Ingenieurfakultät Bau Geo Umwelt

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Sustainable Development Criteria of Real Estate Projects in Developing Countries from The Perspective of the Indonesian Housing Industry

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„I cannot teach anybody anything. I can only make them think.“
Socrates

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Abstract

When aiming to improve the environmental performance of a building, a comprehensive measurement of the building's quality and impact on the environment is needed. Efforts by individual countries around the world to mitigate the environmental problems caused by the activities of their construction industries have led to the creation of systems that can improve the environmental performance of buildings. These assessment methods shape projects to minimize negative impacts on the environment, or in other words, they minimize the load on the environment that the building activities produce. Environmental building assessment methods offer essential frameworks that explain how a building must be designed, built and operated based on sustainable development principles.

Sustainability is the guarantee for the future ability to successfully meet the changing requirements. In this sense, the idea of sustainability also means a return on the risk in the development, construction and operation of buildings. Sustainable construction aims at minimizing the consumption of energy and resources as well as minimizing the burden on the natural environment for all phases of the lifecycle of buildings from planning, construction, use and renewal to deconstruction. The sole demand to reduce lifecycle costs is not a criterion for sustainability

The challenge for the Indonesian government is to deliver and actually implement an effective and efficient policy instrument that can address the specific environmental issues surrounding the construction industry in Indonesia while maximising the benefits to society of continued development. Their overall goal should be to encourage more investment in sustainable building developments by changing the dynamics of market forces in Indonesia in a way which leads to a higher demand for sustainable building from end users. This could be achieved by meeting the actual requirements and preferences of the end users.

An empirical study was conducted using questionnaire as the data collection method to identify preferences of the end user regarding housing in general and its tendency toward sustainable development in particular. Improvements or solution for the existing environmental problems such as difficulty in accessing clean water, poor quality of drinking water, flooding, unreliable electricity source, inadequate solid waste disposal and collection service as well as bad air quality are highly necessary. More importantly, the criteria from the existing green building certification system shows no significant correlation with the serious problems facing by end users of housing in Indonesia.

Furthermore, inadequate solid waste disposal and collection service is known as problem that triggers the occurrences of other existing problems. This problem is also found as the only problem which end users are not willing to invest more in.

Finally, the certification system was reconsidered based on the actual environmental problems and the investment willingness of end users as well as important criteria of the existing system in Indonesia. A set of new criteria is then established from defined serious problems and considered financially important green building criteria.

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List of Abbreviations

A	
AIA	American Institute of Architects
B	
BREEAM	Building Research Establishment Environmental Assessment Method
C	
ca.	circa
D	
DGNB	Deutchse Gesellschaft fur Nachhaltiges Bauen
E	
EDF	Environmental Defence Fund
Etc.	Et cetera
G	
GBC	Green Building Council
GBTool	Green Building Tool
GDP	Gross Domestic Product
L	
LEED	Leadership in Energy and Environmental Design
N	
NB	New Building
V	
VAT	Value Added Tax

Abstract

When aiming to improve the environmental performance of a building, a comprehensive measurement of the building's quality and impact on the environment is needed. Efforts by individual countries around the world to mitigate the environmental problems caused by the activities of their construction industries have led to the creation of systems that can improve the environmental performance of buildings. These assessment methods shape projects to minimize negative impacts on the environment, or in other words, they minimize the load on the environment that the building activities produce. Environmental building assessment methods offer essential frameworks that explain how a building must be designed, built and operated based on sustainable development principles.

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1 Introduction

1.1 Overview

The construction and real estate industry is a broad and complex industry that plays an important role in both the social and economic development of a country. It includes housing, high rise buildings and infrastructure development that involve new construction, renovation, alterations, maintenance, and landscape preparation for new construction projects etc. The world's population has increased by more than 4 billion over the last 50 years and this has automatically increased demand for housing as the main product of the construction and real estate industry. Unfortunately, continued growth of the global population always comes with a cost. Groundwater extraction, deforestation and landfill are some of the prices that must be paid when the construction industry expands and develops to meet a continuously increasing demand for housing.

Globally, the construction and real estate industries are known as creators of multiplier effects for employment and business processes. At the same time however, it has been regularly criticized for contributing to several environmental challenges and problems such as the overuse of resources during the construction and operation of buildings, as well as adding to already high global emissions and flow of waste to the environment. It is well known as one of the largest end users of environmental resources and one of the largest polluters of manmade and natural environments.[1] Despite its dangerous and polluting activities, construction products are also known as products that are seldom defect-free and it has been proven that construction projects tend to be awarded to the lowest bidder without sufficient regard to their environmental or sustainability credentials.

