's findings suggested there is imbalance SDP adaptations, hence assessment criteria used in pre-occupancy might not fully fulfilled the sustainable neighborhood development upon occupancy. From this conclusion the researcher developed a POEM evaluation criteria based GBI-TAC using SDP category, with equal scoring weightage and simplified descriptive criteria for end-users/households experience valuation score.

For Phase 3 study, the survey questionnaires is designed to rate the sustainability level of GBI certified neighborhood based on end-user/household's opinion. Based on the findings, the POEM sustainability mean level value for Ken Rimba is between 1.75 to

3.77, Bandar Rimbayu is between 2.08 to 4.66 and Sunway Resort City is between 2.37 to 4.34. Thus, Bandar Rimbayu comparatively has the highest post occupancy sustainable level, followed by Sunway Resort City and lastly Ken Rimba. The lowest post occupancy sustainable level values is criteria Q8.23 whether respondents own a business or working within the neighborhood, the findings suggested that most of the respondents either homeowners of tenants are not owning business or working within the neighborhood.

Stakeholders-Inclusion Approach study concludes that the expert and professional stakeholders were in consensus regarding the contents of the proposed POEM for sustainable neighborhood development, and emphasized the significance of a balanced SDP adaptations being implemented in POEM criteria. The end-users/households stakeholders confirm that the implementation of the proposed POEM will support to assess and evaluate the post occupancy sustainable level of the certified sustainable neighborhood.

For Stage 5, POEM Handbook on-site testing in the three certified sustainable neighborhood case studies of Ken Rimba, Bandar Rimbayu, and Sunway Resort City have presented three diverse narratives of how sustainable urban neighborhood / township development being developed in the Klang Valley/Greater KL in the last half decades. The results derived from the previous on-site studies point out that the three selected certified sustainable neighborhood in particular have resultant a rather lower dimension score achieved in post-occupancy evaluation based on end-users/households opinion compared to pre-occupancy evaluation criteria during planning assessment or completion and verification assessment of sustainable neighborhood/township. The obtained results have established that the certified sustainable neighborhood of Ken Rimba, Bandar Rimbayu, and Sunway Resort City being evaluated with an adaptation gap and recognition of the three dimensions of the proposed POEM that include different SDP aspects of environmental, social, and economic. Different post-occupancy evaluation dimension score achieved occurred as an outcome of the pre-occupancy evaluation due to design and planning envisaged functionality are slightly dissimilar from end-users/households perception on the occupied space.

Research Question 2:

What are most significant POEM sustainable urban framework criteria?

The research Question 2 was answered by the results from the three (3) practical stages: the Phase 1: Stakeholders-Inclusion Approach – Experts' Semi-Structured Interviews/Surveys, Phase 2: Stakeholders-Inclusion Approach – Professionals' Stakeholders Surveys, Phase 3: Stakeholders-Inclusion Approach – End-User/Household Surveys, the Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM), and the on-site POEM Handbook testing procedure phase. From the Phase 1: Stakeholders-Inclusion Approach – Experts' Semi-Structured Interviews/Surveys of 31 experts, the statistical analysis have shown that majority of the experts are agreeable with the proposed POEM contents, Based on the findings on extensiveness of POEM for SND contents which include the core assessment criteria, SDP and loading factors are about the right contents. On the further comments on proposed POEM, the experts commented it is comprehensive. The statistical analysis of Phase 1 study shows the mean values of the proposed POEM is 4.34 and 6.12 that suggested expert's agreement with the contents of the proposed POEM and it are well developed. Standard deviations is below 1 value meaning the experts are at congruence and consensus on the proposed POEM.

Throughout Phase 2: Stakeholders-Inclusion Approach – Professionals' Stakeholders Surveys on existing GBI Township Assessment Criteria, The findings suggested there is imbalance SDP adaptations, hence assessment criteria used in pre-occupancy might not fully fulfilled the sustainable neighborhood development upon occupancy. Based on this findings the researcher adopted SDP as core criteria (POEM evaluation dimension) instead of six (6) core-criteria in existing GBI Township Assessment Criteria. For balanced SDP adaptation, the POEM for SND framework employed equal scoring weighting for all simplified evaluation sub-criteria of sustainable dimension. Thus, the Phase 3 end-users/households survey questionnaires and POEM Handbook is design based on simplified sub-criteria in Phase 2 (refer to Table 7.2 in Chapter 7) in order to find out opinion based on their experiences occupying certified sustainable neighborhood. Based on the Phase 3: Stakeholders-Inclusion Approach – End-User/Household Survey's findings, the POEM sustainability level value for Ken Rimba is 1.75 to 3.77, Bandar Rimbayu is between 2.08 to 4.66 and Sunway Resort City is between 2.37 to 4.34. Thus, Bandar Rimbayu comparatively has the highest

post occupancy sustainable level, followed by Sunway Resort City and lastly Ken Rimba. The standard deviations for all comparative selected case studies are below 1, meaning all respondents in the three selected case studies are in congruence and consensus in responding to this study. POEM evaluation criteria was also analyzed using One way ANOVA. Based on the One way ANOVA conducted all the POEM evaluation criteria are **significant** where the value of $p < 0.05$ hence suggested diverse opinion view, except for evaluation criteria of Q8.3, Q8.6 and Q8.16 where the value of $p > 0.05$ which mean **not significant** or show similarity in opinion.

Following the structural model using Confirmatory Factor Analysis and full structural model of Structural Equation Modeling of Phase 3 study and as discussed in Chapter 6, the hypotheses formulated as the base of the SEM modeling, the yielded results summarized that all hypotheses (evaluation criteria) for POEM models in terms of its P-value is accepted. All path coefficients of the causal structure were statistically significant when the P-value indicated less than 0.001 (***), showing that all the hypotheses are all supported (Table 6.13). Thus, all criteria in POEM for SND Framework are significant.

Research Question 3:

How can these POEM criteria be adapted on the workability and implemented through neighborhood development project?

The research Question 3 was answered by the results from the two (2) practical stages: the Phase 3: Stakeholders-Inclusion Approach – End-User/Household Surveys and the on-site POEM Handbook testing procedure phase.

Based on the Phase 3: Stakeholders-Inclusion Approach – End-User/Household Surveys the overall opinion findings by end-users/households stakeholders demonstrated that SDP should be taken into account equally on the same level of the importance in order to achieve post occupancy sustainability for the certified neighborhood development. The overall average ratings of the Phase 3: Stakeholders-Inclusion Approach – End-User/Household Surveys results from One way ANOVA analysis concluded that POEM criteria was significant, which means that there is consensus agreement between the respondents.

For testing the workability and implementation through neighborhood development

project, this adapted criteria in POEM Handbook was applied to actual on-site testing of three selected sustainable neighborhood development of Ken Rimba, Bandar Rimbayu and Sunway Resort City neighborhood. A total 378 respondents participated in this study. The result of this test have shown that Ken Rimba have rather lower total dimension score of 54% and rated as 'CERTIFIED', followed by Sunway Resort City with total dimension score of 59% and rated as 'CERTIFIED' and finally the highest total dimension score is Bandar Rimbayu with 60% score and also rated as 'CERTIFIED'. Thus, the POEM Handbook on-site testing have demonstrated and validated on how these POEM criteria can be adapted on the workability and implemented through neighborhood development project.

Research Question 4:

Would and Why theory of post-occupancy differ from pre-occupancy?

The research Question 4 was answered by the results from all the practical stages: the Phase 1: Stakeholders-Inclusion Approach – Experts' Semi-Structured Interviews/Surveys, Phase 2: Stakeholders-Inclusion Approach – Professionals' Stakeholders Surveys Semi-Structured Interviews/Surveys, Phase 3: Stakeholders-Inclusion Approach – End-User/Household Surveys, the Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM), and the on-site POEM Handbook testing procedure phase. Based on the total results achieved, the answers and the justifications discussed in the earlier paragraph, the POEM for SND development and implementation to on-site testing process have emphasized that pre-occupancy assessment criteria and theory is differ from the post-occupancy evaluation criteria and theory. The differences are significantly apparent based on the results obtained from POEM Handbook on-site testing, whereby only one (1) case study (Ken Rimba neighborhood) have 'ACHIEVED' the same benchmark rating of 'CERTIFIED' same as pre-occupancy assessment while the other two (2) case studies (Bandar Rimbayu and Sunway Resort City neighborhood) have 'NOT ACHIEVED' the same benchmark rating as the same as pre-occupancy assessment. The pre-occupancy assessment benchmark rating for these two (2) case studies are 'SILVER' (66-75 score) while the post-occupancy benchmark rating is 'CERTIFIED' (50-65 score). Thus, it answer the Research Question 4 that post-occupancy theory is differ from pre-occupancy theory in

evaluating sustainable neighborhood development.

The SEM modeling findings suggested that there is a distinct value outscore generated in Average Std. (V), Phase 2 pre-occupancy standardized regression weight value is highly significant while Phase 3 post-occupancy standardized regression weight value is below significant level. Therefore post-occupancy evaluation model (POEM) assessment criteria and theory would differ from the pre-occupancy assessment criteria and theory. Thus, this hypothesis is supported.

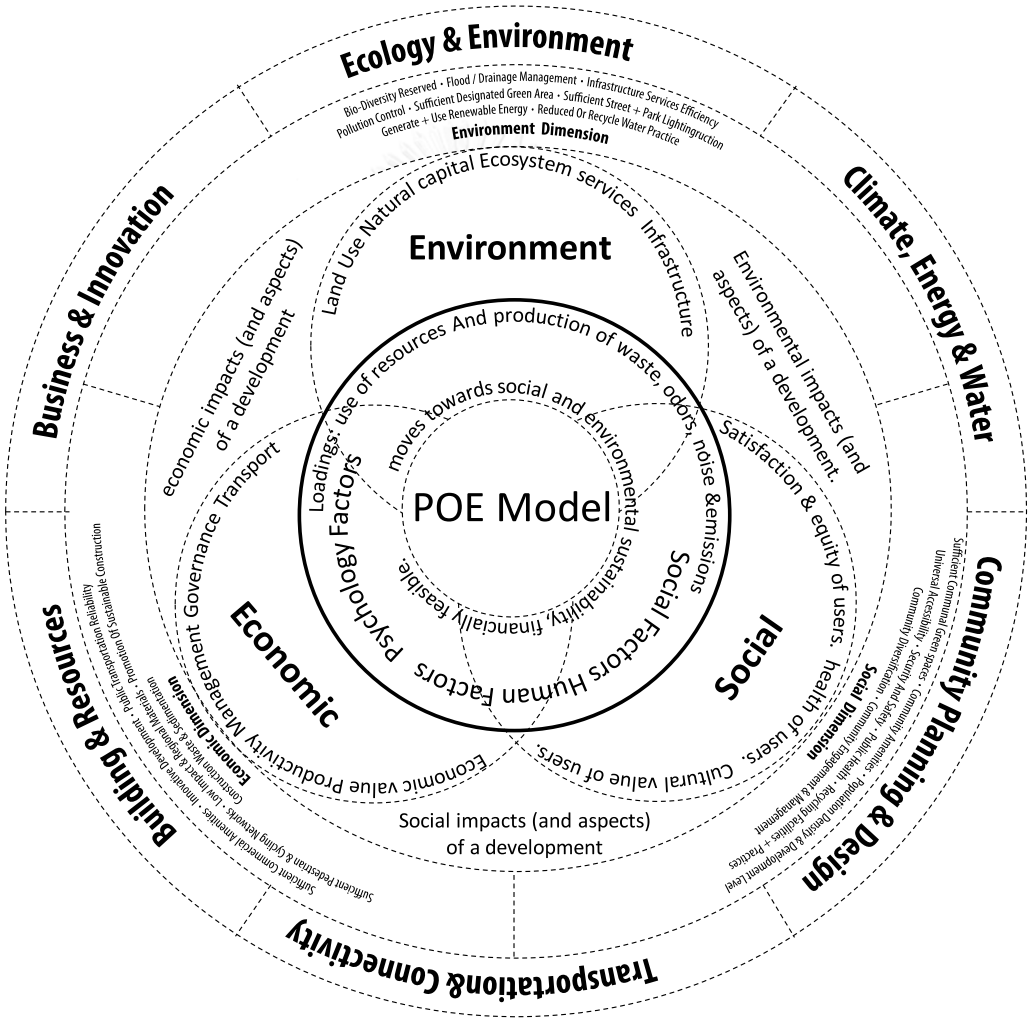


Figure118. The finalized proposed Post-Occupancy Evaluation Model (POEM) for Sustainable Neighborhood Development (SND).

Source: Author

As an outcome of the discussion and investigation included throughout this research studies, it is a certainty to conclude that the main problem statement and hypotheses of this study has been proven. The findings have indicated that a comprehensive Stakeholder-Inclusion Approach method in developing POEM for SND (Figure 131), supported by key issues of SDP understanding in sustainability neighborhood development and guided by clear and comprehensive POEM Handbook procedures, can oversee and foster the neighborhood development and its communities towards an enhanced, balanced and holistic sustainability of the Klang Valley/Greater KL.

Most of the results generated in the course of this study have verified that the function and significance of post-occupancy evaluation in becoming one of the important issues to be taken into consideration by the related institutions or authorities in charge of the urban development and community well-being in the urban area. Pre-occupancy sustainable assessment may lay the foundation for the vision sustainable goals but the sustainable post-occupancy evaluation is the actual measure in rating the sustainability level; it is in the physical building environment instead on the drawings on papers. The actors are real as it is engaged in all related stakeholders instead of projected statistical numbers of occupants. Finally it also concerns the local context of culture, customs and religions. As suggested during this study on the certified sustainable neighborhood in the Klang Valley/Greater KL, there is still a sustainable dimensions gap that needs to be addressed in order to maintain the continuity neighborhood community sustainable practices and management upon occupancy. The POEM for SND end-user/household opinion feedbacks on the lacking pre-occupancy assessment criteria will also contribute a valuable information for refinement and review of future pre-occupancy sustainable township / neighborhood assessment criteria. The absence or non-implementation of POEM for SND evaluation criteria in the certified sustainable neighborhood upon its occupancy compromised sustainable agenda continuation at community and individual level and sustainable growth of the certified sustainable neighborhood particularly and the city urban development generally.

Thus, this study claims that the adoption and implementation of POEM for SND in the Klang Valley/Greater KL will facilitate to enhance the current and future sustainable condition of urban neighborhood development by delivering a clear interpretation of the present sustainable dimension of post-occupied development and providing insights

towards the forthcoming progression in order to achieve the sustainable urban growth of the whole Klang Valley/Greater KL. Experts and Professionals Stakeholders who involved and contributed in this study have indicated a mutual consensus and agreed upon the balanced dimensional approach of SDP adaptations to be employed in the proposed POEM for SND; its simplified and comprehensive enough for end-user/household to comprehend and relates to different evaluation sub-criteria within the model framework. It also disambiguating in term of reference and information for end-user/household to opinion out their sustainable related experience in order to achieve the anticipated study objectives. Lastly, there is no doubt that pre-occupancy sustainable assessment criteria is necessary to serve its purposes in sustainable urban development. This study is not doubting its establishment nor does this study try to challenge its sustainable rating benchmark. The intent of POEM for SND is to further facilitate the continuation and improvement in sustainable urban development, be it at individual, community, neighborhood or township level. It is for betterment in sustainable discourse or agenda as whole.

9.3 General Recommendations

The planned sustainable outline and agenda of viable urban development expansion for the Klang Valley/Greater KL should ensure to anticipate sustainable objectives to be commendably achieved parallel with the sustainable related agenda in 11th National Plan of Malaysia. Hence, there are numerous general recommendations from this study, and for which the intended model framework. Particularly, grounds profound significance in effective implementation. Generally. the current sustainable neighborhood / township scenario in Malaysia Capital region, Klang Valley/Greater KL could be further enhanced substantially by the supportive role of this outcome outlines. Listed below are fundamental points to exemplify the significant recommendations:

- Even though urban development is determined by terrestrial contextual and cultural study topic, there is still a room for added value advantages when incorporating or considering models of frameworks from other domains or more established trans-region. For example, adapting and assimilating a developed

country sustainable assessment criteria and urban development experience can assist and configure constructive element when considering sustainable urban development criteria in developing region such as the Klang Valley/Greater KL. The researcher fully suggests for future related studies an inclusive considerations on this factor to be incorporated.

- Incorporating related skills and collaboration from all relating institutions or organizations and communities' representatives in the Klang Valley/Greater KL for sustainable planning and development of the township will further enrich the sustainable development process. Moreover, stakeholders from the various backgrounds and expertise are also incorporated so that the broader sustainable awareness and education can be acknowledged and fosters throughout the nations.
- All the related stakeholders in sustainable urban development in particular green neighborhood planning should be involved in anticipation of projected and physical indicators in emphasizing general advantages to the relevant authority and institution in order to avoid objectives redundancy and conflict of interests between partakers in advance.
- For multi-ethnicity Malaysia nation context, it is vital to take into account a mechanism to include all races and diverse backgrounds stakeholders in Stakeholders-Inclusion Approach study in order to manifest in the outcome of appropriate and conclusive stakeholder's opinions in future sustainable urban development studies in the country.
- The typical unsustainable practice in particular on the new urban development must be halted, in particular the act of totally clearing a virgin green-site into a brown-site in making a way for new urban development. Sustainable measures by education and awareness together with preservation and conservation enforcement in bio-diversity reserved and ecological system must be duly upheld. This measure should be a fundamental compliance in assessing sustainable development.
- Significance of post-occupancy sustainable management and practice at community and individual level through the adaptation of economic dimension, environmental dimension and social dimension (SDP Adaptations) aspects and

issues should be established by introducing educational and awareness based campaign and programs at all level for continuing sustainable agenda of the nations.

- Climate change, carbon emission issues and capitalization of natural resources must be significantly focused in order to enhance the atmosphere and environment quality alongside with the effective control and practice in preventing and mitigating the vulnerability and natural hazards such as flash flood, pollution and vector diseases.

9.4 Limitation of the Research

Throughout this particular study, the researcher came across numerous difficulties and constraints facing many similar previous research studies. Findings of the study are probably derive to these limits due to the exploitation of diverse research methods such as the all three (3) phases of Stakeholders-Inclusion Approach and on-site POEM Handbook testing, where lots repeated dispatch of survey questionnaires to the all stakeholders and several face-to-face semi-structured interviews are engaged. The study has shown several limitations. This has enacted an important part in addressing the scope of the study. The key limitations are listed below:

- There is limited data and previous study on post-occupancy evaluation for sustainable neighborhood development in the Klang Valley/Greater KL or other similar studies in the other region. Besides the related data of pre-occupancy assessment criteria of the three selected case studies are classified and controlled document. It is not permitted by the developers and GBI Malaysia for accessibility. The intent to compare the original data of pre-occupancy assessment with the post-occupancy evaluation outcome data has certainly been compromised and affected. This has led to POEM Handbook findings comparable to only available benchmark rating in MGBC public website instead of actual pre-occupancy assessment weightage score; hence, it might not be comparable and addressed in an accurate and significant manner.
- Regarding the discussion on the current GBI Township Assessment Criteria and GBI certified township/neighborhood development, this study points out that

this Township Assessment Criteria is relatively new (Tools Version 1.01). Hence, it is not being reviewed since it was launched in March 2011; and there is very limited technical articles and scientific papers in analysis. Furthermore, sustainable township assessment criteria is not mandatory in Malaysia. It is on voluntarily basis applied by the developers. Hence, there is not many sustainable township / neighborhood available for the study. According to MGBC website, there is so far only 18 applications for this sustainable township assessment since launching, only 6 out of 18 were certified with sustainable Provisional Assessment and only 3 occupied for more than 1 year, the 3 selected case studies. Where limiting the reference and comparison of technical and scientific aspect and limited access for wider opinion from end-users/households experience, somehow the overall outcome of this study might have to be compromised.

- Regarding the sampling number of respondents for on-site POEM Handbook testing as discussed in Chapter 7 sample size, the researcher would like to acknowledge that there is no available data of actual population number in each selected certified sustainable neighborhood. Hence, it was difficult to estimate appropriate sample size. Furthermore, since certified sustainable neighborhood is a gated and secured community area, it is mounting task to gather required feedback from the respondents.
- Also, as mentioned in the second limitation, the researcher would like to clarify that only three GBI certified sustainable neighborhood which was occupied for more than a year is available to examine and validate the applicability of the proposed POEM for SND instead of considerable neighborhood development in the Klang Valley/Greater KL. This limitation might affect the study outcomes as the major neighborhood development of Klang Valley/Greater KL study as domain is not considered.

9.5 Recommendations for Further Research

As elaborated in the previous sub-section, there are listed number of research limitations that formed the scope and procedures of this undertaken study. Certainly,

these research limitations prove to offer further research guidelines for future study conduct. This study has focused on the certified sustainable neighborhood development in the Klang Valley/Greater KL and it delivers a policy framework for assessing a sustainable urban development upon its occupancy in managing the continuous sustainable growth of neighborhoods and its communities. However, as discussed previously, this study has implemented the proposed POEM for SND to the three (3) selected certified sustainable neighborhood in the Klang Valley/Greater KL due to the only availability of the case studies at the current time. Therefore, future study would be beneficial from the imparted knowledge that gained from conducting this study work with its reference guide and procedures to other or future sustainable neighborhood development within or outside the Klang Valley/Greater KL. Additionally, further study could be further developed and implemented on the other similar region of South East Asia where exhibiting common geographical and cultural values, or even beyond regional trans-boundary of similar development phenomenon throughout the world.