Clear evidence of environmental degradation caused by the activity and product of the construction industry has enhanced awareness of how to protect and to prevent the environment from further damage. Along with an increasing awareness of global environmental problems, the challenge of how to build sustainably has become a significant consideration within the construction industry. Sustainable development emphasizes the concept of meeting the needs of the present generation without compromising the needs and wellbeing of future generations[2]. Applying this concept to the construction industry means to build without abdicating our environmental responsibilities.

According to The American Institute of Architects (AIA), building and the built environment play a major role in the overall human impact on the natural environment and quality of life.[3] The past decade has seen the increasing application of sustainable development concepts to the complete cycles of building projects from the feasibility study and design, through to construction and building operation, in order to improve the environmental performance of buildings, the aim is to improve quality of living and to minimize negative environmental consequences.

[1] Ding, G. K. C.: Sustainable construction - the role of environmental assessment tools. Journal of Environmental Management, 86, 451–464. 2008.
[2] United Nation. Our Common Future – Report of the World Commission on Environmental and Development. 1987
[3] The American Institute of Architects – Green Building Policy in a Changing Economic Environment. The American Institute of Architects. 2009

1.2 Initiatives toward Sustainable Building Development in the Construction and Real Estate Industry

Building performance has various meanings depending upon the actors and their different interests and requirements. When aiming to improve the environmental performance of a building, a comprehensive measurement of the building's quality and impact on the environment is needed. Efforts by individual countries around the world to mitigate the environmental problems caused by the activities of their construction industries have led to the creation of systems that can improve the environmental performance of buildings. These assessment methods shape projects to minimize negative impacts on the environment, or in other words, they minimize the load on the environment that the building activities produce. Environmental building assessment methods offer essential frameworks that explain how a building must be designed, built and operated based on sustainable development principles.

Many countries use environmental building assessment methods to measure the environmental performance of buildings. These methods incorporate sustainable development as their governing principle and cover economic, social and environmental factors. The method can be applied using a rating system which accommodates a certain level of certification that defines the performance of the building in the market as well as clearly identifying the sustainable components of a building's portfolio that have been taken into consideration.

Environmental building assessment methods cover several environmental criteria like energy efficiency, water use, pollution, resources, indoor air quality, site-ecology and so on. Each criterion is weighted according to its usefulness, importance, and influence in addressing and/or reducing existing environmental problems. Without a weighting system, all the criteria are given the same weight which will challenge the main purpose of the assessment method in solving the relevant environmental issues.[4] As it has clearly understood that each region has some specific environmental condition that can diver it from others. Different environmental condition has different environmental problems that have to be taken into consideration, therefore it is really important to add weighting system into the whole assessment system in order to address the most crucial environmental problem in that relevant region.

Most weighting systems represent the consensus views of government, education and research institutions and industry professionals. The more crucial step is the addressing of the relevant existing environmental problems at a local or regional level that can improve the accuracy of the system itself. Environmental building assessment methods were originally designed to cover buildings in their area of origin. However, different areas have different environmental issues that have to be taken into consideration. Generally, regional variation is inseparable from social and cultural variation and differences in climatic conditions, income levels, building materials, techniques, existing building stock and appreciation of historic value. Thus, at present, existing consensus-based approaches do not guide the assignment of weightings satisfactorily from a sustainability perspective because they fail to consider certain variables.

[4] Todd, J.A., Crawley, D., Geissler, S., Lindsey, G: Comparative assessment of environmental performance tools and the role of the Green Building Challenge. Building Research and Information 29 (5),324–335. 2001

1.3 Sustainable Development Policy and Methods in Indonesia

In 2011 the Indonesian construction industry contributed 6.5% to the country's gross domestic product. As a country that gets the majority of its income from its natural resources, Indonesia still suffers from unsustainable resource management, which has led to overexploitation and environmental degradation. The Indonesian construction industry also contributes to this severe environmental degradation due to the construction process itself, the operation of buildings and the accompanying waste produced by construction activities. Problems also result from the use of unsafe building materials that may harm the health of building's workers and end users, caused by a lack of rigorous consumer protection.