Study can be further developed, intensified and expanded in dealing with specific related issues. For example, further elaborated or focused research on one of the main three dimensions of the proposed model which was developed in this study. Moreover, specific intensified POEM evaluation sub-criteria can be an exclusive research topic for further study. In Malaysia context, for instance, further studies on bio-diversity reserved and hydrological system in urban development issues are highly recommended because of the loss of these natural ecosystems which led to urban vulnerability such as flash flooding or urban heat island effect in the city. The studies could refer to the methodology applied in this thesis in establishing the opinion from all related stakeholders involved including public concerning the idea of measuring and managing a bio-diversity reserved or hydrological systems in sustainable urban development, and to identify the main evaluation criteria and sub-criteria for that. More specific focus could be attained on how to balance this bio-diversity reserved with physical development, for example, through integrated planning and design co-existence of nature and manmade instead of totally clearing up the green and bluescapes in making way for new development and try to recreate it back with minimum means. Logically, this act of trying to recreate bio-diversity or natural hydrological systems is totally absurd as any natural bio-diversity loss is irreplaceable and gone forever. Thus, this

notion certainly will help to preserve and conserve a natural ecosystem reserved in the development area within the urban setting in addition to transforming the current development policy to be more environmentally, socially and economically just.

REFERENCES

(2010). State of the World's Cities 2010/11: Cities for All: Bridging the Urban Divide, Taylor & Francis.

(2012). State of the World's Cities 2008/9: Harmonious Cities, Taylor & Francis.

ABS-Consulting (2009). "Overall Liking Score (OLS)

Occupant feedback is fundamental for continuous improvement."

Alkan Olsson, J., et al. (2009). "A goal oriented indicator framework to support integrated assessment of new policies for agri-environmental systems." Environmental Science & Policy **12**(5): 562-572.

Allen, A. (2009). "Sustainable cities or sustainable urbanisation." Retrieved April **18**: 2014.

Alwaer, H. and D. J. Clements-Croome (2010). "Key performance indicators (KPIs) and priority setting in using the multi-attribute approach for assessing sustainable intelligent buildings." Building and Environment **45**(4): 799-807.

Angel, S., et al. (2007). Urban sprawl metrics: an analysis of global urban expansion using GIS.

Baird, G. (2001). "Post-occupancy evaluation and probe: a New Zealand perspective." Building Research & Information **29**(6): 469-472.

Baker, J. L. (2012). Climate Change, Disaster Risk, and the Urban Poor: Cities Building Resilience for a Changing World, World Bank Publications.

Baumert, K. A., et al. (2005). Navigating the numbers: Greenhouse gas data and international climate policy, World Resources Inst.

Berardi, U. (2013). "Sustainability assessment of urban communities through rating systems." Environment, Development and Sustainability **15**(6): 1573-1591.

Berg, P. G. and G. Nycander (1997). "Sustainable neighbourhoods—a qualitative model for resource management in communities." Landscape and Urban Planning **39**(2–3): 117-135.

Bhattacharya, A., et al. (2015). "Driving sustainable development through better infrastructure: Key elements of a transformation program." Brookings Global Working Paper Series.

Bordass, B. and A. Leaman (2005). "Making feedback and post-occupancy evaluation routine 1: A portfolio of feedback techniques." Building Research & Information **33**(4): 347-352.

Bordass, B., et al. (2002). "Walking the tightrope: the Probe team's response to BRI commentaries." Building Research & Information **30**(1): 62-72.

Brain, D. (2005). "From good neighborhoods to sustainable cities: Social science and the social agenda of the new urbanism." International Regional Science Review **28**(2): 217-238.

Brundtland, G., et al. (1987). "Our Common Future (\'Brundtland report\')."

Bryman, A. (2006). "Integrating quantitative and qualitative research: how is it done?" Qualitative Research **6**(1): 97-113.

Bryman, A. (2012). Social research methods, Oxford university press.

CABE (2011). "Post-occupancy evaluation." (Sustainable Places).

Carmin, J., et al. (2012). "Urban Climate Adaptation in the Global South: Planning in an Emerging Policy Domain." Journal of Planning Education and Research **32**(1): 18-32.

Chansomsak, S. and B. Vale (2009). "The roles of architects in sustainable community development." J. Archit. Plann. Res. Stud **6**(3): 107-137.

Chiu, L. F., et al. (2014). "A socio-technical approach to post-occupancy evaluation: interactive adaptability in domestic retrofit." Building Research & Information **42**(5): 574-590.

Choguill, C. L. (2008). "Developing sustainable neighbourhoods." Habitat International **32**(1): 41-48.

Churchill, G. A. and D. Iacobucci (2009). "Marketing Research: Methodological Foundations: Cengage Learning."

CIBSE, T. M. (1999). "Environmental factors affecting office worker performance: A review of evidence." The Chartered Institution of Building Services Engineers.

Clark, G. (2007). "Evolution of the global sustainable consumption and production policy and the United Nations Environment Programme's (UNEP) supporting activities." Journal of cleaner production **15**(6): 492-498.

Cohen, B. (2006). "Urbanization in developing countries: Current trends, future projections, and key challenges for sustainability." Technology in Society **28**(1–2): 63-80.

Cole, R. J. (2004). "Changing context for environmental knowledge." Building Research & Information **32**(2): 91-109.

Congress, U. S. (1969). "National Environmental Policy Act of 1969." Public Law(91-190): 1075.

Cooper, I. (1999). "Which focus for building assessment methods–environmental performance or sustainability?" Building Research & Information **27**(4-5): 321-331.

Council, U. S. G. B. (2006). "LEED for Neighborhood Developments." Washington, DC: US Green Building Council.

Council, U. S. G. B. (2009). LEED 2009 for neighborhood development, US Green Building Council, Incorporated.

CSIRO (2014). "The Report - State of the Climate 2014." **SoC 2014 Report**.

Dahiya, B. (2012). "Cities in Asia, 2012: Demographics, economics, poverty, environment and governance." Cities **29**: S44-S61.

Dahiya, B. (2014). "Southeast Asia and Sustainable Urbanization." Global Asia **9**(3): 84-91.

Dahiya, B. (2016). "ASEAN Economic Integration and Sustainable Urbanization." Journal of Urban Culture Research **13**(1): 8-15.

Dahl, A. L. (2012). "Achievements and gaps in indicators for sustainability." Ecological Indicators **17**: 14-19.

Declaration, R. (1992). Rio declaration on environment and development.

DESA-UNDP (2013). "TST Issues Brief: Sustainable cities and human settlements. The Technical Support Team is co-chaired by the Department of Economic and Social Affairs and the United Nations Development Programme.".

Ding, G. K. C. (2008). "Sustainable construction—The role of environmental assessment tools." Journal of environmental management **86**(3): 451-464.

Du Plessis, C., et al. (2001). "Agenda 21 for Sustainable Construction in Developing Countries, First Discussion Document." CIB and CSIR-Boutek, available at: www. sustainablesettlem ent. co. za/docs/a21_ discussiondoc. pdf (accessed 20 April 2008).

Duffy, F. and L. Hutton (2004). Architectural knowledge: the idea of a profession, Taylor & Francis.

Eriksson, O., et al. (2005). Life cycle impact assessment—a damage based weighting method for environmental impact assessment. Proceedings of the world sustainable building conference (SB05), Tokyo.

Fellows, R. F. and A. M. M. Liu (2015). Research methods for construction, John Wiley & Sons.

Freundschuh, S. M. and M. J. Egenhofer (1997). "Human conceptions of spaces: implications for GIS." Transactions in GIS **2**(4): 361-375.

Garde, A. (2009). "Sustainable by Design?: Insights From U.S. LEED-ND Pilot Projects." Journal of the American Planning Association **75**(4): 424-440.

Garde, A. (2009). "Sustainable by design?: Insights from US LEED-ND pilot projects." Journal of the American Planning Association **75**(4): 424-440.

GBI (2010). "GBI TOWNSHIP RATING TOOL." Seminar On Sustainable Cities – Sharing Swedish Experience24 May 2011, Park Royal Hotel, Kuala Lumpur -(Asian Green Cities Index).

Geels, F. W. (2012). "A socio-technical analysis of low-carbon transitions: introducing the multi-level perspective into transport studies." Journal of Transport Geography **24**: 471-482.

Gething, B. and B. Bordass (2006). "Rapid assessment checklist for sustainable buildings." Building Research & Information **34**(4): 416-426.

Gill, J. and P. Johnson (2010). Research methods for managers, Sage.

Girardet, H. and S. Australia (2004). Creating a sustainable Adelaide, Department of the Premier and Cabinet.

Gorski, J. and E. Yantovsky (2011). Zero Emissions Future City, (Chapter 9). Clean Energy Systems and Experiences. (Ed.: Kei Eguchi), SCYIO**:** 165-177.

Grimm, N. B., et al. (2000). "Integrated Approaches to Long-Term Studies of Urban Ecological Systems: Urban ecological systems present multiple challenges to ecologists—pervasive human impact and extreme heterogeneity of cities, and the need to integrate social and ecological approaches, concepts, and theory." BioScience **50**(7): 571-584.

Haapio, A. (2012). "Towards sustainable urban communities." Environmental Impact Assessment Review **32**(1): 165-169.

Haapio, A. and P. Viitaniemi (2008). "A critical review of building environmental assessment tools." Environmental impact assessment review **28**(7): 469-482.

Habitat, U. N. (2008). "State of the world's cities 2008/2009: Harmonious cities." Earthscan, London. 264pp.

Habitat, U. N. (2012). "Urban patterns for a green economy working with nature." UN Habitat, Nairobi.

Habitat, U. N. (2013). State of the world's cities 2012/2013: Prosperity of cities, Routledge.

Hamedani, A. Z. and F. Huber (2012). "A comparative study of DGNB, LEED and BREEAM certificate systems in urban sustainability." The Sustainable City VII: Urban Regeneration and Sustainability **1121**.

Hamid, A. A. and M. R. Embi (2012). "Constraints and potentials for implementing the green building rating tool for government buildings in Malaysia."

Hara, Y., et al. (2005). "Urbanization linked with past agricultural landuse patterns in the urban fringe of a deltaic Asian mega-city: a case study in Bangkok." Landscape and Urban Planning **73**(1): 16-28.

Harger, J. R. E. and F. M. Meyer (1996). "Definition of indicators for environmentally sustainable development." Chemosphere **33**(9): 1749-1775.

Hezri, A. A. (2004). "Sustainability indicator system and policy processes in Malaysia: a framework for utilisation and learning." Journal of environmental Management **73**(4): 357-371.

Hiremath, R. B., et al. (2013). "Indicator-based urban sustainability—A review." Energy for Sustainable Development **17**(6): 555-563.

Ho, C. S., et al. (2013). "Low carbon urban development strategy in Malaysia – The case of Iskandar Malaysia development corridor." Habitat International **37**: 43-51.

ICSU (2014). "ANNUAL REPORT ICSU 2014."

IEA (2008). World Energy Outlook 2008, OECD Publishing.

IFRCRC (2010). "World Disasters Report 2010–Focus on Urban Risk." International Federation of Red Cross and Red Crescent Societies, Geneva.

Inalhan, G., et al. (2010). "Evaluating user experience in green buildings in relation to workplace culture and context." Facilities **28**(3/4): 225-238.

IPCC (2007). "Climate change. Fourth Assessment Report of the IPCC." Cambridge University Press, Cambridge.

Isa, M., et al. (2013). "Factors Affecting Green Office Building Investment in Malaysia." Procedia-Social and Behavioral Sciences **105**: 138-148.

IUCN (1980). "World Conservation Strategy." Living Resource Conservation for Sustainable Development.

Kamaruzzaman, S. N., et al. (2011). "The effect of indoor environmental quality on occupants' perception of performance: A case study of refurbished historic buildings in Malaysia." Energy and Buildings **43**(2): 407-413.

Karim, H. and C. Carl (2009). "Post-occupancy evaluation: purpose, benefits and barriers." Facilities **27**(1/2): 21-33.

KeTTHA (2011). "Low Carbon Cities Framework and Assessment System."

Kochan, T., et al. (2003). "The effects of diversity on business performance: Report of the diversity research network." Human resource management **42**(1): 3-21.

Kohler, N. (1999). "The relevance of Green Building Challenge: an observer's perspective." Building Research & Information **27**(4-5): 309-320.

Kraas, F. (2007). "Megacities and global change: key priorities." Geographical Journal **173**(1): 79-82.

Kumar, S., et al. (2010). "PERFORMANCE BASED RATING AND ENERGY PERFORMANCE BENCHMARKING FOR COMMERCIAL BUILDINGS IN INDIA."

Kyrkou, D. and R. Karthaus (2011). "Urban sustainability standards: predetermined checklists or adaptable frameworks?" Procedia Engineering **21**: 204-211.

Leaman, A., et al. (2010). "Building evaluation: practice and principles." Building Research & Information **38**(5): 564-577.

Lee, W. L. (2013). "A comprehensive review of metrics of building environmental assessment schemes." Energy and Buildings **62**: 403-413.

Lee, Y. S. and D. A. Guerin (2009). "Indoor environmental quality related to occupant satisfaction and performance in LEED-certified buildings." Indoor and Built Environment **18**(4): 293-300.

Lowe, C. and A. Ponce (2010). "UNEP-FI/SBCI'S financial & sustainability metrics report." An international review of sustainable building performance indicators & benchmarks. Available online: http://www. unepfi. org/fileadmin/documents/metrics_report_01. pdf (accessed on 20 March 2014).

Luederitz, C., et al. (2013). "A systematic review of guiding principles for sustainable urban neighborhood development." Landscape and Urban Planning **118**: 40-52.

Lutzenhiser, L. (1993). "Social and behavioral aspects of energy use." Annual Review of Energy and the Environment **18**(1): 247-289.

Mallory-Hill, S., et al. (2012). Enhancing building performance, John Wiley & Sons.

Mattarozzi, S. and E. Antonini (2011). "Sustainability assessment: An integrated approach with inhabitant participation." Procedia Engineering **21**: 560-569.

McMichael, A. J. (2000). "The urban environment and health in a world of increasing globalization: issues for developing countries." Bulletin of the World Health Organization **78**(9): 1117-1126.

Meakin, S. (1992). The Rio Earth Summit: Summary of the United Nations Conference on Environment and Development, Library of Parliament, Research Branch.

MGBC (2010). "New Opportunities & New Challenges', Sustainable Buildings South East Asia 2010." Conference E-Booklet, SB10SEA, 2010.

Miyazawa, I. (2012). "What are Sustainable Development Goals." IGES Rio+ 20 Issue Brief.

Mori, K. and A. Christodoulou (2012). "Review of sustainability indices and indicators: Towards a new City Sustainability Index (CSI)." Environmental Impact Assessment Review **32**(1): 94-106.

Muhammad, Z. B. (2005). "Development Of Urban Indicators: A Malaysian Initiative." Department of Town and Country Planning Peninsular Malaysia.

Munda, G. (2005). ""Measuring Sustainability": A Multi-Criterion Framework." Environment, Development and Sustainability **7**(1): 117-134.

Murphy, K. (2012). "The social pillar of sustainable development: a literature review and framework for policy analysis." Sustainability: Science, Practice, & Policy **8**(1): 15-29.

Nations, U. (2007). "Indicators of Sustainable Development: Guidelines and Methodologies." Economic and Social Affairs(October 2007 Third Edition): 99.

Niemeijer, D. (2002). "Developing indicators for environmental policy: data-driven and theory-driven approaches examined by example." Environmental Science & Policy **5**(2): 91-103.

Niemeijer, D. and R. S. de Groot (2008). "A conceptual framework for selecting environmental indicator sets." Ecological Indicators **8**(1): 14-25.

Okoli, C. and S. D. Pawlowski (2004). "The Delphi method as a research tool: an example, design considerations and applications." Information & management **42**(1): 15-29.

Omer, A. M. (2008). "Energy, environment and sustainable development." Renewable and sustainable energy reviews **12**(9): 2265-2300.

OWG-UN. (2014). "Open Working Group Proposal for Sustainable Development Goals." Full report of the Open Working Group of the General Assembly on Sustainable Development Goals. New York: United Nations Open Working Group.

Pauchard, A., et al. (2006). "Multiple effects of urbanization on the biodiversity of developing countries: the case of a fast-growing metropolitan area (Concepción, Chile)." Biological conservation **127**(3): 272-281.

Peirce, N. R., et al. (2008). Century of the city: no time to lose, Rockefeller Foundation.

Plass, N. and I. Kaltenegger (2007). "Strategic and Practical Implications in Decision Making and Planning for Sustainability." Indoor and Built Environment **16**(3): 204-215.

Poston, A., et al. Developing holistic frameworks for the next generation of sustainability assessment methods for the built environment.

Potter, R. B. (2004). Geographies of development, Pearson Education.

Powell, C. (2003). "The Delphi technique: myths and realities." Journal of Advanced Nursing **41**(4): 376-382.

Preiser, W. F. E. (1995). "Post-occupancy evaluation: how to make buildings work better." Facilities **13**(11): 19-28.

Preiser, W. F. E. (2001). "The evolution of post-occupancy evaluation: Toward building performance and universal design evaluation." Learning from our buildings: A state-of-the-practice summary of post-occupancy evaluation: 9-22.

Presidency, G. (2007). "Leipzig charter on sustainable European Cities." Final draft, document prepared by the German Presidency of the European Union, Leipzig.

Pucher, J. and L. Dijkstra (2000). "Making walking and cycling safer: lessons from Europe." Transportation Quarterly **54**(3): 25-50.

Rashid, Y. R., et al. (2011). "Greening government's office buildings: PWD Malaysia experiences." Procedia Engineering **21**: 1056-1060.

Reed, M. S., et al. (2006). "An adaptive learning process for developing and applying sustainability indicators with local communities." Ecological economics **59**(4): 406-418.

Repetti, A. and G. Desthieux (2006). "A Relational Indicatorset Model for urban land-use planning and management: Methodological approach and application in two case studies." Landscape and Urban Planning **77**(1–2): 196-215.

Robinson, N. A. (1993). Agenda 21: earth's action plan, Oceana Publications, Inc.

Robson, C. (2002). Real world research: A resource for social scientists and practitioner-researchers.

Roy, S., et al. (2001). "Identifying Software Project Risks: An International Delphi Study." J. Manage. Inf. Syst. **17**(4): 5-36.

Sachs, J. D. (2012). "From millennium development goals to sustainable development goals." The Lancet **379**(9832): 2206-2211.

San-José, J. T., et al. (2007). "Approach to the quantification of the sustainable value in industrial buildings." Building and Environment **42**(11): 3916-3923.

Sands, P. and J. Peel (2012). Principles of international environmental law, Cambridge University Press.

Schnur, O. (2005). "EXPLORING SOCIAL CAPITAL AS AN URBAN NEIGHBOURHOOD RESOURCE: EMPIRICAL FINDINGS AND STRATEGIC CONCLUSIONS OF A CASE STUDY IN BERLIN-MOABIT." Tijdschrift voor economische en sociale geografie **96**(5): 488-505.

Seto, K. C., et al. (2011). "A Meta-Analysis of Global Urban Land Expansion." PLoS ONE **6**(8): e23777.

Shari, Z., et al. (2008). "The Potential of sustainable building rating System in the Malaysian building industry." ALAM CIPTA, International Journal on Sustainable Tropical Design Research & Practice **3**(1): 3-14.

Sharifi, A. and A. Murayama (2013). "A critical review of seven selected neighborhood sustainability assessment tools." Environmental Impact Assessment Review **38**: 73-87.

Sharifi, A. and A. Murayama (2014). "Neighborhood sustainability assessment in action: Cross-evaluation of three assessment systems and their cases from the US, the UK, and Japan." Building and Environment **72**: 243-258.

Shen, L.-Y., et al. (2011). "The application of urban sustainability indicators – A comparison between various practices." Habitat International **35**(1): 17-29.

Shika, S. A., et al. (2012). "Developing Post Occupancy Evaluation Sustainability Assessment Framework for Retrofitting Commercial Office Buildings: A Proposal." Procedia - Social and Behavioral Sciences **65**: 644-649.

Singh, J., et al. (2010). "Building pathology, investigation of sick buildings—toxic moulds." Indoor and Built Environment **19**(1): 40-47.

Singh, R. K., et al. (2009). "An overview of sustainability assessment methodologies." Ecological Indicators **9**(2): 189-212.

Steffen, W., et al. (2015). "The trajectory of the Anthropocene: The Great Acceleration." The Anthropocene Review **2**(1): 81-98.

Steuteville, R. (2004). "The new urbanism: An alternative to modern, automobile-oriented planning and development." The New Urban News: 5.

Stevenson, F. and H. B. Rijal (2010). "Developing occupancy feedback from a prototype to improve housing production." Building Research & Information **38**(5): 549-563.

Stuckenschneider, H. (2004). "Pictures of the Future: Siemens Corporate Technology." Siemens AG, München.

Sullivan, L. J., et al. (2014). "Neighbourhood sustainability frameworks-a literature review."

Summit, E. (1992). "Press Summary of Agenda 21. United Nations Conference on Environment and Development (Rio de Janeiro, Brazil, 3-14 June 1992)." New York: United Nations.

Tanguay, G. A., et al. (2010). "Measuring the sustainability of cities: An analysis of the use of local indicators." Ecological Indicators **10**(2): 407-418.

Tiwari, G. (1999). "Towards a sustainable urban transport system: Planning for non-motorized vehicles in cities." Transport and Communications Bulletin for Asia and the Pacific **68**: 49-66.

Truitt, P. (2009). "Potential for reducing greenhouse gas emissions in the construction sector." US Environmental Protection Agency: 12.

Tyler, S. and M. Moench (2012). "A framework for urban climate resilience." Climate and Development **4**(4): 311-326.

UN-DESA (2013). "World population projected to reach 9.6 billion by 2050." UN News. New York.

Un, H. (2004). "The challenge of slums: global report on human settlements 2003." Management of Environmental Quality: An International Journal **15**(3): 337-338.

UNEP-WGBC (2012). "Sustainable Cities: Building Cities for The Future." UNEP Sustainable Buildings and Climate Initiative and the World Green Building Council.

Valentin, A. and J. H. Spangenberg (2000). "A guide to community sustainability indicators." Environmental Impact Assessment Review **20**(3): 381-392.

Varga, T. and I. Vercseg (1992). "An Experiment in Community Development in the Bakony, Hungary." Community Development Journal **27**(1): 50-59.