Moreover, in big cities like Jakarta, building development occurs not simply to meet primary needs, but also to satisfy less vital demands such as for new hotels and shopping centres, resulting in huge levels of new construction activity and products. This large-scale urbanization has increased the demand for new buildings which often replace green areas vital for water absorption. Pollution and lack of waste management have also led to serious problems for health and clean water supply. The need for action is pressing, both to prevent Indonesia from becoming trapped into a cycle of further environmental degradation and to protect vulnerable populations from the effects of climate change as they increasingly become manifest. Consequently, the Indonesian government has taken concrete action towards addressing these issues through the introduction of new policies and regulations, as well as the development of an environmental building assessment method that encourages building in an environmentally and friendly way based on the principle of sustainable development by the Indonesian Green Building Council.

From a global perspective, building assessment methods should take into account the fact that a greater proportion of the material production activity of the construction industry takes place in developing countries rather than in industrialised nations[5]. In recent years, interest in sustainable building and the environmental assessment of buildings has increased in the developing world. However, development of environmental building assessment methods and tools has been dominated by industrialised countries. Indeed, many developing countries have created assessment methods simply by adapting them from the existing advanced environmental building assessment methods of industrialised countries like BREEAM, GreenStar, LEED etc. As has been previously stated, tackling environmental issues requires combining a global perspective with an understanding of local and regional environmental problems because what leads to sustainability in one context does not necessarily lead to it in others. Therefore, this over-reliance on adapting methods devised by industrialised countries may result in sustainable construction initiatives in developing countries being ineffective and inefficient unless they are further clarified or altered.[6]

There have been some recent initiatives designed to help Indonesia walk this difficult path. For example, *Green Building Council Indonesia has developed a new rating tool called GREENSHIP, designed to assess new buildings and existing buildings in Indonesia. The rating system is divided into six aspects as follows:* Appropriate Land Use (Appropriate Site

[5] Haapio, Appu., Pertti, Viitaniemi: A critical review of building environmental assessment tools. Environmental Impact Assessment Review28 (8): 469-82. 2008.

[6] Cole, R.J: Building environmental assessment methods: redefining intentions and roles. Building Research and Information 35 (5), 455–467. 2005.

Development / ASD), Energy Efficiency &Refrigerants (Energy Efficiency & Refrigerant / EER), Conservation of Water (Water Conservation / WAC), Source & Cycle Materials (Materials & Cycle Resources / MRC), Air Quality & Leisure Air (Indoor Health & Comfort / IHC), and Environmental Management Building (Building & Environment Management).[7]

The rating system was developed through the cooperation of many stakeholders including industry professionals, industry, government, academics, and other organizations in Indonesia. GBC INDONESIA cooperated with the HK-BEAM Society from Hong Kong to develop GREENSHIP and itself emerged as an organisation as a result of cooperation with Green Building Council Australia. GREENSHIP itself is essentially a modification of methods devised for different countries and suffers from some of the problems already identified with such systems, i.e. it was arrived at through a simple consensus approach without further consideration of the environmental problems specific to Indonesia.

Together with the national and regional building regulations, the Environmental Building Assessment Method in Indonesia is presumed to be able to solve the existing problem and to prevent further environmental degradation. However, it is widely understood that green building is a relatively expensive investment and it's very difficult for investors to estimate whether it will bring a greater profit than a conventional building. Moreover, the economic condition in Indonesia is also known as one of the inhibiting factors making it difficult to the implement sustainable building.

Awareness of the importance of building sustainably has been increasing in some big cities in Indonesia recently. However, the ethical consideration is still insufficient on its own to encourage people to invest. Therefore, in order to successfully implement sustainable building, it is necessary to provide a sustainable cash flow for both the investor and the end user. Without a clear consideration of a sustainable cash flow there won't be any further investment in sustainable buildings.

The challenge for the Indonesian government is to deliver and actually implement an effective and efficient policy instrument that can address the specific environmental issues surrounding the construction industry in Indonesia while maximising the benefits to society of continued development. Their overall goal should be to encourage more investment in sustainable building developments by changing the dynamics of market forces in Indonesia in a way which leads to a higher demand for sustainable building from end users. This can only be achieved by making it easier for sustainable buildings to have a sustainable cash flow and become more profitable.

Real estate development in Indonesia like most developing countries in general still showed typical problems in the housing industry. These problems mostly occurred in big cities in Indonesia such as Jakarta, Surabaya, Medan and Bandung.