Vidal, J. and D. Adam (2007). "China overtakes US as world's biggest CO2 emitter." The Guardian **19**.

Vidal, L.-A., et al. (2011). "Using a Delphi process and the Analytic Hierarchy Process (AHP) to evaluate the complexity of projects." Expert Systems with Applications **38**(5): 5388-5405.

Vischer, J. C. (2008). "Towards a user-centred theory of the built environment." Building research & information **36**(3): 231-240.

Walton, J. S., et al. (2005). "Integrated assessment of urban sustainability." Proceedings of the ICE-Engineering Sustainability **158**(2): 57-65.

Watson, V. (2009). "Seeing from the South: Refocusing urban planning on the globe's central urban issues." Urban Studies **46**(11): 2259-2275.

Way, M. and B. Bordass (2005). "Making feedback and post-occupancy evaluation routine 2: Soft landings–involving design and building teams in improving performance." Building Research & Information **33**(4): 353-360.

Wced, U. N. (1987). "Our common future." World Commission on Environment and DevelopmentOxford University Press.

WGBC (2012/2013). "World Green Building Council Annual Report 2012/2013."

Wolfgang, F. E. P. (1995). "Post-occupancy evaluation: how to make buildings work better." Facilities **13**(11): 19-28.

Wolfgang, F. E. P. and S. Ulrich (2002). "Intelligent office building performance evaluation." Facilities **20**(7/8): 279-287.

Woodcraft, S., et al. (2011). Design for social sustainability: A framework for creating thriving new communities, Future Communities.

Wu, J. (2014). "Urban ecology and sustainability: The state-of-the-science and future directions." Landscape and Urban Planning **125**: 209-221.

Wu, P. and S. P. Low (2010). "Project management and green buildings: lessons from the rating systems." Journal of Professional Issues in Engineering Education and Practice **136**(2): 64-70.

Yahya, W. K. and N. H. Hashim (2011). The role of public awareness and government regulations in stimulating sustainable consumption of Malaysian consumers. Business, Engineering and Industrial Applications (ICBEIA), 2011 International Conference on, IEEE.

Yiing, C. F., et al. (2013). "Achieving sustainable development: accessibility of green buildings in Malaysia." Procedia-Social and Behavioral Sciences **101**: 120-129.

Yu, A. T. W., et al. (2007). "An empirical study of the variables affecting construction project briefing/architectural programming." International Journal of Project Management **25**(2): 198-212.

Yu, C. W. F. and K. Jeong Tai (2011). "Building Environmental Assessment Schemes for Rating of IAQ in Sustainable Buildings." Indoor and Built Environment **20**(1): 5-15.

Zagreus, L., et al. (2004). "Listening to the occupants: a Web-based indoor environmental quality survey." Indoor Air **14**(s8): 65-74.

Zimring, C. M. and J. E. Reizenstein (1980). "Post-occupancy evaluation an overview." Environment and Behavior **12**(4): 429-450.

APPENDIX

Appendix A – Chulalongkorn University Research Undertakings Letter

Environment, Development and Sustainability Program
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254 Phayathai Road Pathumwan Bangkok 10330 Thailand
Tel./Fax : +66(0)-2-218-8133 E-mail : eds@chula.ac.th

Ref. No. EDS.086/2016

13 May 2016

To whom it may concern

I would like to introduce my student, Mr. Rostam Yaman, Ph.D. candidate of Environment, Development and Sustainability Program (EDS) of Chulalongkorn University.

Mr. Rostam wishes to collect data by using questionnaire for her doctoral research. Her research topic is "Developing A Post Occupancy Evaluation Model For Neighborhood Assessment Towards Sustainable Urban Development in Malaysia". The main research objectives are to identify and formulate post-occupancy evaluation modeled based on sustainable pillars towards sustainable neighborhood development and to implement post-occupancy evaluation model in assessing & evaluate GBI certified neighborhood towards sustainable urban development for Malaysia.

Mr. Rostam will comply with research ethics strictly, and will treat the information obtained from the questionnaire with sensitivity.

I will be grateful if you could receive his questionnaire.

Sincerely yours,

Assoc. Prof. Dr. Vithaya Kulsomboon

Program Director

Appendix B - Invitation to Participate In the Research

Chulalongkorn University
จุฬาลงกรณ์มหาวิทยาลัย
Pillar of the Kingdom
Environment, Development and Sustainability.
Rostam Yaman 578 77992 20

Invitation Letter

DATE: 6th June 2016

สวัสดี ครับ,
To Whom It May Concern:

INVITATION TO PARTICIPATE IN THE STAKEHOLDER-INCLUSION APPROACH QUESTIONNAIRE

Dear Participant,

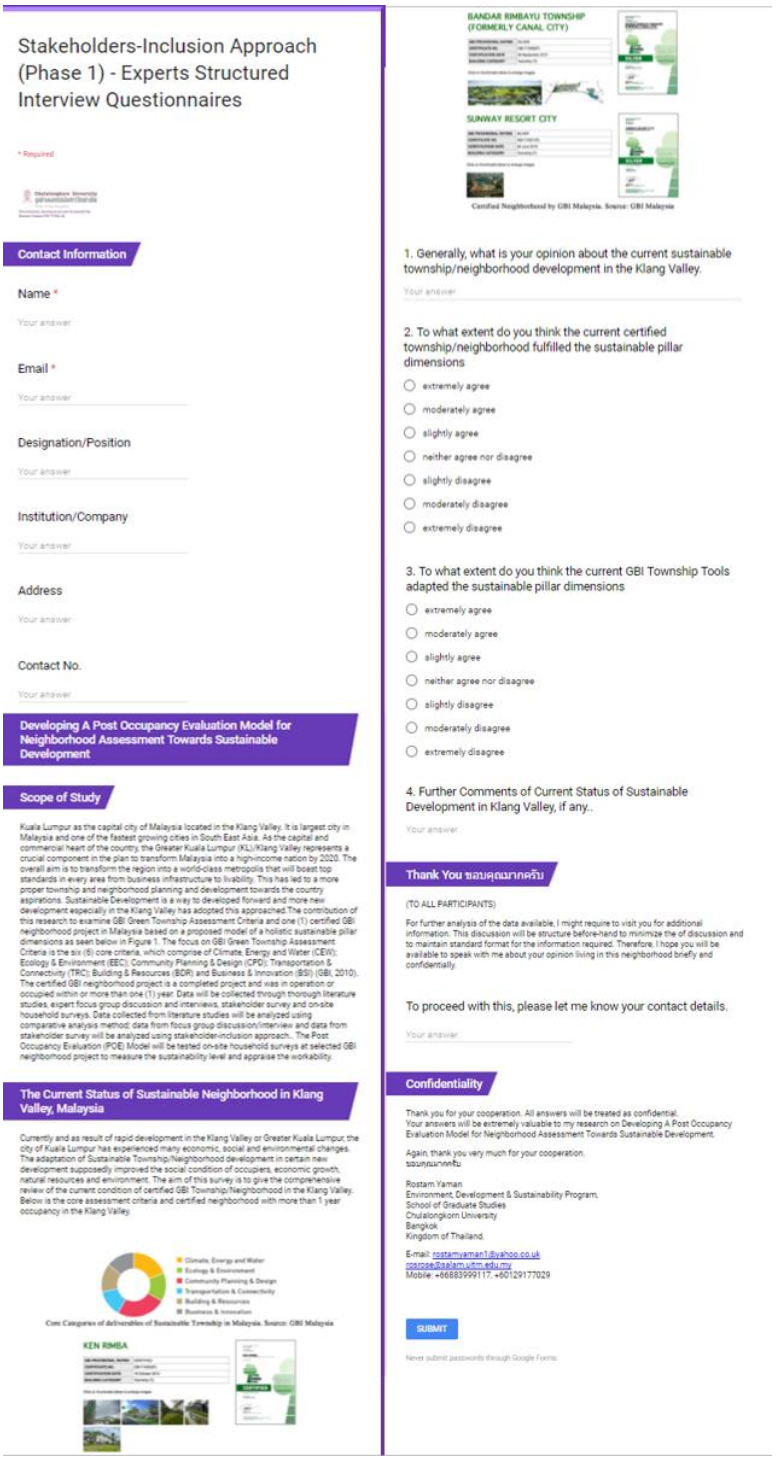
I am a PhD student at Environment Development & Sustainability Program, Graduate School, Chulalongkorn University in Thailand. As a partial fulfillment of my Degree, I am undertaking a research that aims to examine the certified sustainable neighborhood assessment criteria in the Klang Valley based on a proposed model of a holistic sustainable pillar dimensions. This framework has been designed based on two main bases. Firstly, the scientific research and knowledge, which include the academic research papers and reports. Secondly, based on the strengths of the existing tools/frameworks of GBI Green Township Tools (Version 1.01).

This research focuses primarily on the evaluation of this proposed model in order to ensure that it is acceptable, reliable and valid. This process will be done through the use of one of the most valuable techniques to evaluate the model, which is the Stakeholders-Inclusion Approach. It will be used to obtain the views of experts and end-users regarding the proposed model in terms of the dimensions, categories and criteria and will involve two rounds of questionnaires.

Your contribution to this research is very significant to the success of this research work. Therefore, I would be grateful if you accept this invitation to participate in this study. Reading and answering the questionnaire will take approximately 30 minutes, and I am looking forward for your participation. All information submitted from the participants will be used for research purposes only and will be treated and analyzed confidentially. Only statistical summary and summarized information will be reported or published.
Please do not hesitate to contact me for any further questions.

Sincerely,
Rostam Yaman
PhD Candidate
EDS, Chulalongkorn University
Bangkok
Thailand
E-mail: rostamyaman1@yahoo.co.uk
rosrose@salam.uitm.edu.my
Mobile: +66883999117, +60129177029

Appendix C – Experts & Survey Questionnaire (Phase 1)



Stakeholders-Inclusion Approach (Phase 1) - Experts Structured Interview Questionnaires

* Required

Contact Information

Name *

Your answer

Email *

Your answer

Designation/Position

Your answer

Institution/Company

Your answer

Address

Your answer

Contact No.

Your answer

Developing A Post Occupancy Evaluation Model for Neighborhood Assessment Towards Sustainable Development

Scope of Study

Kuala Lumpur as the capital city of Malaysia located in the Klang Valley. It is largest city in Malaysia and one of the fastest growing cities in South East Asia. As the capital and commercial heart of the country, the Greater Kuala Lumpur (KL)/Klang Valley represents a crucial component in the plan to transform Malaysia into a high-income nation by 2020. The overall aim is to transform the region into a world-class metropolis that will boast top standards in every area from business infrastructure to livability. This has led to a more proper township and neighborhood planning and development towards the country aspirations. Sustainable Development is a way to developed forward and more new development especially in the Klang Valley has adopted this approached.The contribution of this research to examine GBI Green Township Assessment Criteria and one (1) certified GBI neighborhood project in Malaysia based on a proposed model of a holistic sustainable pillar dimensions as seen below in Figure 1. The focus on GBI Green Township Assessment Criteria is the six (6) core criteria, which comprise of Climate, Energy and Water (CEW); Ecology & Environment (EEC); Community Planning & Design (CPD); Transportation & Connectivity (TRC); Building & Resources (BDR) and Business & Innovation (BSI) (GBI, 2010). The certified GBI neighborhood project is a completed project and was in operation or occupied within or more than one (1) year. Data will be collected through thorough literature studies, expert focus group discussion and interviews, stakeholder survey and on-site household surveys. Data collected from literature studies will be analyzed using comparative analysis method; data from focus group discussion/interview and data from stakeholder survey will be analyzed using stakeholder-inclusion approach.. The Post Occupancy Evaluation (POE) Model will be tested on-site household surveys at selected GBI neighborhood project to measure the sustainability level and appraise the workability.

The Current Status of Sustainable Neighborhood in Klang Valley, Malaysia

Currently and as result of rapid development in the Klang Valley or Greater Kuala Lumpur, the city of Kuala Lumpur has experienced many economic, social and environmental changes. The adaptation of Sustainable Township/Neighborhood development in certain new development supposedly improved the social condition of occupiers, economic growth, natural resources and environment. The aim of this survey is to give the comprehensive review of the current condition of certified GBI Township/Neighborhood in the Klang Valley. Below is the core assessment criteria and certified neighborhood with more than 1 year occupancy in the Klang Valley.

Climate, Energy and Water
Ecology & Environment
Community Planning & Design
Transportation & Connectivity
Building & Resources
Business & Innovation

Core Categories of deliverables of Sustainable Township in Malaysia. Source: GBI Malaysia

KEN RIMBA

BANDAR RIMBAYU TOWNSHIP (FORMERLY CANAL CITY)

SUNWAY RESORT CITY

Certified Neighborhood by GBI Malaysia. Source: GBI Malaysia

1. Generally, what is your opinion about the current sustainable township/neighborhood development in the Klang Valley.

Your answer

2. To what extent do you think the current certified township/neighborhood fulfilled the sustainable pillar dimensions

- extremely agree
- moderately agree
- slightly agree
- neither agree nor disagree
- slightly disagree
- moderately disagree
- extremely disagree

3. To what extent do you think the current GBI Township Tools adapted the sustainable pillar dimensions

- extremely agree
- moderately agree
- slightly agree
- neither agree nor disagree
- slightly disagree
- moderately disagree
- extremely disagree

4. Further Comments of Current Status of Sustainable Development in Klang Valley, if any..

Your answer

Thank You ขอบคุณมากครับ

(TO ALL PARTICIPANTS)

For further analysis of the data available, I might require to visit you for additional information. This discussion will be structure before-hand to minimize the of discussion and to maintain standard format for the information required. Therefore, I hope you will be available to speak with me about your opinion living in this neighborhood briefly and confidentially.

To proceed with this, please let me know your contact details.

Your answer

Confidentiality

Thank you for your cooperation. All answers will be treated as confidential.
Your answers will be extremely valuable to my research on Developing A Post Occupancy Evaluation Model for Neighborhood Assessment Towards Sustainable Development.

Again, thank you very much for your cooperation.
ขอบคุณมากครับ

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SUBMIT

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Appendix D – Stakeholders Survey Questionnaire (Phase 2)

Stakeholders-Inclusion Approach (Phase 2)- Stakeholders Survey Questionnaires

* Required

Contact Information

Name *

Your answer

Email *

Your answer

Designation/Position

Your answer

Institution/Company

Your answer

Address

Your answer

Contact No

Your answer

Developing A Post Occupancy Evaluation Model for Neighborhood Assessment Towards Sustainable Development

Kuala Lumpur as the capital city of Malaysia located in the Klang Valley. It is largest city in Malaysia and one of the fastest growing cities in South East Asia. As the capital and commercial heart of the country, the Greater Kuala Lumpur (KL)/Klang Valley represents a crucial component in the plan to transform Malaysia into a high-income nation by 2020. The overall aim is to transform the region into a world-class metropolis that will boast top standards in every area from business infrastructure to livability. This has led to a more proper township and neighborhood planning and development towards the country aspirations. Sustainable Development is a way to developed forward and more new development especially in the Klang Valley has adopted this approached.
The contribution of this research to examine GBI Green Township Assessment Criteria and one (1) certified GBI neighborhood project in Malaysia based on a proposed model of a holistic sustainable pillar dimensions as seen below in Figure 1. The focus on GBI Green Township Assessment Criteria is the six (6) core criteria, which comprise of Climate, Energy and Water (CEW); Ecology & Environment (EEC); Community Planning & Design (CPD); Transportation & Connectivity (TRC); Building & Resources (BDR) and Business & Innovation (BSI) (GBI, 2010). The certified GBI neighborhood project is a completed project and was in operation or occupied within or more than one (1) year. Data will be collected through thorough literature studies, expert focus group discussion and interviews, stakeholder survey and on-site household surveys. Data from focus group discussion/interview, stakeholder survey and household survey will be analyzed using stakeholder-inclusion approach. The Post Occupancy Evaluation (POE) Model will be tested on-site household surveys at selected GBI neighborhood project to measure the sustainability level and appraise the workability.

Table for GBI Township Core & Sub Criteria

Below is the core criteria and sub-criteria table excerpted from GBI Malaysia Township Tools. The tools is used to rate green township/neighborhood development in Malaysia. For the purpose of this survey only the table below was uploaded, for further reference the full version of the tools with detail descriptions can be accessed at: http://new.greenbuildingindex.org/Files/Resources/GBI%20Tools/GBI%20Township%20Tool%20V1.01.pdf

GBI Township Tools core criteria & sub-criteria. Source GBI Malaysia

Expert opinions on sustainable pillar dimensions adaptation againts sustainable township/neighborhood assessment criteria

Kindly indicate the level of sustainable pillar dimensions adaptation in the GBI Green Township Assessment Core Criteria 1: Climate, Energy and Water (CEW)

1.1 Heat Island Design Principles - 4 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

1.2 Efficient Streetscape & GreenspaceLighting - 2 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

1.3 On Site Energy Generation - 2 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

1.4 Renewable Energy - 4 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

1.5 Reduction in Waste Water - 4 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

1.6 Reduced Water Use - 4 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

Expert opinions on sustainable pillar dimensions adaptation againts sustainable township/neighborhood assessment criteria

Kindly indicate the level of sustainable pillar dimensions adaptation in the GBI Green Township Assessment Core Criteria 2: Ecology & Environment (EEC):

2.1 Biodiversity Reserve - 2 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

2.2 Land Reuse - 1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

2.3 Ecology -3 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

2.4 Flood Management & Avoidance -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

2.5 Wetland & Water Body Conservation -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

2.6 Agricultural Land Preserve -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

2.7 Sustainable StormwaterDesign & Management -2 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

2.8 Proximity to Existing Infrastructure Services -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

2.9 Services Infrastructure Provision -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

2.10 Light Pollution -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

Expert opinions on sustainable pillar dimensions adaptation againts sustainable township/neighborhood assessment criteria

Kindly indicate the level of sustainable pillar dimensions adaptation in the GBI Green Township Assessment Core Criteria 3: Community Planning & Design (CPD):

3.1 Greenspaces -3 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

3.2 Compact Development -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

3.3 Amenities for Communities -3 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

3.4 Provision for Universal Accessibility -3 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

3.5 Secure Design -2 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

3.6 Health in Design -2 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

3.7 Recycling Facilities -2 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

3.8 Community Diversity -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

3.9 Affordable Housing -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

3.10 Community Thrust -4 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

3.11 Governance -4 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

Expert opinions on sustainable pillar dimensions adaptation againts sustainable township/neighborhood assessment criteria

Kindly indicate the level of sustainable pillar dimensions adaptation in the GBI Green Township Assessment Core Criteria 4 Transportation & Connectivity (TRC);

4.1 Green Transport Masterplan -8 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

4.2 Availability and Frequency of Public Transport -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

4.3 Facilities for Public Transportation -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

4.4 Pedestrian Networks -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

4.5 Cycling Networks -2 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

4.6 Alternative Transport Options -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

Expert opinions on sustainable pillar dimensions adaptation againts sustainable township/neighborhood assessment criteria

Kindly indicate the level of sustainable pillar dimensions adaptation in the GBI Green Township Assessment Core Criteria 5 Building & Resources (BDR);

5.1 Low Impact Material (Infrastructure) -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

5.2 Low Impact Material (Building & Structures) -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

5.3 Regional Material -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

5.4 Quality in Construction -2 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

5.5 Construction Waste Management – 1 Credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

5.6 Site Sedimentation and Pollution Control -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

5.7 Sustainable Construction Practice -2 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

5.8 GBI Certified Building -6 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

Expert opinions on sustainable pillar dimensions adaptation againts sustainable township/neighborhood assessment criteria

Kindly indicate the level of sustainable pillar dimensions adaptation in the GBI Green Township Assessment Core Criteria 6: Business & Innovation (BSI):

6.1 Business -3 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

6.2 Innovation -6 credits *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

6.3 GBI Facilitator -1 credit *

	very low	low	moderate	high	very high
Social Pillar	○	○	○	○	○
Environment Pillar	○	○	○	○	○
Economic Pillar	○	○	○	○	○

7. Further Comments, if any...

Your answer

Thank You ขอบคุณมากครับ

(TO ALL PARTICIPANTS)

For further analysis of the data available, I might require to visit you for additional information. This discussion will be structure before-hand to minimise the of discussion and to maintain standard format for the information required. Therefore, I hope you will be available to speak with me about your professional expertise briefly and confidentially.

To proceed with this, please let me know your contact details.

Your answer

Confidentiality

Thank you for your cooperation. All answers will be treated as confidential.
Your answers will be extremely valuable to my research on Developing A Post Occupancy Evaluation Model for Neighborhood Assessment Towards Sustainable Development.

Again, thank you very much for your cooperation.
ขอบคุณมากครับ

Rostam Yaman
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rostam@salam.uitm.edu.my
Mobile: +66883999117, +60129177029

SUBMIT

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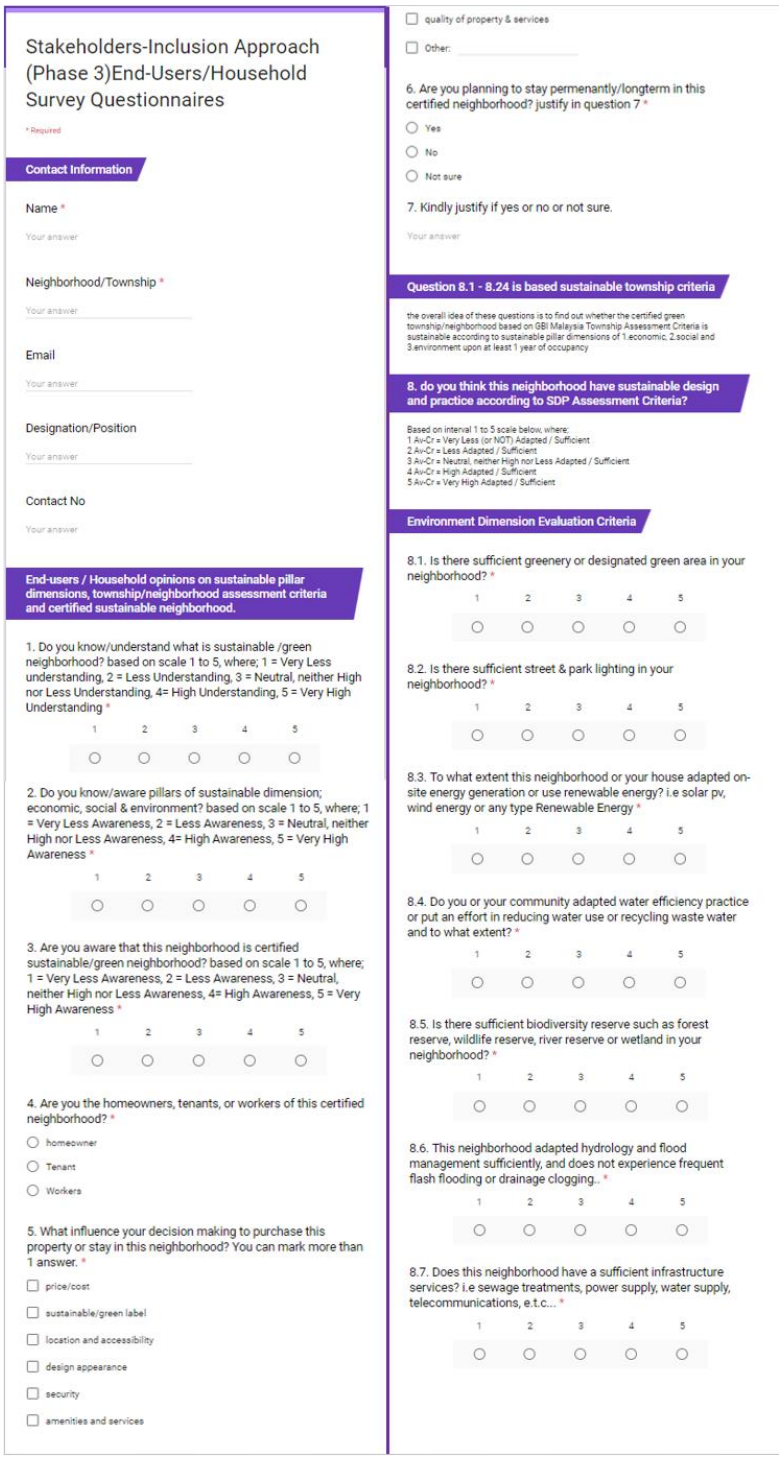
Appendix E – End-User/Household Survey Questionnaire (Phase 3)



Stakeholders-Inclusion Approach (Phase 3)End-Users/Household Survey Questionnaires

* Required

Contact Information

Name *

Your answer

Neighborhood/Township *

Your answer

Email

Your answer

Designation/Position

Your answer

Contact No

Your answer

End-users / Household opinions on sustainable pillar dimensions, township/neighborhood assessment criteria and certified sustainable neighborhood.

1. Do you know/understand what is sustainable /green neighborhood? based on scale 1 to 5, where; 1 = Very Less understanding, 2 = Less Understanding, 3 = Neutral, neither High nor Less Understanding, 4= High Understanding, 5 = Very High Understanding *

1 2 3 4 5

2. Do you know/aware pillars of sustainable dimension; economic, social & environment? based on scale 1 to 5, where; 1 = Very Less Awareness, 2 = Less Awareness, 3 = Neutral, neither High nor Less Awareness, 4= High Awareness, 5 = Very High Awareness *

1 2 3 4 5

3. Are you aware that this neighborhood is certified sustainable/green neighborhood? based on scale 1 to 5, where; 1 = Very Less Awareness, 2 = Less Awareness, 3 = Neutral, neither High nor Less Awareness, 4= High Awareness, 5 = Very High Awareness *

1 2 3 4 5

4. Are you the homeowners, tenants, or workers of this certified neighborhood? *

- homeowner
- Tenant
- Workers

5. What influence your decision making to purchase this property or stay in this neighborhood? You can mark more than 1 answer. *

- price/cost
- sustainable/green label
- location and accessibility
- design appearance
- security
- amenities and services
- quality of property & services
- Other:

6. Are you planning to stay permenantly/longterm in this certified neighborhood? justify in question 7 *

- Yes
- No
- Not sure

7. Kindly justify if yes or no or not sure.

Your answer

Question 8.1 - 8.24 is based sustainable township criteria

the overall idea of these questions is to find out whether the certified green township/neighborhood based on GBI Malaysia Township Assessment Criteria is sustainable according to sustainable pillar dimensions of 1.economic, 2.social and 3.environment upon at least 1 year of occupancy

8. do you think this neighborhood have sustainable design and practice according to SDP Assessment Criteria?

Based on interval 1 to 5 scale below, where;
1 Av-Cr = Very Less (or NOT) Adapted / Sufficient
2 Av-Cr = Less Adapted / Sufficient
3 Av-Cr = Neutral, neither High nor Less Adapted / Sufficient
4 Av-Cr = High Adapted / Sufficient
5 Av-Cr = Very High Adapted / Sufficient

Environment Dimension Evaluation Criteria

8.1. Is there sufficient greenery or designated green area in your neighborhood? *

1 2 3 4 5

8.2. Is there sufficient street & park lighting in your neighborhood? *

1 2 3 4 5

8.3. To what extent this neighborhood or your house adapted on-site energy generation or use renewable energy? i.e solar pv, wind energy or any type Renewable Energy *

1 2 3 4 5

8.4. Do you or your community adapted water efficiency practice or put an effort in reducing water use or recycling waste water and to what extent? *

1 2 3 4 5

8.5. Is there sufficient biodiversity reserve such as forest reserve, wildlife reserve, river reserve or wetland in your neighborhood? *

1 2 3 4 5

8.6. This neighborhood adapted hydrology and flood management sufficiently, and does not experience frequent flash flooding or drainage clogging.. *

1 2 3 4 5

8.7. Does this neighborhood have a sufficient infrastructure services? i.e sewage treatments, power supply, water supply, telecommunications, e.t.c... *

1 2 3 4 5

8.8. This neighborhood have sufficient and adapted pollution control, and it does not experience excessive light, noise or any form of pollution.. *

1 2 3 4 5

Social Dimension Evaluation Criteria

8.9. Does this neighborhood have sufficient common greenspaces? i.e playground, recreational lake, public park, community garden, e.t.c.. *

1 2 3 4 5

8.10. Do you think this neighborhood is highly dense populated or over developed? *

1 2 3 4 5

8.11. Does this neighborhood have sufficient universal accessibility or handicapped friendly *

1 2 3 4 5

8.12. Do you think this neighborhood is sufficiently secured? i.e crime free, no disturbance, well lighted...? *

1 2 3 4 5

8.13. Does this neighborhood concerns itself with public health planning and design sufficiently ? i.e free from dengue fever cases or other waterborne diseases, industrial pollution, waste discharge, e.t.c...? *

1 2 3 4 5

8.14. Does this neighborhood have sufficient recycling facilities and adapted waste separation practice? *

1 2 3 4 5

8.15. Is this neighborhood's community diversified in term of mixed income groups or backgrounds? *

1 2 3 4 5

8.16. Does this neighborhood have a good community participation and maintenance in sustainable practice? i.e active dialogue with developers, existing community within vicinity, e.t.c.. *

1 2 3 4 5

Economic Dimension Evaluation Criteria

8.17. Does commercial facilities and public amenities for community within your walking distance? i.e shop area, community centre, place of worship, groceries, eateries, e.t.c.... *

1 2 3 4 5

8.18. If you are not using your private transport to commute, is the public transports system sufficient, reliable and convenient in this neighborhood? *

1 2 3 4 5

8.19. Does this neighborhood have a sufficient pedestrian and cycling network? *

1 2 3 4 5

8.20. Do you think the materials used in building and infrastructures in this neighborhood is sufficiently low impact (green or sustainable) and available locally? based on your opinion or as explained by the developers. *

1 2 3 4 5

8.21. Does the quality of property/premises in this neighborhood promote sufficient or adapted sustainable construction? based on your opinion or as explained by the developers. *

1 2 3 4 5

8.22. This neighborhood promote sufficient or adapted construction waste management. Kindly answer based on your experience on traces of construction waste, sedimentation or any kind of debris when you move into this neighborhood. *

1 2 3 4 5

8.23. Does this neighborhood have a proper and sufficient commercial area? i.e shops, banks, leisure & entertainment, e.t.c.. *

1 2 3 4 5

8.24. As part of community in this neighborhood, do you find this neighborhood development is sufficiently innovative in adapting sustainable development? i.e, economic, social and environmentally? *

1 2 3 4 5

9. Further Comments

9.1. based on all the questions above, do you have any further comments that you think is useful for this study? kindly comment below

Your answer

Thank You ขอบคุณมากครับ

(TO ALL PARTICIPANTS)

For further analysis of the data available, I might require to visit you for additional information. This discussion will be structure before-hand to minimize the of discussion and to maintain standard format for the information required. Therefore, I hope you will be available to speak with me about your opinion living in this neighborhood briefly and confidentially.

to proceed with this, let me know you contact details

Your answer

Confidentiality

Thank you for your cooperation. All answers will be treated as confidential.
Your answers will be extremely valuable to my research on Developing A Post Occupancy Evaluation Model for Neighborhood Assessment Towards Sustainable Development.

Again, thank you very much for your cooperation.
ขอบคุณมากครับ

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Appendix F – Experts POEM Semi-structure Interview & Survey Questionnaire

Stakeholders-Inclusion Approach (Validation) - POEM Experts Structured Interview Questionnaires

* Required

Invitation Letter

DATE: 6th June 2016

สวัสดี คร้บ,
To Whom It May Concern:

INVITATION TO PARTICIPATE IN THE STAKEHOLDER-INCLUSION APPROACH QUESTIONNAIRE

Dear Participant,

I am a PhD student at Environment Development & Sustainability Program, Graduate School, Chulalongkorn University in Thailand. As a partial fulfillment of my Degree, I am undertaking a research that aims to examine the certified sustainable neighborhood assessment criteria in the Klang Valley based on a proposed model of a holistic sustainable pillar dimensions. This framework has been designed based on two main bases. Firstly, the scientific research and knowledge, which include the academic research papers and reports. Secondly, based on the strengths of the existing tools/frameworks of GBI Green Township Tools (Version 1.01).

This research focuses primarily on the evaluation of this proposed model in order to ensure that it is acceptable, reliable and valid. This process will be done through the use of one of the most valuable techniques to evaluate the model, which is the Stakeholders-Inclusion Approach. It will be used to obtain the views of experts and end-users regarding the proposed model in terms of the dimensions, categories and criteria and will involve two rounds of questionnaires.

Your contribution to this research is very significant to the success of this research work. Therefore, I would be grateful if you accept this invitation to participate in this study. Reading and answering the questionnaire will take approximately 30 minutes, and I am looking forward for your participation. All information submitted from the participants will be used for research purposes only and will be treated and analyzed confidentially. Only statistical summary and summarized information will be reported or published. Please do not hesitate to contact me for any further questions.

Sincerely,
Rostam Yaman
PhD Candidate
EDS, Chulalongkorn University
Bangkok
Thailand
E-mail: rostamyaman1@yahoo.co.uk
rostam@siswa.ukm.edu.my
Mobile: +66883999117, +60129177029

Chulalongkorn University Research Undertaking Letter

Environment, Development and Sustainability Program
Graduate School, Chulalongkorn University
254 Phayathai Road Pathumwan Bangkok 10330 Thailand
Tel./fax : +66(0)-2-218-8195 E-mail : sds@chula.ac.th

Ref. No. EDS./TP/2016

13 May 2016

To whom it may concern

I would like to introduce my student, Mr. Rostam Yaman, Ph.D. candidate of Environment, Development and Sustainability Program (EDS) of Chulalongkorn University.

Mr. Rostam wishes to collect data by using questionnaire for her doctoral research. Her research topic is "Developing A Post Occupancy Evaluation Model For Neighborhood Assessment Towards Sustainable Urban Development in Malaysia". The main research objectives are to identify and formulate post-occupancy evaluation modelled based on sustainable pillars towards sustainable neighborhood development and to implement post-occupancy evaluation model in assessing & evaluate GBI certified neighborhood towards sustainable urban development for Malaysia.

Mr. Rostam will comply with research ethics strictly, and will treat the information obtained from the questionnaire with sensitivity.

I will be grateful if you could receive his questionnaire.

Sincerely yours,

Assoc. Prof. Dr. Vilaiwan Kalaignanam
Program Director

Contact Information

Name *

Your answer

Email *

Your answer

Designation/Position

Your answer

Institution/Company

Your answer

Address

Your answer

Contact No.

Your answer

Developing A Post Occupancy Evaluation Model for Neighborhood Assessment Towards Sustainable Development

Scope of Study

Kuala Lumpur as the capital city of Malaysia located in the Klang Valley. It is largest city in Malaysia and one of the fastest growing cities in South East Asia. As the capital and commercial heart of the country, the Greater Kuala Lumpur (KL)/Klang Valley represents a crucial component in the plan to transform Malaysia into a high-income nation by 2020. The overall aim is to transform the region into a worldclass metropolis that will boast top standards in every area from business infrastructure to livability. This has led to a more proper township and neighborhood planning and development towards the country aspirations. Sustainable Development is a way to developed forward and more new development especially in the Klang Valley has adopted this approached.The contribution of this research to examine GBI Green Township Assessment Criteria and one (1) certified GBI neighborhood project in Malaysia based on a proposed model of a holistic sustainable pillar dimensions as seen below in Figure 1. The focus on GBI Green Township Assessment Criteria is the six (6) core criteria, which comprise of Climate, Energy and Water (CEW); Ecology & Environment (EEC); Community Planning & Design (CPD); Transportation & Connectivity (TRC); Building & Resources (BDR) and Business & Innovation (BSI) (GBI, 2010). The certified GBI neighborhood project is a completed project and was in operation or occupied within or more than one (1) year. Data will be collected through thorough literature studies, expert focus group discussion and interviews, stakeholder survey and on-site household surveys. Data collected from literature studies will be analyzed using comparative analysis method; data from focus group discussion/interview and data from stakeholder survey will be analyzed using stakeholder-inclusion approach. The Post Occupancy Evaluation (POE) Model will be tested on-site household surveys at selected GBI neighborhood project to measure the sustainability level and appraise the workability.

Proposed POEM Model for Sustainable Neighborhood Development

The fundamentals of this post occupancy evaluation model (POEM) derived from sustainable township/neighborhood assessment core criteria againts three pillars of sustainable dimensions; Social, Economic and Environment. The overall idea is to identify the adaptation of these sustainable pillars dimension on sustainable township/neighborhood core assessment criteria and induced these sustainable pillar dimensions in achieving a well balance and holistic POEM. This proposed model can be seen in the figure 1 which consist the core assessment criteria, sustainable pillar dimensions and loading factors.

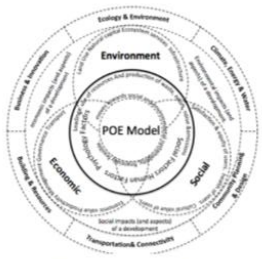
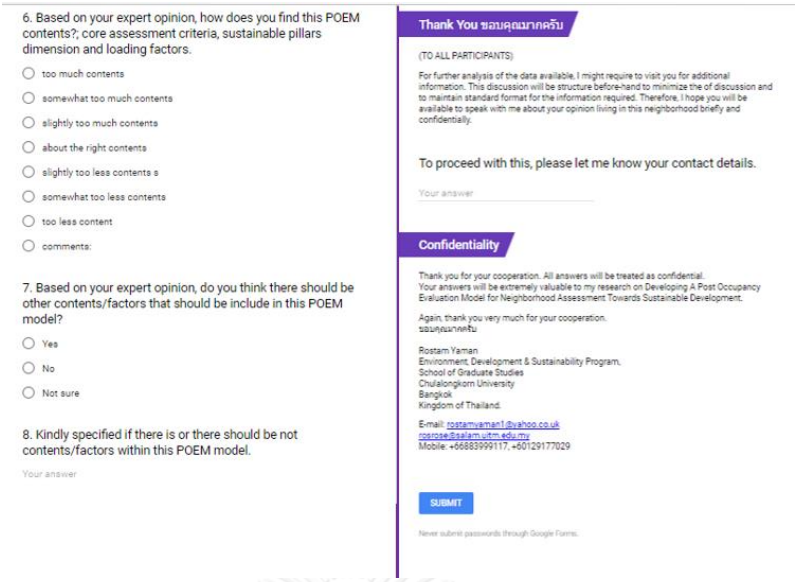


Figure 1: Conceptual Framework of POEM model

5. to what extent do you find (agree/disagree) with the contents of this proposed POEM?

- extremely agree
- moderately agree
- slightly agree
- neither agree nor disagree
- slightly disagree
- moderately disagree
- extremely disagree



6. Based on your expert opinion, how does you find this POEM contents?; core assessment criteria, sustainable pillars dimension and loading factors.

- too much contents
- somewhat too much contents
- slightly too much contents
- about the right contents
- slightly too less contents s
- somewhat too less contents
- too less content
- comments:

7. Based on your expert opinion, do you think there should be other contents/factors that should be include in this POEM model?

- Yes
- No
- Not sure

8. Kindly specified if there is or there should be not contents/factors within this POEM model.

Your answer

Thank You ขอบคุณมากครับ

(TO ALL PARTICIPANTS)

For further analysis of the data available, I might require to visit you for additional information. This discussion will be structure before-hand to minimize the of discussion and to maintain standard format for the information required. Therefore, I hope you will be available to speak with me about your opinion living in this neighborhood briefly and confidentially.

To proceed with this, please let me know your contact details.

Your answer

Confidentiality

Thank you for your cooperation. All answers will be treated as confidential.
Your answers will be extremely valuable to my research on Developing A Post Occupancy Evaluation Model for Neighborhood Assessment Towards Sustainable Development.

Again, thank you very much for your cooperation.
ขอบคุณมากครับ

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Appendix G – POEM Handbook for SND (Copyright by the Author)

Sustainable Neighborhood Development.

POEM ASSESSMENT CRITERIA
FOR
CERTIFIED GREEN NEIGHBORHOOD

POEM Handbook

Version 1 | 2017

POEM Handbook

Stakeholders-Inclusion Approach

End-Users/Households Surveys

Post Occupancy Evaluation Model for Certified Green Neighborhood
Sustainable Neighborhood Development. EDS-CU
Version 1 | 2017

Contents

STAKEHOLDERS-INCLUSION APPRAOCH FOR SUSTAINABLE NEIGHBORHOOD DEVELOPMENT

The Current Scenario

The world is experiencing the largest wave of urban growth in history and this process is mainly a domain of developing countries. According to the UN reports (Kraas 2007), in the year 2015 more than 600 million people will be living in about 60 mega-cities worldwide. The need for sustainable neighborhood as a center of sustainable development and economy is vital. The mainstream of sustainable development was progressively developed through the World Conservation Strategy (1980), the Brundtland Report (1987), and the UN Conference on Environment and Development in Rio (1992), and this sustainable development agenda keep on developing till today (Hessle, 2016; Røe, 2016; Kharas et. al., 2015). The aim of the World Conservation Strategy is to achieve sustainable development through the conservation of living resources and provide policy guidance on how sustainable development can be carried out (IUCN 1980).

The Issues; Drivers for POEM Evaluation

Sustainable rating system in Malaysian urban development is still new. Even though Green Building Index (GBI) Township Assessment Criteria has been developed and implemented but there is no post-occupancy evaluation being conducted in assessing the performance, effectiveness and sustainability on the certified development? There has been no study done to measure the greenness'' of the tools and the post certified neighborhood development. Do green neighborhood frameworks in general fully represent sustainability? (Sullivan, Rydin et al. 2014). Thus, embark the problem of the research: **'whether the certified green neighboorhood developement and it's urban neighborhood assessment criteria fulfilled the effectiveness and sustainability concept according to sustainability dimension pillars'.**

What is Sustainable Neighborhood Development?

Neighborhoods are the part areas and systems of cities, which made up by their own architectural, cultural and economic (Varga and Vercseg 1992). The concept of 'Sustainable Neighborhood' are livable places that meet the diverse needs of the community, both now and in the future (Poston, Emmanuel et al. , GBI 2010). The neighborhood is organized to be self-governing. A formal association debates and decides matters of maintenance, security and physical change.

Post Occupancy Evaluation Model (POEM)

Post-Occupancy Evaluation Model (POEM) is a structured review of the functional, operational and strategic performance of the built/development during/upon occupation (Galvin, 2012). POEM model will assess and evaluate the core criterias in green township assessment criterias. The aim of this POEM evaluation is to assess and gauge GBI Neighborhood Assessment Criteria and certified neighborhood developemnt in Malaysia. Even though at this study level this POEM is targeted at Certified Urban Neighborhood project by private developers, it is highly hoped that it will be path the way as a model guidelines for any type of urban neighborhood developments especially government initiated development project.

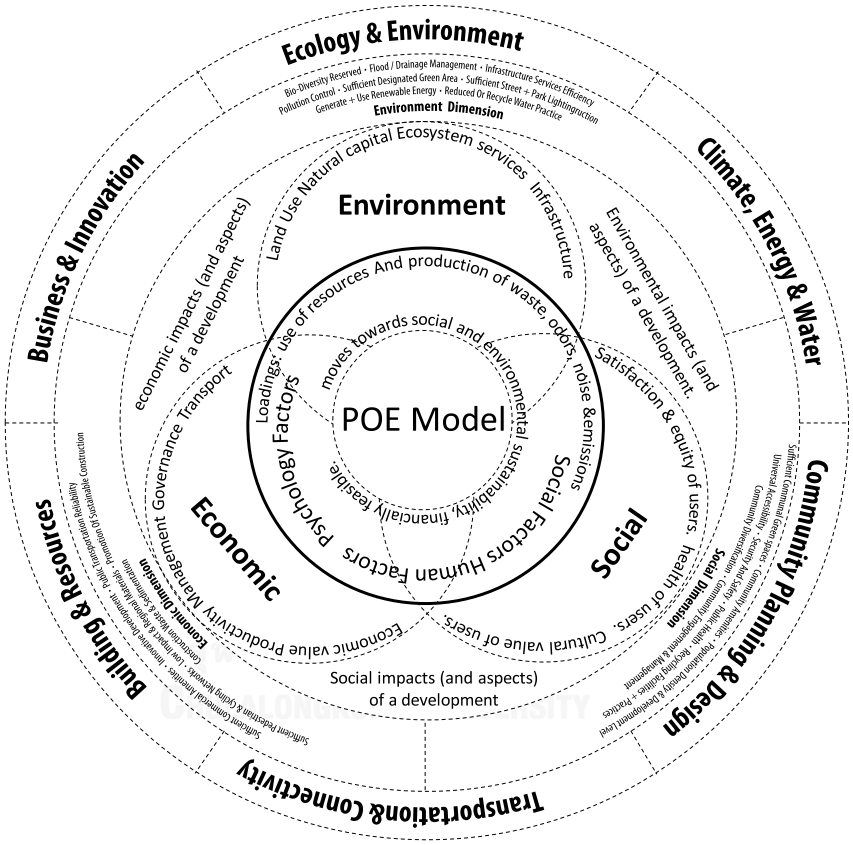

Figure 1 –Conceptual POEM for Sustainable Neighborhood Development

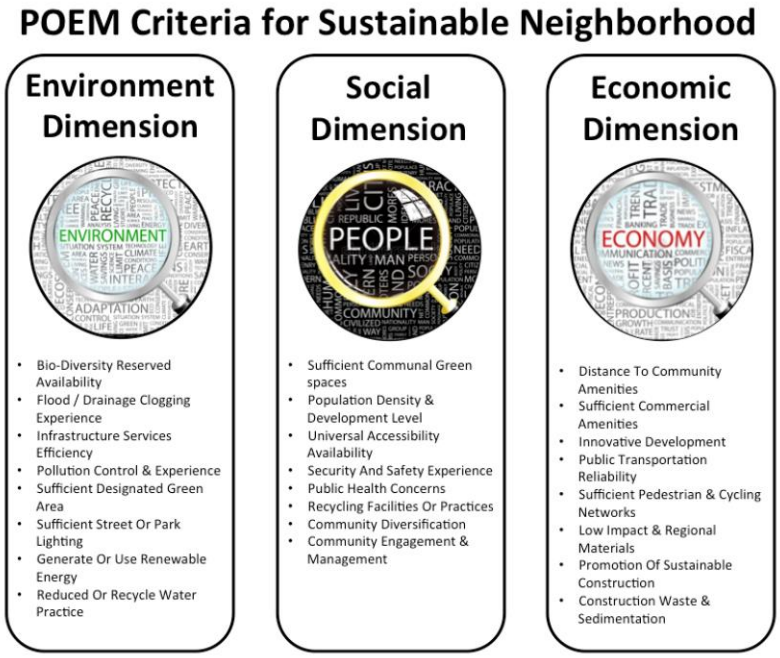

Figure 2 –POEM evaluation criteria for Sustainable Neighborhood Development

POEM HANDBOOK FOR SUSTAINABLE NEIGHBORHOOD DEVELOPMENT

Introduction

This POEM Handbook for Sustainable Neighborhood Development outlines the purpose and process of the Post Occupancy Evaluation Model (POEM) for Sustainable Neighborhood Development (SND) from the perspective of an end-users/households undertaking the POEM evaluation process.

Purpose

The POEM Evaluation methodology was developed to find out end-user/household sustainable evaluation of SND and its criteria that take place at least a minimum one years after the occupation of the neighborhood. The POEM Evaluation methodology supports the GBI Green Township Assessment Criteria – (GBI Township Tool v1, 2011), which is widely used pre-occupancy green township assessment criteria in Malaysia.

The purpose of a POEM Evaluation is to:
1. Review actual/assessed certified neighborhood outcomes against vision outcomes;
2. Disseminate awareness to end-users/households;
3. Inform future review decisions/actions.

POEM Evaluation is not intended to be a certification compliance procedure. The methodology outlined in the POEM Evaluation Guideline was developed as a systematic approach to compare certified neighborhood outcomes against vision outcomes. The application of POEM evaluation process may improve the assessment and certification of future sustainable neighborhood development projects. The POEM evaluation, for example, when looking at social dimension issues such as functional relationships between the developers and homeowners, always does so in relation to the contribution the neighborhood planning and community activities make to the goals of the sustainable neighborhood i.e. the support of community thrust activities.

The ‘evaluator’ implementing a POEM evaluation process collects and analyze neighborhood end-users’/households’ opinions and perceptions, into study recommendations for future improvement of green neighborhood assessment criteria and certification procedures. Quantitative data is required to evaluate end-users/households opinions towards the occupied certified green neighborhood. Qualitative data is needed to understand the nature and circumstances of the anticipated and attained outcomes. The POEM evaluation is used to evaluate the sustainable level outcomes upon occupancy based on sustainable dimension pillars (SDP) adaptations on certification assessment criteria of SND.

POEM Evaluation Information

The conceptual of the POEM (Figure 1) evaluation process derived from the green township assessment core-criteria outlined in GBI Green Township Tools V1, 2011. This model signifies the contents and required key information for the development of a POEM. The assessment core criteria and sub criteria is simplified and summarized in order to adept end-users/households comprehension on POEM evaluation criteria (Table 1). The process is to find out the sustainability level of certified green neighborhood range criteria scores and award category compared to the actual end-users'/households' opinions and perceptions. This outcome is the fundamental of the POEM evaluation process.

There are five phases in completing a POEM Evaluation as shown in the diagram below;

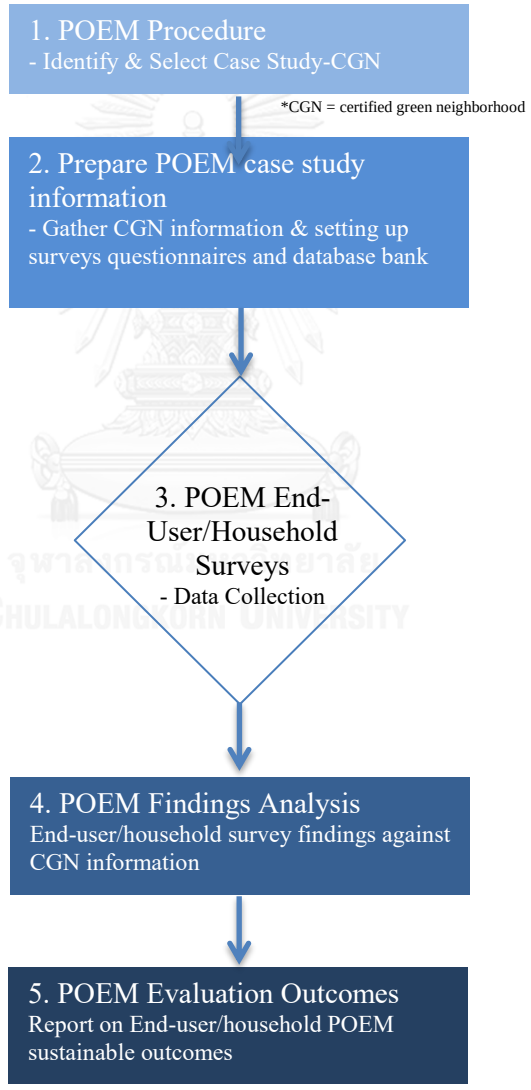

Diagram 1 – Phases of POEM Evaluation Processes

Table 1 –POEM Evaluation towards Neighborhood Assessment Criteria

POEM End-Users/Households Evaluation Criteria				
Item	**Criteria**	**Description**	**Score**	**Total**
Environment Dimension Pillar				40
1	EnP Q1	Sufficient Designated Green Area	1-5	
2	EnP Q2	Sufficient Street Or Park Lighting	1-5	
3	EnP Q3	Generate Or Use Renewable Energy	1-5	
4	EnP Q4	Reduced Or Recycle Water Practice	1-5	
5	EnP Q5	Bio-Diversity Reserved Availability	1-5	
6	EnP Q6	Flood / Drainage Clogging Experience	1-5	
7	EnP Q7	Infrastructure Services Efficiency	1-5	
8	EnP Q8	Pollution Control & Experience	1-5	
Social Dimension Pillar				40
1	SoP Q1	Sufficient Communal Greenspaces	1-5	
2	SoP Q2	Population Density & Development Level	1-5	
3	SoP Q3	Universal Accessibility Availability	1-5	
4	SoP Q4	Security And Safety Experience	1-5	
5	SoP Q5	Public Health Concerns	1-5	
6	SoP Q6	Recycling Facilities Or Practices	1-5	
7	SoP Q7	Community Diversification	1-5	
8	SoP Q8	Community Engagement & Management	1-5	
Economic Dimension Pillar				40
1	EcP Q1	Distance To Community Amenities	1-5	
2	EcP Q2	Public Transport Reliability	1-5	
3	EcP Q3	Sufficient Pedestrian & Cycling Networks	1-5	
4	EcP Q4	Low Impact & Regional Materials	1-5	
5	EcP Q5	Promotion Of Sustainable Construction	1-5	
6	EcP Q6	Construction Waste & Sedimentation	1-5	
7	EcP Q7	Sufficient Commercial Amenities	1-5	
8	EcP Q8	Innovative Development	1-5	
TOTAL POINTS				**120**

Table 2 –POEM Evaluation Classification Ratings

Total Score	**Ratings**	**Descriptions**
86 to 100 TD-CA	Platinum	Beyond outstanding criteria ratings of POEM for Sustainable Neighborhood
76 to 85 TD-CA	Gold	Outstanding criteria ratings of POEM for Sustainable Neighborhood
66 to 75 TD-CA	Silver	Good criteria ratings POEM for Sustainable Neighborhood
50 to 65 TD-CA	Certified	Fulfilled minimum criteria of POEM for Sustainable Neighborhood
Below 50 TD-CA	-	Failed to fulfilled minimum criteria of POEM for Sustainable Neighborhood

How to use this handbook

The intent of this handbook is to assess certified green neighborhood development and implementation of post occupancy evaluation model (POEM) evaluation process designed specifically to find out the outcomes based on end-users'/households' opinions and perceptions. It is written from 'evaluator' perspectives conducting this POEM Evaluation process.

POEM Scored Credits

The methods for computing the scored credits and POEM total rating are based on the steps below. These can be summarized in the following points:

- The available credits for each dimension will be calculated based on the number of criteria that have been achieved in accordance with the scoring nominated by end-users/household post-occupancy experience.
- For each POEM SDP dimension the total score achieved be added together to give the overall score achieved in the dimension.
- The method of calculating the individual respondents dimension score achieved is by dividing the total scored credits by the total credits available multiplied by the weighting, as shown by the following equation:

$$\frac{Sc\_CR}{Av\_CR} \times W\ (100\%) = D\_SA$$

Sc_CR: Individual Scored Credits
Av_Cr: Available Credits
W: Weighting
D_SA: Dimension Scored Achieved

- To summarized up the total respondents dimension score achieved (tD_SA) is by the summation of total respondents dimension score credits (tSc_CR) divide the total sampling (N), as shown by the following equation:

$$\frac{tSc\_CR}{N} = tD\_SA$$

tSc_CR: total respondents Scored Credits
N: total respondents
tD_SA: total Dimension Scored Achieved

- Lastly, the total Dimensions Scored Achieved are compared with the POEM Benchmarks Rating which was previously illustrated in Table 2 To determine the

POEM Evaluation Classification Rating, Table 3 is a shown example of how the total respondents Dimensions Scored Achieved is calculated.

Table 3: Example of POEM Scoring Calculation Master Sheet.

Q_No	Criteria Coding	POEM Evaluation Criteria	Available Credits	Scored Credits
Environment Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EnP Q1	Sufficient Designated Green Area	1-5(n)	3
2	EnP Q2	Sufficient Street Or Park Lighting	1-5(n)	3
3	EnP Q3	Generate Or Use Renewable Energy	1-5(n)	3
4	EnP Q4	Reduced Or Recycle Water Practice	1-5(n)	3
5	EnP Q5	Bio-Diversity Reserved Availability	1-5(n)	3
6	EnP Q6	Flood / Drainage Clogging Experience	1-5(n)	3
7	EnP Q7	Infrastructure Services Efficiency	1-5(n)	3
8	EnP Q8	Pollution Control & Experience	1-5(n)	3
		Dimension Av-Cr / Sc-Cr	40(n)	24
Social Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	SoP Q1	Sufficient Communal Greenspaces	1-5(n)	3
2	SoP Q2	Population Density & Development Level	1-5(n)	3
3	SoP Q3	Universal Accessibility Availability	1-5(n)	3
4	SoP Q4	Security And Safety Experience	1-5(n)	3
5	SoP Q5	Public Health Concerns	1-5(n)	3
6	SoP Q6	Recycling Facilities Or Practices	1-5(n)	3
7	SoP Q7	Community Diversification	1-5(n)	3
8	SoP Q8	Community Engagement & Management	1-5(n)	3
		Dimension Av-Cr / Sc-Cr	40(n)	24
Economic Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EcP Q1	Distance To Community Amenities	1-5(n)	3
2	EcP Q2	Public Transport Reliability	1-5(n)	3
3	EcP Q3	Sufficient Pedestrian & Cycling Networks	1-5(n)	3
4	EcP Q4	Low Impact & Regional Materials	1-5(n)	3
5	EcP Q5	Promotion Of Sustainable Construction	1-5(n)	3
6	EcP Q6	Construction Waste & Sedimentation	1-5(n)	3
7	EcP Q7	Sufficient Commercial Amenities	1-5(n)	3
8	EcP Q8	Innovative Development	1-5(n)	3
		Dimension Av-Cr / Sc-Cr	40(n)	24
		Total Dimension Av-Cr / Sc-Cr	120(n)	72
		Sc-Cr (72) / Av-Cr (120) x Weighting (100%)		60%
		Dimension Scored Achieved		**60**

In order to find out the achievement level of post-occupancy evaluation based on end-users/households compared to pre-occupancy certification status of the sustainable neighborhood, this study used a five-point measures scale system for awarding the scored achieved. This five-point scaling system is measured as follows:

1 Av-Cr = Very Less Adapted / Sufficient
2 Av-Cr = Less Adapted / Sufficient
3 Av-Cr = Neutral, neither High nor Less Adapted / Sufficient
4 Av-Cr = High Adapted / Sufficient
5 Av-Cr = Very High Adapted / Sufficient

POEM EVALUATION PROCESS

1. Identify and Select Case Study

To begin Stakeholders-Inclusion Approach of POEM evaluation, the evaluator needs to identify potential green neighborhood for the case study. The potential green neighborhood for the case study should be certified by any green neighborhood or township assessment criteria tools whether by government agency or third party institution. For the case in Malaysia, the commonly used green neighborhood or township assessment criteria is GBI Township Assessment Criteria by GBI (Malaysia) Sdn. Bhd., other assessment criteria is Low Carbon Cities Framework and Assessment System by Ministry of Energy, Green Technology and Water Malaysia (KETTHA).

To select the case study, evaluator should consider the selection of the case study based on evaluation-focused scope as listed below;

- The evaluation will focus on neighborhood assessment criteria and certified urban green neighborhood project in Malaysia
- The focus on green neighborhood assessment criteria is normally the six (6) green core criteria, which comprise of Climate, Energy and Water ; Ecology & Environment; Community Planning & Design; Transportation & Connectivity; Building & Resources; and Business & Innovation (GBI, 2010).
- The certified green neighborhood project is an indexed and certified project, which under green rating or classification, for example; Platinum, Gold, Silver or Certified Award (GBI, 2010).
- The certified green neighborhood development project is in operation or occupied within or more than one (1) year.

Upon the identification and selection of the certified green neighborhood (CGN), evaluator justifies the criteria for selection.

2. Prepare POEM Case Study Information

Gathering Certified Neighborhood Information

The second process in Stakeholders-Inclusion Approach of POEM evaluation is gather information of selected case study. All related information to selected case study particularly on the certification of green neighborhood is important as it will become the baseline comparison for the POEM end-users'/households' evaluation criteria findings outcome.

The required information of the selected case study is as listed below;

- Neighborhood Title and Address
- Neighborhood Description which summarize the general information especially

description related to green features and facilities.

- Contact Person details for evaluation process follow up
- List of Professional Consultants involved in the development such as urban planners, architects, designers, landscape architects, engineers and other specialist such as EIA Consultant, Biodiversity Consultant, Horticulturalist and etc..
- Local Approving Authority that approved and issued development order of the selected green neighborhood project.
- Gross Development Area & Description which include percentage of different development category for example residential area, commercial area, industrial area, amenities and public facilities area, open greenspace and recreational area, utilities and infrastructure area and biodiversity reserved area.
- Certification Details, which describe the certification, body, certification category awards or rating scores, certification date and validity if available.

The information on award category or the ranging score by those selected case study-certified green neighborhood will be considered as a baseline comparison that will enable the conclusion of POEM Evaluation outcomes

Setting Up Survey Questionnaires & Database Bank

Next stages in Process 2 are to prepare the Stakeholders-Inclusion Approach End-Users/Households Surveys questionnaires and database bank. It is highly advisable for Evaluators'' to set up surveys questionnaires and database bank using online application such as Google Docs (available free online) or using other applications for data safe keeping and easy data tracking. Evaluators can set up the survey form and database bank as per attached template in this handbook Appendix 1: Stakeholders-Inclusion Approach End-User/Household Survey Form, or using online form available at:
https://docs.google.com/forms/d/1I8lWjU6fbvL3TNxHZJ1MOmopi99hK8I_6CtQt1BYAO4/edit
To set up the Google Docs account, the evaluators can follow step-by-step instruction from this link (Figure 3);
https://docs.google.com/document/u/0/

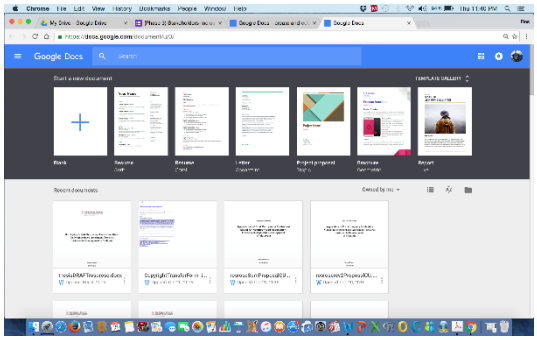

Figure 3 –Screen shot of setting up Google Docs

Once the account is set up, the evaluators are able to create the surveys form and have a safe database, which can be easily accessed from any devices. Below is the example of created survey form documents (Figure 4).

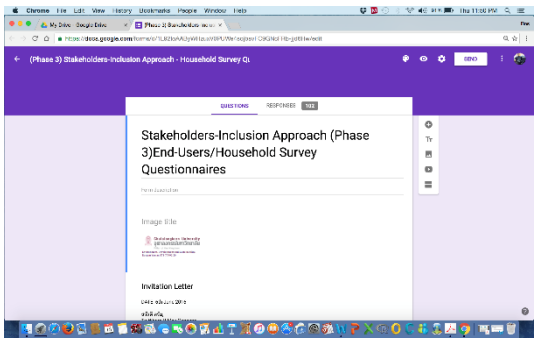

Figure 4 –Screen shot of surveys form

Upon respondents answer the surveys online or after the evaluators key in the face to face manual forms, Google Docs or similar online application will saved the data for easy tracking and extracting. Below is the example of respondent responses (Figure 5) and further comments (Figure 6) qualitative data.

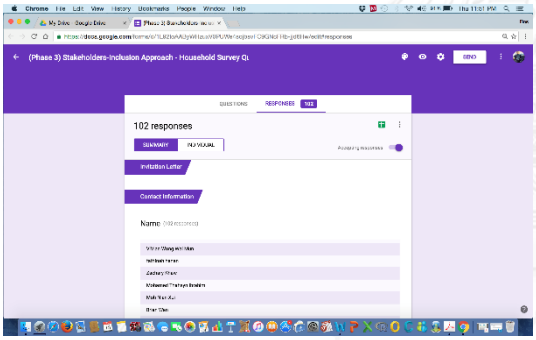

Figure 5 –Screen shot of survey responses

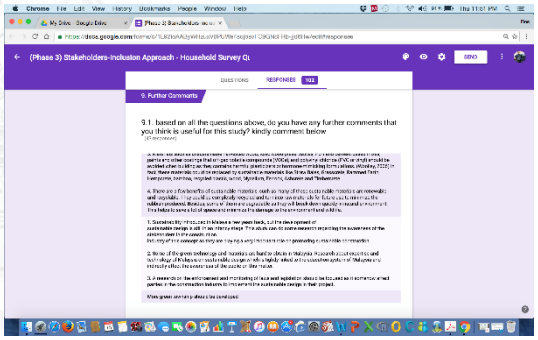

Figure 6 –Screen shot of further comment responses

3. POEM End-User/Household Surveys

The third process in Stakeholders-Inclusion Approach of POEM evaluation process is collect data from end-users/household of the selected certified green neighborhood. Below is the procedures definition and roles of POEM evaluation participants;

Evaluator

(Nominated Researcher/Consultant, CGN Service Officer, Resident's Representative)

- Acquire process and manage the conduct of POEM
- Collect data and information; - Database - types and format of data to be input, surveys, interviews and industry benchmarks
- Assess and analyze data gathered
- Assess survey's findings in terms of the process strategic goals including POEM evaluation

delivery objectives
• Write report.

Respondents

(End-Users/Households - includes homeowners, tenants and workers of CGN)
• Participate in completing the survey and other data collection exercises if necessary
• Report accurately on the findings (qualitative and quantitative based)
• Provide feedback and context for data provided and evidence derived.

Selecting Respondents

A POEM evaluation should be as broadly as possible. The nomination of evaluators and selection of respondents in this POEM evaluation will depend on the agreed intent and investigation level required for this exercise. CGN POEM evaluation focuses on sustainable neighborhood development evaluation, surveys should be conducted to equal numbers of homeowners, tenants and workers for a reliable outcomes. These participants will generally view the evaluation from different perspectives and these will vary from the view of a single respondents group. The number of respondents for study is varies and depending on the number of household units of the selected CGN.

Issues for consideration

Respondents should always be voluntary and with informed consent.
When selecting respondents for the evaluation, the following issues should be consider:
• Ability to understand and aware on sustainable green neighborhood or sustainable dimension pillar especially in supporting criteria of social, environment and economic amenities, facilities and practices.
• Experience and time spent living/working in the CGN being evaluated. New end-users/households may not have sufficient experience to provide surveys commentary.

In addition to the willingness and availability of the end-users/households to become the respondent of this exercise, the mutual understanding to undertake the POEM Evaluation procedure should clearly state the intent and scope of the POEM Evaluation. A clear statement of the POEM Evaluation objectives should be rendered and listed information that need to be gather as shown in Appendix 1: Stakeholders-Inclusion Approach End-User/Household Survey Form. There are two ways to collect the data; first using manual attached template in this handbook Appendix 1: Stakeholders-Inclusion Approach End-User/Household Survey Form, and secondly using online form available at: https://docs.google.com/forms/d/1I8lWjU6fbvL3TNxHZJ1MOmopi99hK8I_6CtQt1BYAO4/edit

POEM Evaluation Survey Components

The Stakeholders-Inclusion Approach POEM Evaluation Survey has been developed through

an Expert's Semi-Structured Interviews and Surveys; Professional Stakeholders Surveys and 3 selected CGN case study process and are based on the GBI Township Assessment Criteria Tools V1, 2011. The Survey template is included as Appendix 1: Stakeholders-Inclusion Approach End-User/Household Survey Form. The Survey consists of 3 parts:

Introduction

This contains an outline of the purpose, an introduction to the survey tasks, an Invitation Letter to Participate in this Stakeholders-Inclusion Approach Surveys which stated the aims, the focus, the required information and the methods of analysis of POEM Evaluation and a Research Undertaking Letter that clearly stated the researcher organization background, the purpose of conducting the research and for what outcome.

Part 1 - Respondent Background

This includes some basic information on Demographic data and contact information of the respondents. This shall include the information of respondents name, the certified neighborhood that been evaluated, designation of the respondents, and contact information such as email address and telephone number.

Scope of study

Scope of study nominated by the research organization that the evaluator should be report on. This will include the background introduction of the study, the operational definitions of the case study, the criteria of the evaluation process and the contributions of the evaluation.

Part 2 – End-Users/Households Role, Understanding & Awareness

End-users'/Households' role, understanding and awareness on sustainable dimension pillars, neighborhood assessment criteria and certified green neighborhood in general. The further information that should be gather include the end-users'/household' decision in purchasing or staying in the neighborhood, planned length of stay and justification on those decision.

Part 3 – End-Users/Households Evaluation Criteria Surveys

End-users'/Households' surveys questionnaires which to obtained their opinions on sustainable features, facilities and practices of occupied certified green neighborhood based on POEM Evaluation criteria as shown in Table 2.

4. POEM Evaluation Findings Analysis

The fourth process in Stakeholders-Inclusion Approach POEM evaluation is to analyze the gathered data and information. The evaluator will administer and manage the POEM Evaluation findings analysis. For manual face to face surveys, the evaluator will key in the data entry into database in Google Docs while for online form, the quantitative score percentage will be analyzed automatically by Google Docs.

For Part 1 – Respondents Background, evaluator can extract and list the respondents and contact information to be compiled in the POEM Evaluation Outcome Report.

Part 2 – End-Users/Households Role, Understanding & Awareness in on sustainable dimension pillars, neighborhood assessment criteria and certified green neighborhood in general. Evaluator can extract the findings from analyzed responses from the database bank (Google Docs or similar online application). The further information within Part 2 that evaluator gathered include the end-users'/household' decision in purchasing or staying in the neighborhood, planned length of stay and justification on those decision. All these analyzed data and information is to be compiled in the POEM Evaluation Report.

To calculate the quantitative data of POEM evaluation criteria scores, the evaluator will extract data findings in responses database bank in Google Docs or similar online application. In online database bank, the evaluator will create spreadsheet in order to get overall score from respondents (Figure 7). In Part 3 – End-Users/Households Evaluation Criteria Surveys question no 8.1 to question 8.24, the highest percentage of five linear scale opinion is converted to 1-5 POEM evaluation criteria as in Table 1. Once evaluator click the spreadsheet button, Google Docs will create and link to the spreadsheet (Figure 8). Below is the example of extracted percentage POEM evaluation criteria scoring from database bank analysis;

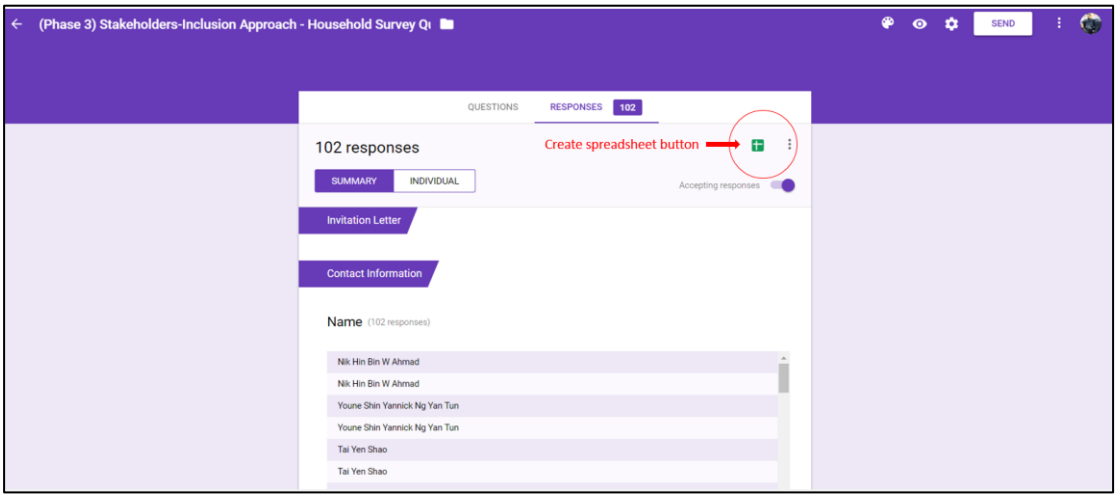

Figure 7 –Screen shot of example POEM criteria percentage scoring

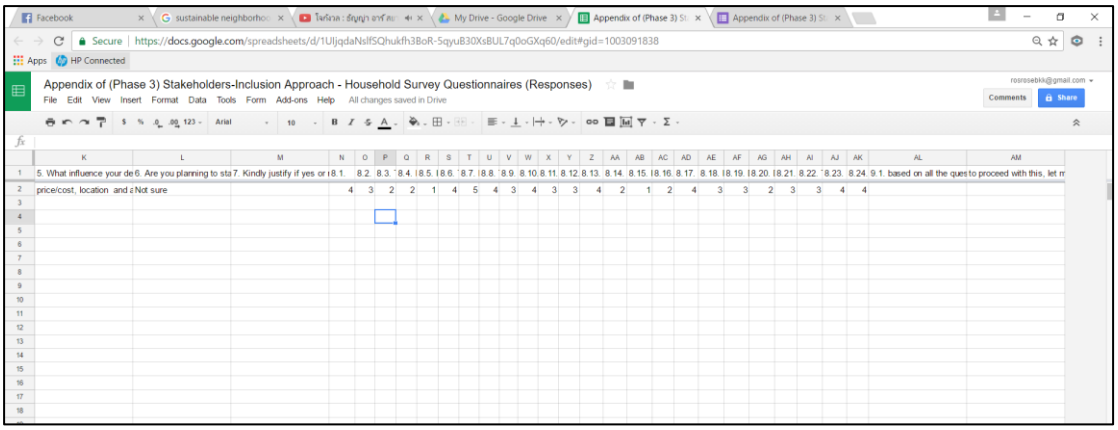

Figure 8 –Screen shot of created and linked spreadsheet by Google Docs.

Based on the example in given in Figure 8 from 1 respondents, the created spreadsheet for question 8.11-8.24 is then sum up and fill in into Table 3 of POEM Scoring Calculation Master Sheet (Table 3) below for POEM scoring calculations;

Table 3 –POEM Scoring Calculation Master Sheet

POEM Scoring Calculation Master Sheet.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Environment Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EnP Q1	Sufficient Designated Green Area	1-5(n)	4
2	EnP Q2	Sufficient Street Or Park Lighting	1-5(n)	3
3	EnP Q3	Generate Or Use Renewable Energy	1-5(n)	2
4	EnP Q4	Reduced Or Recycle Water Practice	1-5(n)	2
5	EnP Q5	Bio-Diversity Reserved Availability	1-5(n)	1
6	EnP Q6	Flood / Drainage Clogging Experience	1-5(n)	4
7	EnP Q7	Infrastructure Services Efficiency	1-5(n)	5
8	EnP Q8	Pollution Control & Experience	1-5(n)	4
		Dimension Av-Cr / Sc-Cr	40(n)	25
Social Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	SoP Q1	Sufficient Communal Greenspaces	1-5(n)	3
2	SoP Q2	Population Density & Development Level	1-5(n)	4
3	SoP Q3	Universal Accessibility Availability	1-5(n)	3
4	SoP Q4	Security And Safety Experience	1-5(n)	3
5	SoP Q5	Public Health Concerns	1-5(n)	4
6	SoP Q6	Recycling Facilities Or Practices	1-5(n)	2
7	SoP Q7	Community Diversification	1-5(n)	1
8	SoP Q8	Community Engagement & Management	1-5(n)	2
		Dimension Av-Cr / Sc-Cr	40(n)	22
Economic Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EcP Q1	Distance To Community Amenities	1-5(n)	4
2	EcP Q2	Public Transport Reliability	1-5(n)	3
3	EcP Q3	Sufficient Pedestrian & Cycling Networks	1-5(n)	3
4	EcP Q4	Low Impact & Regional Materials	1-5(n)	2
5	EcP Q5	Promotion Of Sustainable Construction	1-5(n)	3
6	EcP Q6	Construction Waste & Sedimentation	1-5(n)	3
7	EcP Q7	Sufficient Commercial Amenities	1-5(n)	4
8	EcP Q8	Innovative Development	1-5(n)	4
		Dimension Av-Cr / Sc-Cr	40(n)	26
		Total Dimension Av-Cr / Sc-Cr	120(n)	73
		Sc-Cr (72) / Av-Cr (120) x Weighting (100%)		60.8%
		Total Dimension Scored Achieved		**61**

Upon the completion of master sheet scoring calculation, the evaluator will do the POEM Evaluation Classification Ratings as shown in Table 2. This will be described and reported in POEM Evaluation Report whether the selected CGN and its urban neighborhood assessment criteria fulfilled the effectiveness and sustainability concept according to sustainability dimension pillars'.

For qualitative data in further comments questions of as Appendix 1: Stakeholders-Inclusion Approach End-User/Household Survey Form, the evaluator will extracts the gathered data and analyzed for comparisons and recommendations for POEM Evaluation Report.

5. POEM Evaluation Outcomes Report.

Standard Report Format

The POEM Evaluation Outcomes Report should reflect the study purpose, focus and scope outlined in survey documents.

Report Framework

Below is a standard POEM Evaluation Outcomes Report framework with brief comments outlining the required report contents.

1. Report Cover Page with mentioning selected CGN as case study, date and prepared by whom.
2. Table of Contents
3. Abstracts or Executive Summary
4. Introduction

   A. Purpose of the POEM evaluation - this should note the purpose of the study and the organization that commissioned the study.

   b. CGN Case Study Information - this should summarize the key CGN case study information for the sustainable neighborhood development that is related of the POEM evaluation. CGN case study information should also include in a standard format the summary of the neighborhood development implementation parameters including:

   - List of Professional Consultants involved in the development such as urban planners, architects, designers, landscape architects, engineers and other specialist such as EIA Consultant, Biodiversity Consultant, Horticulturalist and etc..
   - Local Approving Authority that approved and issued development order of the selected green neighborhood project.
   - Gross Development Area & Description which include percentage of different development category for example residential area, commercial area, industrial area, amenities and public facilities area, open greenspaces and recreational area, utilities and infrastructure area and biodiversity reserved area.
   - Certification Details, which describe the certification, body, certification category awards or rating scores, certification date and validity if available.
   - Any other project information relevant to the study and that is collected by the general information proforma.

   c. Participants in the Evaluation

   - List the POEM Evaluation evaluator's team members and their respective roles.
   - List of respondents

   d. Outline of the Methodology Used

   - Set out a summary of the site visits, questionnaires and interviews used to collect respondents feedback; documentation may be included in appendices to the report as required.

5. Data Collection and Analysis

   a. Instruments Used - comment on the data collection instruments used.

   b. Quantitative Data Analysis

- Completed quantitative data master sheet templates in hardcopy and softcopy.
- Conclusions obtained from quantitative data analysis.

c. Qualitative Data Analysis

- Complete extracted qualitative data listed from further comments in hardcopy and softcopy.
- Conclusions obtained from of qualitative data analysis.

Based on the focus of the POEM Evaluation for sustainable neighborhood development, the following outline may be helpful in reporting the findings of data analysis;

Sustainable Dimension Understanding & Awareness: the outcome report of Part 2 – End-Users/Households role, understanding & awareness on sustainable dimension pillars, neighborhood assessment criteria and certified green neighborhood in general. The further information that should be gather include the end-users'/household' decision in purchasing or staying in the neighborhood, planned length of stay and justification on those decision.

Sustainable Level Outcomes Achieved: Both the quantitative data and qualitative data findings should be evaluated to indicate whether sustainable level outcomes required by POEM ratings and classification were achieved.

Assessment Criteria Issues Raised: Summary of related issues that may be raised and directly concerns to any specific neighborhood / township assessment criteria.

POEM Evaluation for Sustainable Outcomes: By means of available benchmarking information the report should specify the compliance or non-compliance, - whether the certified green neighborhood development and its urban neighborhood assessment criteria fulfilled the effectiveness and sustainability concept according to sustainability dimension pillars.

6. Conclusions and Recommendations

Collection and Analysis Data Results.

- Summarize in key areas as noted in data collection and analysis above.
- Key POEM Evaluation outcomes and recommendations
- Outcomes that should be included in future review of the current Neighborhood / Township Assessment Criteria
- Any other relevant outcomes or recommendations.

POEM Evaluation Methodology Review

Upon completion of the POEM evaluation process, the Evaluator (or any nominated personnel or organization who conduct this study) should prepare a review of this methodology, as used to conduct this POEM evaluation procedures. A separate but concisely summarized report to GBI Malaysia or any institutions who certified the selected case study, shall include the following outlines in regard to the evaluation study:

• A short description of the methodology applied;
• A summary of the methodology weaknesses and strengths;
• Definitive recommendations for future process improvement.

Further References and Reading

Brundtland, G., Khalid, M., Agnelli, S., Al-Athel, S., Chidzero, B., Fadika, L., . . . de Botero, M. M. (1987). Our Common Future (\'Brundtland report\').

Bryman, A. (2012). *Social research methods*: Oxford university press.

Choguill, C. L. (2008). Developing sustainable neighbourhoods. *Habitat International, 32*(1), 41-48. doi: http://dx.doi.org/10.1016/j.habitatint.2007.06.007

Churchill, G. A., & Iacobucci, D. (2009). Marketing Research: Methodological Foundations: Cengage Learning.

Dali, M. M., & Nordin, N. A. (2010). Is there an integrated society in urban neighbourhoods of Klang Valley in Malaysia?. *Journal of Sustainable Development*, *3*(3), 266.

Department of Statistic (1996a). Urbanization and Urban Growth in Malaysia, Population Census Monograph Series No. 1, Department of Statistics, Kuala Lumpur

Department of Statistic (1996b). Internal Migration in Malaysia, Population Census Monograph Series No. 2, Department of Statistics, Kuala Lumpur

Malaysia, Department Of Statistics. (2000). Preliminary Count Report: population and Housing Census of Malaysia, Kuala Lumpur.

DESA-UNDP. (2013). TST Issues Brief: Sustainable cities and human settlements. The Technical Support Team is co-chaired by the Department of Economic and Social Affairs and the United Nations Development Programme.

Ding, G. K. C. (2008). Sustainable construction—The role of environmental assessment tools. *Journal of environmental management, 86*(3), 451-464.

GBI. (2010). GBI TOWNSHIP RATING TOOL. *Seminar On Sustainable Cities –Sharing Swedish Experience24 May 2011, Park Royal Hotel, Kuala Lumpur,* -(Asian Green Cities Index).

Gill, J., & Johnson, P. (2010). *Research methods for managers*: Sage.

Hamzah Sendut (1962). Pattern of Urbanization in Malaya, Journal of Tropical Geography, 114-130

Hamzah Sendut (1965). Statistical Distribution of Cities in Malaysia, Kajian Ekonomi Malaysia, 11(2), 49-67

Hezri, A. A. (2004). Sustainability indicator system and policy processes in Malaysia: a framework for utilisation and learning. *Journal of environmental management, 73*(4), 357-371.

IPCC. (2007). Climate change. Fourth Assessment Report of the IPCC. *Cambridge University Press, Cambridge.*

IUCN. (1980). World Conservation Strategy. *Living Resource Conservation for Sustainable Development*.

Kochan, T., Bezrukova, K., Ely, R., Jackson, S., Joshi, A., Jehn, K., . . . Thomas, D. (2003). The effects of diversity on business performance: Report of the diversity research network. *Human resource management, 42*(1), 3-21.

Kraas, F. (2007). Megacities and global change: key priorities. *Geographical Journal, 173*(1), 79-82. doi: 10.1111/j.1475-4959.2007.232_2.x

Lowe, C., & Ponce, A. (2010). UNEP-FI/SBCI'S financial & sustainability metrics report. *An international review of sustainable building performance indicators & benchmarks. Available online:* http://www*. unepfi. org/fileadmin/documents/metrics_report_01. pdf (accessed on 20 March 2014)*.

Nagata, J.A., (1974). Urban Interlude: Some Aspect of Internal Malay Migration in West Malaysia, International Migration Review, 8, 301-324

Poston, A., Emmanuel, R., & Thomson, C. *Developing holistic frameworks for the next generation of sustainability assessment methods for the built environment*.

Preiser, W. F. E. (1995). Post-occupancy evaluation: how to make buildings work better. *Facilities, 13*(11), 19-28.
Pucher, J., & Dijkstra, L. (2000). Making walking and cycling safer: lessons from Europe. *Transportation Quarterly, 54*(3), 25-50.
Rauland, V., & Newman, P. (2015). Making It Work. In *Decarbonising Cities* (pp. 205-233). Springer International Publishing.
Robson, C. (2002). *Real world research: A resource for social scientists and practitioner-researchers* (Vol. 2).
Saw, S.H., (1972). Patterns of Urbanisation in West Malaysia, 1911-1970. Malayan Economic Review, 17, 114-120
Shika, S. A., Sapri, M., Jibril, J. D. a., Sipan, I., & Abdullah, S. (2012). Developing Post Occupancy Evaluation Sustainability Assessment Framework for Retrofitting Commercial Office Buildings: A Proposal. *Procedia - Social and Behavioral Sciences, 65*, 644-649. doi: http://dx.doi.org/10.1016/j.sbspro.2012.11.178
Singh, R. K., Murty, H. R., Gupta, S. K., & Dikshit, A. K. (2009). An overview of sustainability assessment methodologies. *Ecological Indicators, 9*(2), 189-212. doi: http://dx.doi.org/10.1016/j.ecolind.2008.05.011
Steuteville, R. (2004). The new urbanism: An alternative to

modern, automobile-oriented planning and development. *The New Urban News*, 5.
Sullivan, L. J., Rydin, Y., & Buchanan, C. (2014). Neighbourhood sustainability frameworks-a literature review.
Truitt, P. (2009). Potential for reducing greenhouse gas emissions in the construction sector. *US Environmental Protection Agency*, 12.
Tyler, S., & Moench, M. (2012). A framework for urban climate resilience. *Climate and Development, 4*(4), 311-326. doi: 10.1080/17565529.2012.745389
Varga, T., & Vercseg, I. (1992). An Experiment in Community Development in the Bakony, Hungary. *Community Development Journal, 27*(1), 50-59.
Woodcraft, S., Hackett, T., & Caistor-Arendar, L. (2011). *Design for social sustainability: A framework for creating thriving new communities*: Future Communities.
Zimring, C. M., & Reizenstein, J. E. (1980). Post-occupancy evaluation an overview. *Environment and Behavior, 12*(4), 429-450.

POEM ASSESSMENT CRITERIA
FOR
SUSTAINABLE NEIGHBORHOOD

POEM END-USER/HOUSEHOLD SURVEY
Version 1.0 | 2017

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NEIGHBORHOOD INFORMATION

Evaluator	
Organization	

Neighborhood Title	
Address	
Postcode	
State/Province	

Neighborhood Information	
Contact Person	
Contact Information	

urban planner	
Architect	
Landscape architect	
Civil engineer	
Mechanical Engineer	
Structural engineer	
Electrical Engineers	
Land Surveyor	
Quantity Surveyor	
EIA Consultant	
Biodiversity Consultant	
Horticulturalist	
Other Specialist Consultants	
Approving Authority	

Neighborhood Description	Acreage	Percentage from total developement
Gross Development Area	Acre	%
1. Residential	Acre	%
2. Commercial	Acre	%
3. Industrial Area	Acre	%
4. Public Amenities & Facilities	Acre	%
5. Open Public Space	Acre	%
6. Natural Reserved Area	Acre	%
7. Utilities & Infrastructure	Acre	%

Pre-Occupancy Score & Ratings	
Awarding Organization	
Date of Certification & Validity	

DETAIL OF EVALUATION CRITERIA				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Environment Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EnP Q1	Sufficient Designated Green Area	1-5(n)	
2	EnP Q2	Sufficient Street Or Park Lighting	1-5(n)	
3	EnP Q3	Generate Or Use Renewable Energy	1-5(n)	
4	EnP Q4	Reduced Or Recycle Water Practice	1-5(n)	
5	EnP Q5	Bio-Diversity Reserved Availability	1-5(n)	
6	EnP Q6	Flood / Drainage Clogging Experience	1-5(n)	
7	EnP Q7	Infrastructure Services Efficiency	1-5(n)	
8	EnP Q8	Pollution Control & Experience	1-5(n)	
		Dimension Av-Cr / Sc-Cr	40(n)	
Social Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	SoP Q1	Sufficient Communal Greenspaces	1-5(n)	
2	SoP Q2	Population Density & Development Level	1-5(n)	
3	SoP Q3	Universal Accessibility Availability	1-5(n)	
4	SoP Q4	Security And Safety Experience	1-5(n)	
5	SoP Q5	Public Health Concerns	1-5(n)	
6	SoP Q6	Recycling Facilities Or Practices	1-5(n)	
7	SoP Q7	Community Diversification	1-5(n)	
8	SoP Q8	Community Engagement & Management	1-5(n)	
		Dimension Av-Cr / Sc-Cr	40(n)	
Economic Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EcP Q1	Distance To Community Amenities	1-5(n)	
2	EcP Q2	Public Transport Reliability	1-5(n)	
3	EcP Q3	Sufficient Pedestrian & Cycling Networks	1-5(n)	
4	EcP Q4	Low Impact & Regional Materials	1-5(n)	
5	EcP Q5	Promotion Of Sustainable Construction	1-5(n)	
6	EcP Q6	Construction Waste & Sedimentation	1-5(n)	
7	EcP Q7	Sufficient Commercial Amenities	1-5(n)	
8	EcP Q8	Innovative Development	1-5(n)	
		Dimension Av-Cr / Sc-Cr	40(n)	
		Total Dimension Av-Cr / Sc-Cr	120(n)	
		Sc-Cr (72) / Av-Cr (120) x Weighting (100%)		
		Dimension Scored Achieved		

POEM RATING CLASSIFICATION		
Score	Ratings	Descriptions
86 to 100 TD-CA	Platinum	Beyond outstanding criteria ratings of POEM for Sustainable Neighborhood
76 to 85 TD-CA	Gold	Outstanding criteria ratings of POEM for Sustainable Neighborhood
66 to 75 TD-CA	Silver	Good criteria ratings POEM for Sustainable Neighborhood
50 to 65 TD-CA	Certified	Fulfilled minimum criteria of POEM for Sustainable Neighborhood
Below 50 TD-CA	-	Failed to fulfilled minimum criteria of POEM for Sustainable Neighborhood

1 ENVIRONMENT DIMENSION [SoP] – 40 Scores

The environmental dimension emphases on varies critical related issues on the environment such as the global warming phenomenon, the significance of reducing GHG emissions to the atmosphere and the conservation of biodiversity and preservation of ecosystem. It focuses in mitigating and reducing the environmental impacts in the various vulnerability aspects of environment due to human activities and natural disasters as a result from unsustainable development.

In the aspect of urban development, measures need to be taken to deal with these issues. Apart from pre-occupancy measures, by assessing the Planning Assessment (PA) and Completion & Verification Assessment (CVA) which was implemented Township Assessment Criteria V.1.1, the post-occupancy measures is equally important in assessing the achieved certification for continuing sustainable efforts. Figure E1 below shown the POEM Environmental Dimension Evaluation Criteria for sustainable neighborhood development.

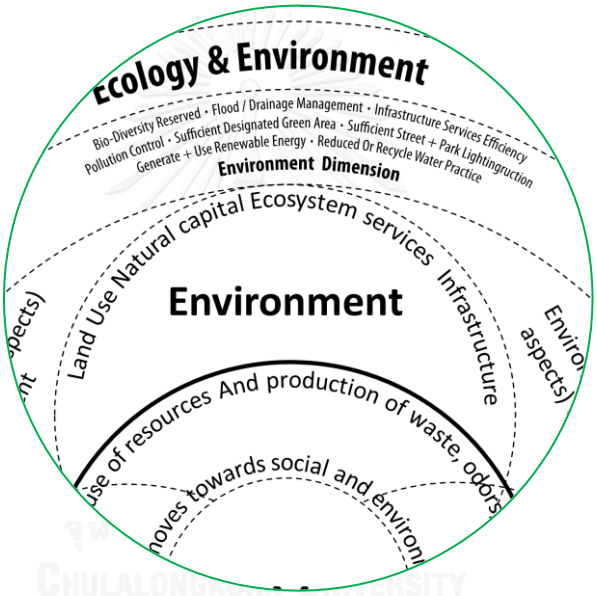

Figure E1: Environment Dimension Evaluation Criteria

Dim	Criteria	Content	Available Credits	Scored Credits
Environment Dimension				
1	EnP Q1	Sufficient Designated Green Area	1-5(n)	40
	EnP Q2	Sufficient Street Or Park Lighting	1-5(n)	
	EnP Q3	Generate Or Use Renewable Energy	1-5(n)	
	EnP Q4	Reduced Or Recycle Water Practice	1-5(n)	
	EnP Q5	Bio-Diversity Reserved Availability	1-5(n)	
	EnP Q6	Flood / Drainage Clogging Experience	1-5(n)	
	EnP Q7	Infrastructure Services Efficiency	1-5(n)	
	EnP Q8	Pollution Control & Experience	1-5(n)	
		Dimension Scored Achieved		**40**

EnPQ1	Sufficient Designated Green Area	5 Scores

The technical intent of sufficient designated green area is to reduce Urban Heat Island micro climate effect and to lower ambient temperatures of the surrounding neighborhood environment. Besides the built occupied units the designated lush greenery area and open space describes as an area that is enclosed or open or reserved. This normally includes open Botanical Park, Public Park, open sports or recreation field, walkway for pedestrian, dedicated cycle lane or a public plaza. The designated area is normally a combination of softscape and hardscape. Green area is defined as open space that is having softscape landscaping in nature. Besides the provision of landscape covers and green shade, the water bodies and the use of featured materials of high SRI (Solar Reflective Index) in the hardscape might reduce the urban heat island impact to the surroundings. For this POEM Handbook evaluation criteria the end-users/households shall nominate the scored credits based on their opinions as the planned or designed neighborhood might not be as what written in the marketing brochures or vision by the planners or architects.

EnPQ2	Sufficient Street & Park Lighting	5 Scores

The intent of this criteria is sustainable lighting design in order to reduce energy use by good lighting design practice for street and park lightings. Most of the urban neighborhood streets and park is heavily used and important after the working hours or during evening. Hence, sufficient street and park lighting is important criteria in reducing energy and preserving the environmental dimension. Sustainable streets and park lighting begins with the implementation of best practice in design of Luminance level and the selection of right context and relevant task light fittings application. Lighting for outdoor application in general specify the illuminance (candela/m2) instead of luminance (lumen/m2 or lux).
However, from end-users/households point of view, sufficient lighting might suggest functional and practical aspect of common area illumination. Other aspect of end-users/households considerations could be light pollution, cover in EnP Q8. Above than what it needs to light may cause glare and uneasy visions. Pre-occupancy sustainable criteria might suggest technical light factors such as color rendering index (CRI) or color temperature, uniformity luminance level (aspect for vehicular or pedestrian or mixed traffic) and the lighting 'creative aspect' for generating moods, or heightening features themes. Thus, in this POEM Handbook evaluation criteria, it is to find out end-users/households opinion on the lighted common area whether it is sufficient, meaning it is neither nor under lit or above lit.

EnPQ3	Generate or Use Renewable Energy	5 Scores

The intent of this POEM Handbook evaluation criteria is to find out end-users/ households opinion on energy use beside the normal supply from the main energy grid. On-site energy generation and the use of renewable energy is to reduce carbon emissions. On-site energy generation whether micro-generation or distributed generation is the energy generation via community run effort for example neighborhood cooling plant, co-generation energy plant, building integrated photovoltaics, and other similar energy generators. The reason of 'on-site' energy generation is to reduce energy transmission losses. Renewable energy production can be applied whether 'in-building' or neighborhood based effort in order to reduce carbon emission. The renewable energy may include energy generated from solar thermal, solar PV, wind, biomass and other sources of renewable energy.

EnPQ4	Reduced or Recycle Water Practice	5 Scores

The intent of EnP Q4 is to minimize the treated and potable water used in the effort for sustainable environment. Reduced or recycle water practice may suggest individual or community effort by using recycled water from harvested storm water for irrigation or garden, green park and other non-potable use. Recycled waste water also can be utilized for landscape irrigation, street cleaning and car wash. Any sustainable design or infrastructure to neighborhood community or individual approach in recycling grey water is valuable and encouraged.

EnPQ5	Biodiversity Reserved Availability	5 Scores

Bio-diversity reserved mentioned under National Land Code includes forest reserve and natural ecosystem in the coastal areas. It's also includes water bodies such as rivers, tributaries, streams, lake, ponds and reservoirs. Its' applied to any river reserves, forest reserves, wildlife sanctuary reserves, or any other types of Protected Areas gazette under various national or local legislation codes. The intent of this criterion is find out the availability of bio-diversity in order to minimize the impact on existing ecological balance and diversity, to conserve natural systems of hydrology and to conserve water bodies or wetlands in order to preserve bio-diversity. This EnP Q5 criterion is also related to EnP Q6 flood and drainage systems which is a common issues in Malaysia especially in high raining season.

EnPQ6	Flood/Drainage Clogging Experience	5 Scores

Flash flood due to improper drainage systems due to heavy precipitation is a major issue in the Klang Valley/Greater KL. It is highly related to EnP Q5 and EnP Q1 especially in low land urban development. Another disaster issue that related to this criteria is landslides if the development is in the hill slope area. The intent of this POEM Handbook evaluation criteria is to find out end-users/household experience on this issues. Any experience suggested that the neighborhood development might not properly conserved natural hydrological systems and mitigate proper flood and landslide risk. Certified sustainable neighborhood or township development should protect dweller's life and property by adopted measures in mitigating and responses action plan, and also reducing the impact of potential arising disasters from development of hill slope. Besides environmental disasters related issues, certified development should in anyway limit the disruption to natural hydrological systems by minimizing water pollutants and sources of contaminants.

EnPQ7	Infrastructure Services Efficiency	5 Scores

EnP Q7 Infrastructure Services Efficiency addressed the sewage treatment plant, mains potable water supply pipes, electric supply and mains distribution station and telecommunication ducts. The intent of this evaluation criterion is to find out end-users/households opinion on efficiency and sufficiency of these infrastructure services provided in the studied certified neighborhood. Pre-occupancy sustainable new neighborhood development highlighted the need in reducing the impact arising from the need to develop these new infrastructures off-site or onsite, and reducing the impact and the disruption arising from post-occupancy reconstruction of these infrastructure by the mean of easy access provision. Thus, this POEM Handbook evaluation criterion is to find out the sufficiency and efficiency of these provisions upon occupancy.

EnPQ8	Pollution Control & Experience	5 Scores

Pollution control suggest all types of pollutants such as air pollution, water pollution, land pollution, noise pollution, light pollution and any means of pollutions experience by the end-users/households in the certified neighborhood. One of the main issue in sustainable development id to maintain the quality of environment by eliminating as possible or reducing pollutions through sustainable design. Proper pollutions control will enhanced neighborhood community living. Pre-occupancy sustainable neighborhood or township criteria suggested specific control on light pollution. Emphasized was given in reducing light trespass, light glare and sky-glow during night time. Light color rendition is an important issues in preserving the effectiveness of the outdoor activities, safety and security of the grounds and decorative effect of surrounding softscapes and hardscapes.

2	SOCIAL DIMENSION [SoP] – 40 Scores

As mentioned previously, the social dimension looks at the various needs of the residents in order to provide high citizen satisfaction. It aims to provide the society with essential services in order to reach citizen satisfaction. For example, human health includes welfare facilities and access to the medical service, and educational development. The dimension has eight key categories that need to be taken into account; each one has a number of criteria that determine the number of available credits per category. Figure E2 below shown the POEM Environmental Dimension Evaluation Criteria for sustainable neighborhood development.

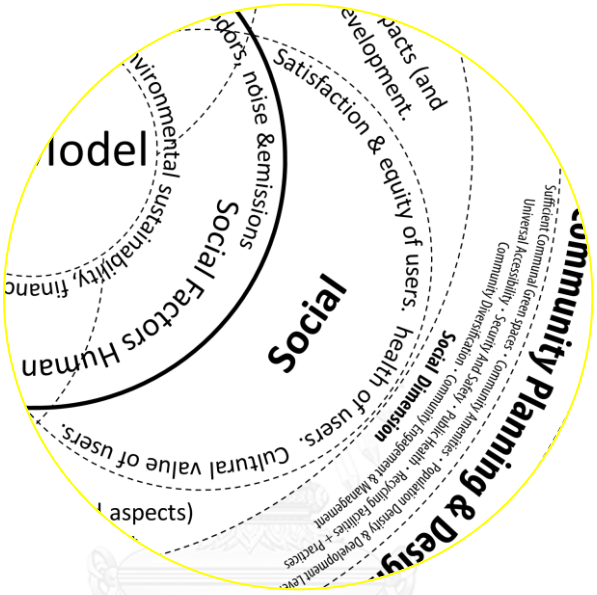

Figure E2: Social Dimension Evaluation Criteria

Dim	Criteria	Content	Available Credits	Scored Credits
Social Dimension				
2	SoP Q1	Sufficient Communal Greenspaces	1-5(n)	40
	SoP Q2	Population Density & Development Level	1-5(n)	
	SoP Q3	Universal Accessibility Availability	1-5(n)	
	SoP Q4	Security And Safety Experience	1-5(n)	
	SoP Q5	Public Health Concerns	1-5(n)	
	SoP Q6	Recycling Facilities Or Practices	1-5(n)	
	SoP Q7	Community Diversification	1-5(n)	
	SoP Q8	Community Engagement & Management	1-5(n)	
		Dimension Scored Achieved		**120**

SoPQ1	Sufficient Communal Greenspaces	5 Scores

Communal greenspaces are defined as listed follows: gardens & parks, semi natural and natural landscape, green side-corridors, green recreational and sports fields, vegetable allotments & community green plots, amenity green spaces & cemeteries. Park category with reference to Local or National Planning standards is defined as play field, play lots, Neighborhood Park, urban park, Local Park, national park or Regional Park. These also includes water bodies within communal greenspaces and parks. Communal greenspaces should be classified as a recreational spaces which accessible to the neighborhood communities. Common communal greenspaces in urban neighborhood development are public field, playground, community shared herbs gardens and recreational lakes. Certified sustainable neighborhood should confirm to pre-occupancy provision of providing communal greenspaces which above by 25% from minimum requirement of the local authority.

SoPQ2	Population Density & Development Level	5 Scores

Population density and development level related closely to SoP Q1 and EnP Q1. In order to achieve sustainable social and environmental dimension the density and level should meets or go above the local development intensity guideline. Pre-occupancy sustainable township/neighborhood development criteria suggested the requirement and the average gross density should complies the local development intensity guideline or higher, which are; for detached house (Low Density) - 10.0% higher above local development intensity guideline, for terrace/townhouse/semi-detached/cluster house (Medium Density) - 7.5% higher above local development intensity guideline and for apartment /flats/condominium (High Density) - 5.0% higher above local development intensity guideline. The higher density in this criterion means compact development that utilized the land plot efficiently through intensive and creative neighborhood and township design and planning. The intent of this criterion is to achieve development intensity for enhanced environmental quality by moderating the micro climate impact on surrounding neighborhood environment.

SoPQ3	Universal Accessibility Availability	5 Scores

The intent of this criterion is to find out the extent of infrastructure that is 'handicapped-friendly' and provision of universal accessibility. Universal Design term is to describe a design that friendly for disabled person and elderly person, it is a design solution to accommodate both disabled and abled persons. Universal environment accessibility for disabled people also benefits others for example paved walkways curb cuts, it is intentionally designed to make walkways and streets accessible by those who use disabled wheelchairs but at the same time also beneficial for kids with skateboards, parents using baby prams or strollers and delivery workers with loads trolleys. The common universal design and accessibility provisions in certified sustainable neighborhood development are disabled parking, disabled ramps, disabled elevators, disabled toilets, guided rails and paving for the blind, and technological aid using sounds and contrasting visual for disabled.

SoPQ4	Security and Safety Experience	5 Scores

The intent of this POEM Handbook evaluation criterion is to find out the extent of provision in security and safety measures in the certified sustainable neighborhood development based on end-users/households experience. This is to further measure the enhanced neighborhood environment through security in design. The certified sustainable neighborhood development is designed in compliance with security neighborhood / township planning guidelines includes the application of Crime Prevention Through Environmental Design (CPTED) principles within neighborhood community, compliance with ISO 8995-3 and CIE S016: Lighting of Internal Work Places and Safety & Security Requirements of External Work Places.

SoPQ5	Public Health Concerns	5 Scores

SoP Q5 Public Health Concerns evaluation criterion is to find out the effectiveness of occupied certified sustainable neighborhood whether it is planned in accordance to public health enhancement through sustainable neighborhood environmental planning. Public health concerns in certified sustainable neighborhood development includes proper area zoning in order to ensure polluting sources such as industrial related facilities, marketplaces and vehicular garages that located in the neighborhood should have sufficient wastewater collection and treatment capability; water features and drainage systems is not the source of water-borne and vectors disease; any hazardous waste listed in Department of Environment (DOE) schedule required disposal plan and through licensed disposal; and adequate sullage collection and treatment systems provision. The common impact from poor public health concerns in neighborhood development in the Klang Valley/Greater KL are water-borne and vector diseases such dengue and leptospirosis; fecal or orally transmitted diseases; chronic health issues related to exposure to residues of agrochemicals; and hazardous pollutions and contaminations.

SoPQ6	Recycling Facilities or Practices	5 Scores

The intent of this POEM Handbook evaluation criteria is to find out the availability and efficiency of recycling facilities and practices. Other intent is to find out the extent of waste separation practices at source. These might applied at community effort level, household level or individual practice. Common recycling facilities in certified sustainable neighborhood are community recycling centers with provided recycled bins. Routine recycling practices may include using recycled shopping bags instead of plastic bags, supporting locally appointed waste disposal company and recycling initiatives and any other undertaken pro-active recycling measures efforts by the community, household or individual.

Since we are living in digital age, unwanted or obsoleted technological gadgets such as computers, tablets or smart phones can be donated for good use. Recycling practice such as donating for other needy use or upgraded it will prolonged the life-cycle of its and keep it from waste stream. Other community practices or efforts is to support Earth Day by setting up community volunteers programs of neighborhood clean-up effort, organize community recycle drive in the neighborhood to collect recyclable waste materials such as glass, papers, plastics and cans, and organize a community pot-luck picnic unwanted or old but still usable clothes, furniture, toys, books and other items for charitable institutions or organizations.

SoPQ7	Community Diversification	5 Scores

POEM Handbook evaluation criterion SoP Q7 Community Diversification is related to housing diversity and affordable housing. The intent is to find out end-users/households opinion on socially equitability and community diversity through in mixed-use and affordable housing in certified sustainable neighborhood. Local authority and pre-occupancy guidelines for this criterion is as shown in the Table E1 below;

Table E1: Guidelines for Housing Diversification and Affordable Housing.

Development Acreages	Housing Diversification	Housing Types	Affordable Housing Price
20 acres - 40 acres	2 Housing Types	1. Detached Houses 2. Semidetached Houses 3. Terrace Houses 4. Townhouses 5. Cluster Houses 6. Low-rise Apartments / Condominiums (< 4 story) 7. High-rise Apartments / Condominiums (> 4 story) 8. Others	1. Low-Cost Flats / Houses (Selling Price < RM42K) 2. Medium-Low-Cost Apartments / Houses (RM42K < Selling Price < RM100K) **3.** Medium-Cost Apartments / Houses (Selling Price > RM100K)
41 acres - 100 acres	3 Housing Types		
101 acres - 150 acres	4 Housing Types		
151 acres - 250 acres	5 Housing Types		
251 acres to 350 acres	6 Housing Types		
exceeds 351 acres	7 Housing Types		

SoPQ8	Community Engagement & Management	5 Scores

SoP Q8 evaluation criterion in this POEM Handbook if assess end-users/households opinion on the extent of community engagement, participation and governance of sustainable practice in the resided certified sustainable neighborhood. This criterion taken into account of active dialogue between the community residents and developer, and also existing surrounding communities within the resided certified sustainable neighborhood vicinity in maintaining and fostering sustainable practices agenda. In term of available facilities within this evaluation criterion is sufficient multipurpose hall, or civic centers, or sports centers / clubs, or wellness centers for community activities. Another community engagement and management shall also include an active Association of Residents and it sustainable related activities such as community recycling programs and events, community food production allotments, community transportation pooling efforts and other sustainable related community initiatives.
For community governance empowerment, measures and practices includes an active community complaints unit for addressing local residents issues, strengthening CPTED measures and create cooperation with local police in maintaining neighborhood security and safety, fosters waste separation at source through community level recycling program and participate actively in any sustainable programs initiated by any local authority or government agencies.

3 ECONOMIC DIMENSION [SoP] – 40 Scores

This dimension deals with a number of aspects regarding the economy, including sustainable economy and employment. It focuses on the significance of the achievement of stable economic growth and work to organize the production and consumption processes and choosing forms of production that minimize the use of resources and reduce environmental pollution. Figure E3 below shown the POEM Environmental Dimension Evaluation Criteria for sustainable neighborhood development.

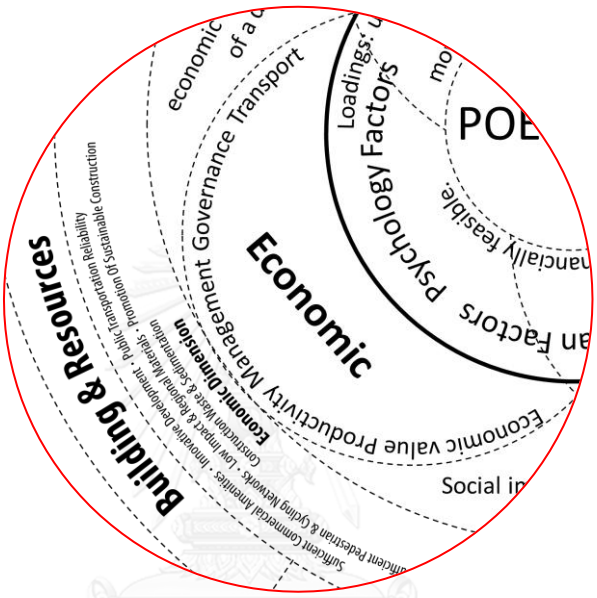

Figure E3: Economic Dimension Evaluation Criteria

Dim	Criteria	Content	Available Credits	Scored Credits
Economic Dimension				
3	EcP Q1	Distance To Community Amenities	1-5(n)	40
	EcP Q2	Public Transport Reliability	1-5(n)	
	EcP Q3	Sufficient Pedestrian & Cycling Networks	1-5(n)	
	EcP Q4	Low Impact & Regional Materials	1-5(n)	
	EcP Q5	Promotion Of Sustainable Construction	1-5(n)	
	EcP Q6	Construction Waste & Sedimentation	1-5(n)	
	EcP Q7	Sufficient Commercial Amenities	1-5(n)	
	EcP Q8	Innovative Development	1-5(n)	
Dimension Scored Achieved				**40**

EcPQ1	Distance to Community Amenities	5 Scores

Evaluation criterion of EcP Q1Distance to Community Amenities to find out end-users/households' opinion whether the essential commercial community amenities or facilities within a walking distance reasonable range or need for a vehicular travel. Certified sustainable neighborhood planning or zoning should locate the essential commercial community amenities or facilities within a walkable range. These essentials amenities or facilities should within 500m radius from residential zone, connected via pedestrian walkways network and coordinated through nodes point of public transportation for accessibility convenience. Essentials commercial community amenities and facilities includes banks, convenience stores or grocery, day care centers, beauty parlors, hardware shops, laundry shops, medical/dental clinics, pharmacies, eatery outlets, supermarkets, fitness centers and others daily community commercial needs. Besides commercial essentials, this evaluation criterion may also applied to public amenities such as school, library, police station, fire station, government health clinics, religious centers, civic hall, and other amenities established by the government for public use.

EcPQ2	Public Transport Reliability	5 Scores

Accessibility is the basic of urban development planning. Means of access suggests economic development growth. For sustainable development, accessibility via reliable public transportation will reduced vehicular carbon emissions from private transportations. The intent of this criterion is find out end-users/households view on public transportation efficiency and reliability in linking both within the certified sustainable neighborhood and linkages to outside commercial centers or any non-available needs outside the neighborhood.

Certified sustainable neighborhood should adopted green transport masterplan in order to reduced vehicular travel and used efficient travel linkages to essentials amenities and facilities via pedestrian network of walkways, cycling lanes and other alternatives mode of sustainable commuting systems. It's also supports public transit oriented commuting with integrated pedestrian and cycling lane system and the linkages to the other zones in the neighborhood. The effort is to reduce private vehicular use where at the same time increased the availability and reliability of public transportation both within the neighborhood and linkage to outside external hubs.

The provision of common public commuting and connectivity network facilities in the certified sustainable neighborhood is covered or shaded bus stops or station of light / mass rapid transit within 500m radius from residential unit or non-residential unit in the neighborhood, covered or sheltered pedestrian walkway linking to bus stops or stations of light / mass rapid transit to the nearest residential units or essentials commercial areas. The alternative forms of sustainable transports or green transportation initiatives include provision of charging dock/station for electric vehicles at strategic location of essentials community commercial facilities and public amenities, park and ride terminal at parking facilities and public transportations depot, community carpooling management system, free or rental bicycle for neighborhood community by public local authority or the association of resident, green public transportation operating using electric or biofuel for commuting within neighborhood zones and other modes of sustainable transportation available.

EcPQ3	Sufficient Pedestrian & Cycling Networks	5 Scores

The intent of EcP Q3 Sufficient Pedestrian and Cycling Networks is to find out end-users/households opinion on the availability and extent of sufficiency of this evaluation criterion in promoting sustainable economic dimensions activities, healthy social lifestyles and reducing vehicular emission to the environment. The pedestrian and cycling networks is planned from economic hubs such as commercial zones, working zones and transitory hubs within the neighborhood to link to other zones such residential zones, public amenities zones and recreational zones for maximum daily utilizations. Pedestrian walkways should be 75% shaded or covered except at vehicular crossings. Cycling networks should have dedicated lanes and proper safety signage. Other provisions of cycling network includes bicycle park or storage space at dedicated high human traffic areas such as commercial and office areas, markets and public amenities areas, landscaped-line shaded cycling lanes should be 75% of the overall cycling network and shaded rest-stop facilities/amenities such as refreshment kiosk or bicycle parking stations at 750m intervals of cycling networks.

EcPQ4	Low Impact & Regional Materials	5 Scores

Optimized low impact materials resource efficiency is benefited for to everyone. It is not only benefits the developers but also good for economy as a whole. Economically it reduced the dependency on high impact and imported raw materials, reduced priced cost fluctuations on business cycles, materials price and gained profits. It is also reduced the risk of triggered new inflation due to materials price increased and mitigate negative economic effect due to materials deficiencies. All these issues will impact economic capability and capacity. The importance growth of this economical factor is evidenced by today rapidly increasing market for low impact and regional materials. The POEM Handbook evaluation criterion intent is to reduce material impact by using recycled and reclaimed materials in the neighborhood development. It is to assess the end-users/households opinion on the material used in building and infrastructures whether it is low impact (green or sustainable) and available locally, based on their opinion or as explained by the developers.

Certified sustainable neighborhood development should use development materials with recycled content for built buildings which includes the occupied residential, commercial and public units and community infrastructure such as the roadways, sub-base and base facility materials, drainages, curbs, water/sewage infrastructure, electrical / communicating infrastructure and street hardscapes or furniture. The intent is also in reducing the carbon emissions impact from transportation by using regional/local materials. Building and constructions materials should have been extracted, processed and manufactured within the development region, hence supporting the local economic resources and reduced transportation cost & carbon emission to the environment.

EcPQ5	Promotion of Sustainable Construction	5 Scores

Sustainable construction are important consideration whether at pre-construction stage, during construction phase and upon completion in order to reduce vulnerability to disaster which might cause severe economic damages. It respond effectively to prone disasters in order to protect lives and property, rehabilitate the vital developed infrastructure and reinstate economic related activities. Sustainable construction development improved capacity and effectiveness by meeting the national economic demand of this sector and to support national economic and social agenda. The POEM Handbook evaluation criterion intent is to assess end-users/households view or as explained by developers on the sustainable construction efficiency and quality thus conserving available resources. It is also to reduce impact on environment resultant from construction works and post-construction work via construction waste management and recycling scheme. These related measures includes construction waste management for the whole development; recycling scheme plan; proper waste disposal upon completion; availability of recycling center and recycling bins; and training and monitoring of development staff and workers on construction waste management plan. On the sustainable construction practice measures, effort includes implementation of rainwater harvesting tank; provision of workers amenities above statutory standard requirement; preserve available existing landscape and greenery, implementation of industrialized building system (IBS); and any other sustainable construction related measures.

EcPQ6	Construction Waste & Sedimentation	5 Scores

The unnecessary materials wastage, improper construction waste management and low awareness and appreciation on waste reduction are common issues in construction and development. Considering the enormous cumulative increased in waste related generation based on the growth of new neighborhood / township development in the Klang Valley/Greater KL can lead to material wastages which has significance economic value. The intent of this evaluation criterion is find out end-users/households opinion on traces of construction waste, sedimentation or any kind of debris when they move into the neighborhood. It is to assess the construction waste, site sedimentation and pollution control implementation in order to reduce the environmental impact of construction activities. Development construction undertakings have a momentous impact to the local neighborhood and surrounding environment. A direct effect of development activities is the changes in natural earth terrain and formation which causes the sedimentation to existing waterways, drainages and other hydrological systems. It's also lead to pollution in the local neighborhood and surrounding environment. In the local context, sedimentation and pollution related control of a development is mandatory and regulated under the local authority control and enforcement. This POEM Handbook evaluation criteria EcP Q8 also aims to find out the extent of implemented mandatory requirement of site sedimentation and pollution control. This control measure includes drainage systems of the development; sedimentation control plan; prevention of soil loss by storm water run-off; prevention of sedimentation in storm sewer or receiving drainages; prevention of air pollution from dust or particulates matter; and monitoring the compliance to local authority construction sedimentation and pollution control standard regulation.

EcPQ7	Sufficient Commercial Amenities	5 Scores

The POEM Handbook evaluation criteria EcP Q7 Sufficient Commercial Amenities is to assess end-users/households views on economic activities sufficiency, thus simultaneously generating local level business opportunities and reducing commuting effort and time for the neighborhood residents. It is to recognize local business and services prospects in the neighborhood. Sufficient commercial amenities and facilities in certified sustainable neighborhood should support the supply and demand requirements of the community and vice-versa. It is supposed to be a balanced mixed development in accordance ratios within the commercials and residential economic dimension catchment and create employment opportunities. Essentials commercial amenities or facilities includes what being described in EcP Q1 evaluation criterion.

EcPQ8	Innovative Development	5 Scores

Sustainable economic development required innovative solutions which are regenerative and at the same time reducing carbon emissions. Innovative development strategies includes active green design approaches, innovative generation on-site energy such as biomass, solar cooling, bio digester and other means, innovative sustainable energy provided from certified "green-energy" provider, community scheme of grey or black water recycling efforts, community self-food production and vegetables/herbs garden, community centralized 'micro' energy or chiller plant, automatic system for leak detection is integrated within water reticulation scheme, innovative community ecological or environmental plan that contributing to sustainable neighborhoods and other innovative development solution means. This strategies may not exhaustive to issues included above. The intent of this POEM Handbook evaluation criterion is to seek end-users/households opinion in innovative neighborhood solutions towards sustainability development.

END-USER/HOUSEHOLD SURVEY
STAKEHOLDERS-INCLUSION APPROACH

Stakeholders-Inclusion Approach (Phase 3)
End-Users/Household Survey Questionnaires
*** Required**
Contact Information

1. Name *

_____

2. Neighborhood/Township *

_____

3. Email

_____

4. Designation/Position

_____

5. Contact No

_____

End-users / Household opinions on sustainable pillar dimensions, township/neighborhood assessment criteria and certified sustainable neighborhood.

1. Do you know/understand what sustainable /green neighborhood is? Based on scale 1 to 5, where; 1 = Very Less understanding, 2 = Less Understanding, 3 = Neutral, neither High nor Less Understanding, 4= High Understanding, 5 = Very High Understanding * Mark only one answer.

1		2		3		4		5	

2. Do you know/aware pillars of sustainable dimension; Economic, social & environment? Based on scale 1 to 5, where; 1 = Very Less Awareness, 2 = Less Awareness, 3 = Neutral, neither High nor Less Awareness, 4= High Awareness, 5 = Very High Awareness * Mark only one answer.

1		2		3		4		5	

3. Are you aware that this neighborhood is certified sustainable/green neighborhood? Based on scale 1 to 5, where; 1 = Very Less Awareness, 2 = Less Awareness, 3 = Neutral, neither High nor Less Awareness, 4= High Awareness, 5 = Very High Awareness * Mark only one answer.

1		2		3		4		5	

4. Are you the homeowners, tenants, or workers of this certified neighborhood? * Mark only one answer.

1. Homeowner		2.Tenant		3.Workers

5. What influence your decision making to purchase this property or stay in this neighborhood? You can mark more than 1 answer. * Check all that apply.

	Price/cost
	Sustainable/green label
	Location and accessibility
	Design appearance
	Security
	Amenities and services
	Quality of property & services
	Other:

6. Are you planning to stay permenantly/longterm in this certified neighborhood? Justify in question 7 * Mark only one answer.

1. Yes		2. No		3. Not sure

7. Kindly justify if yes or no or not sure.

_____
_____
_____
_____

Question 8.1 - 8.24 is based sustainable township criteria
The overall idea of these questions is to find out whether the certified green township/neighborhood based on GBI Malaysia Township Assessment Criteria is sustainable according to sustainable pillar dimensions of 1.economic, 2.social and 3.environment upon at least 1 year of occupancy

8. do you think this neighborhood have sustainable design and practice according to SDP Assessment Criteria? Based on interval 1 to 5 scale below, where;
1 Av-Cr = Very Less (or NOT) Adapted / Sufficient
2 Av-Cr = Less Adapted / Sufficient
3 Av-Cr = Neutral, neither High nor Less Adapted / Sufficient
4 Av-Cr = High Adapted / Sufficient
5 Av-Cr = Very High Adapted / Sufficient

Environment Dimension Evaluation Criteria

8.1. Is there sufficient greenery or designated green area in your neighborhood? * Mark only one answer.

1		2		3		4		5	

8.2. Is there sufficient street & park lighting in your neighborhood? * Mark only one oval.

1		2		3		4		5	

8.3. To what extent this neighborhood or your house adapted on-site energy generation or use renewable energy? i.e solar PV, wind energy or any type Renewable Energy * Mark only one answer.

1		2		3		4		5	

8.4. Do you or your community adapted water efficiency practice or put an effort in reducing water use or recycling waste water and to what extent? * Mark only one answer.

1		2		3		4		5	

8.5. Is there sufficient biodiversity reserve such as forest reserve, wildlife reserve, river reserve or wetland in your neighborhood? * Mark only one answer.

1		2		3		4		5	

8.6. This neighborhood adapted hydrology and flood management sufficiently, and does not experience frequent flash flooding or drainage clogging... * Mark only one answer.

1		2		3		4		5	

8.7. Does this neighborhood have a sufficient infrastructure services? i.e sewage treatments, power supply, water supply, telecommunications, e.t.c... * Mark only one answer.

1		2		3		4		5	

8.8. This neighborhood have sufficient and adapted pollution control, and it does not experience excessive light, noise or any form of pollution... * Mark only one answer.

1		2		3		4		5	

Social Dimension Evaluation Criteria

8.9. Does this neighborhood have sufficient common greenspaces? i.e playground, recreational lake, Public Park, community garden, etc... * Mark only one answer.

1		2		3		4		5	

8.10. Do you think this neighborhood is highly dense populated or over developed? * Mark only one answer.

1		2		3		4		5	

8.11. Does this neighborhood have sufficient universal accessibility or handicapped friendly * Mark only one answer.

1		2		3		4		5	

8.12. Do you think this neighborhood is sufficiently secured? i.e crime free, no disturbance, well lighted...? * Mark only one answer.

1		2		3		4		5	

8.13. Does this neighborhood concerns itself with public health planning and design sufficiently? i.e free from dengue fever cases or other waterborne diseases, industrial pollution, waste discharge, etc...? * Mark only one answer.

1		2		3		4		5	

8.14. Does this neighborhood have sufficient recycling facilities and adapted waste separation practice? * Mark only one answer.

1		2		3		4		5	

8.15. Is this neighborhood's community diversified in term of mixed income groups or backgrounds? * Mark only one answer.

1		2		3		4		5	

8.16. Does this neighborhood have a good community participation and maintenance in sustainable practice? i.e active dialogue with developers, existing community within vicinity, etc... * Mark only one answer.

1		2		3		4		5	

Economic Dimension Evaluation Criteria

8.17. Does commercial facilities and public amenities for community within your walking distance? i.e shop area, community centre, place of worship, groceries, eateries, e.t.c... * Mark only one answer.

1		2		3		4		5	

8.18. If you are not using your private transport to commute, is the public transports system sufficient, reliable and convenient in this neighborhood? * Mark only one answer.

1		2		3		4		5	

8.19. Does this neighborhood have a sufficient pedestrian and cycling network? * Mark only one answer.

1		2		3		4		5	

8.20. Do you think the materials used in building and infrastructures in this neighborhood is sufficiently low impact (green or sustainable) and available locally? Based on your opinion or as explained by the developers. * Mark only one answer.

1		2		3		4		5	

8.21. Does the quality of property/premises in this neighborhood promote sufficient or adapted sustainable construction? Based on your opinion or as explained by the developers. * Mark only one answer.

1		2		3		4		5	

8.22. This neighborhood promote sufficient or adapted construction waste management. Kindly answer based on your experience on traces of construction waste, sedimentation or any kind of debris when you move into this neighborhood. * Mark only one answer.

1		2		3		4		5	

8.23. Does this neighborhood have a proper and sufficient commercial area? i.e shops, banks, leisure & entertainment, etc... * Mark only one answer.

1		2		3		4		5	

8.24. As part of community in this neighborhood, do you find this neighborhood development is sufficiently innovative in adapting sustainable development? i.e, economic, social and environmentally? * Mark only one answer.

1		2		3		4		5	

9. Further Comments

Based on all the questions above, do you have any further comments that you think is useful for this study? Kindly comment below

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Thank You ขอบคุณมากครับ

(TO ALL PARTICIPANTS) For further analysis of the data available, I might require to visit you for additional i nformation. This discussion will be structure before-hand to minimize the ofdiscussion and to maintain standard fo

rmat for the information required. Therefore, I hope you will be available to speak with me about your opinion livi ng in this neighborhood briefly and confidentially.
To proceed with this, let me know you contact details
Confidentiality
Thank you for your cooperation. All answers will be treated as confidential. Your answers will be extremely valua ble to my research on Developing a Post Occupancy Evaluation Model for Neighborhood Assessment towards Sus tainable Development.
Again, thank you very much for your cooperation. **ขอบคุณมากครับ**

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POEM Scoring Calculation Master Sheet.				
Q_ No	**Criteria Coding**	**POEM Evaluation Criteria**	**Available Credits**	**Scored Credits**
Environment Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EnP Q1	Sufficient Designated Green Area	1-5(*n*)	
2	EnP Q2	Sufficient Street Or Park Lighting	1-5(*n*)	
3	EnP Q3	Generate Or Use Renewable Energy	1-5(*n*)	
4	EnP Q4	Reduced Or Recycle Water Practice	1-5(*n*)	
5	EnP Q5	Bio-Diversity Reserved Availability	1-5(*n*)	
6	EnP Q6	Flood / Drainage Clogging Experience	1-5(*n*)	
7	EnP Q7	Infrastructure Services Efficiency	1-5(*n*)	
8	EnP Q8	Pollution Control & Experience	1-5(*n*)	
		Dimension Av-Cr / Sc-Cr	40(*n*)	
Social Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	SoP Q1	Sufficient Communal Greenspaces	1-5(*n*)	
2	SoP Q2	Population Density & Development Level	1-5(*n*)	
3	SoP Q3	Universal Accessibility Availability	1-5(*n*)	
4	SoP Q4	Security And Safety Experience	1-5(*n*)	
5	SoP Q5	Public Health Concerns	1-5(*n*)	
6	SoP Q6	Recycling Facilities Or Practices	1-5(*n*)	
7	SoP Q7	Community Diversification	1-5(*n*)	
8	SoP Q8	Community Engagement & Management	1-5(*n*)	
		Dimension Av-Cr / Sc-Cr	40(*n*)	
Economic Dimension Pillar			**Av-Cr**	**Sc-Cr**
1	EcP Q1	Distance To Community Amenities	1-5(*n*)	
2	EcP Q2	Public Transport Reliability	1-5(*n*)	
3	EcP Q3	Sufficient Pedestrian & Cycling Networks	1-5(*n*)	
4	EcP Q4	Low Impact & Regional Materials	1-5(*n*)	
5	EcP Q5	Promotion Of Sustainable Construction	1-5(*n*)	
6	EcP Q6	Construction Waste & Sedimentation	1-5(*n*)	
7	EcP Q7	Sufficient Commercial Amenities	1-5(*n*)	
8	EcP Q8	Innovative Development	1-5(*n*)	
		Dimension Av-Cr / Sc-Cr	40(*n*)	
		Total Dimension Av-Cr / Sc-Cr	120(*n*)	
		Sc-Cr (72) / Av-Cr (120) x Weighting (100%)		
		Total Dimension Scored Achieved		

VITA

Mr Rostam Yaman was born on November 5th, 1973 in Kelantan Darul Naim, Malaysia. He graduated with Bachelor of Arts Three Dimensional Design - Int Architecture from Kent Institute of Art & Design, University of Kent at Canterbury UK in 1997. After that, he continued his study with Masters of Art & Design in Architectural Composite Painting at Faculty of Art & Design Universiti Teknologi MARA in Malaysia. He currently is the senior academician of the Faculty of Architecture, Survey and Planning at Universiti Teknologi MARA Malaysia and Members of Malaysian Green Building Confederation. Prior to that, he served as an academician and research specialist for 15 years working on projects such as green building index, sustainable neighborhood post-occupancy evaluation, and urban space development. Among others, the awards and grants he received were Gold Medal for Invention, Innovation & Design Exposition 2014 in Malaysia and Research Acculturation Grant Scheme (RAGS) and SLAB Scholarship from the Government of Malaysia. Within this research work, he was elected as a delegates to ASEAN 50 -2017 in Manila, The Philippines to present his study titled “Post Occupancy Evaluation Model for Certified Sustainable Neighborhood Development”. His contact information is No. 50, Jalan Bukit Mulia 1/4, Bukit Antarabangsa, 50300 Kuala Lumpur (home address), +6012 917 7029 (mobile) and rostamyaman1@yahoo.co.uk, rosrose@salam.uitm.edu.my (email)