1.4 Aim of Study and Questions

The overall aim of this study is to develop an effective and efficient policy instrument addressing environmental issues relating to the construction industry that is efficient in terms of maximizing the benefits to society on the time axis. The associated overriding research question inquires: how to accelerate the expansion of Indonesian's construction and real estate towards

[7] Indonesian Green Building Council: GREENSHIP, Indonesia Green Building Rating Tools for New Building. Version 1,0. Guidelines. 2010.

sustainable development. Some questions were formulated to allow adequate examination of the overall aim of the study and respond to the overriding research question:

- What are the key issues that underpin the environmental performance of buildings in Indonesian real estate development?
- What are the lesson learned from the implementation of GREENSHIP in Indonesia?
- What is the main sustainability consideration in the Indonesian's real estate industry?
- How to effectively apply Building Certification System in order to accelerate the growth of Indonesian Real Estate Industry towards sustainable development?

1.5 Study Objectives

In line with the aim of the questions above, the practical objectives of the study were:

- Identifying the key issues that underpin environmental performance of buildings in Indonesian real estate development
- Develop a methodology for effectively incorporating these benchmarks into relevant Building Certification System in Indonesia
- Evaluating of GREENSHIP's scope, criteria, weighting system and its role in Indonesian's construction and real estate industry towards sustainable development
- Propose an overall implementation system of Environmental Building Certification System in Indonesia using market force approach
- Determination the contribution of the Environmental Building Certification System towards Environmental and Financial Aspects
- Finding the rationale behind the right criteria for Building Certification System in Indonesia

1.6 Organization of Chapters

This study will investigate how to accelerate the movement of Indonesia's construction and real estate industry towards sustainable development. The study material is arranged in seven chapters:

- Chapter One deals with the background to and initial statement of the problem, the aim of the study, main questions and related sub-questions as well as the practical and theoretical objectives.
- Chapter Two describes the context of real estate industry in Indonesia, housing condition, taxation as well as the initiatives of building stakeholders and regulation towards sustainable development as well as the relevant environmental issues. Two cities are used here as example of the more detail condition of Indonesia. Jakarta as capital and largest city in Indonesia is argued to be the best representative of urban condition in Indonesia. Surabaya on the other hand as the second largest city in Indonesia is used as the control-city as in order to have a comparison of Jakarta as the main object.
- Chapter Three provides a literature review concerning the classification of environmental building assessment methods and highlights the historical and theoretical background, characteristics, frameworks and roles of the existing methods. As well as the basic

definitions of sustainable development and the general development of the construction and real estate industry as it adopts sustainability principles.

- Chapter Four analyses and reviews the role of GREENSHIP in the Indonesian construction and real estate industry. This chapter also describes its benchmarks, sustainability targets, the assessment model itself, the history of its development and implementation as well as its effectiveness, financial efficiency and impacts on stakeholders.
- Chapter Five explores the main consideration of sustainable building investment from the end user perspective (housing or non-commercial buildings) including potential housing problems, willingness to pay in order to improve related problems as well as end user preferences and priorities toward sustainable buildings criteria. It scrutinizes relevant weighting system preferences based on empirical study conducted with questionnaire data collection and statistical data analysis method to support the further self-sustain financial model in order to establish a better sustainable building investment in Indonesia. This chapter discusses about the establishment of the questionnaire for empirical study purpose as well as proposes the method of analysis.
- Chapter Six presents funding and result of the empirical study, using statistical data analysis to describe the current problem or potential household as well as end user preferences toward sustainable building criteria. Furthermore, this chapter will also analyse the willingness of end users to pay for the solution of their housing problems and the improvement through green building criteria. A correlation analysis will be conducted between housing problems and existing green building criteria to identify the relationship in between.
- Chapter Seven is aimed to explaining the rationale behind the proposed green building criteria. This chapter begins with defining serious household problems and their causality in order to examine the role of each problem in the system. In addition, it observes the key characteristics that any such system must have to make an impact on the dynamics of the Indonesian market. A cross impact analysis will be conducted to support the reasoning behinds causality among serious housing problems. Lastly, factors influencing the housing industry in Indonesia towards sustainable development will be discussed.
- Chapter Eight presents the main findings and conclusions along with recommendations for the Indonesian housing industry along with suggested strategy that can accelerate the its development towards sustainable development, together with its implications, limitations and recommendations for further research.

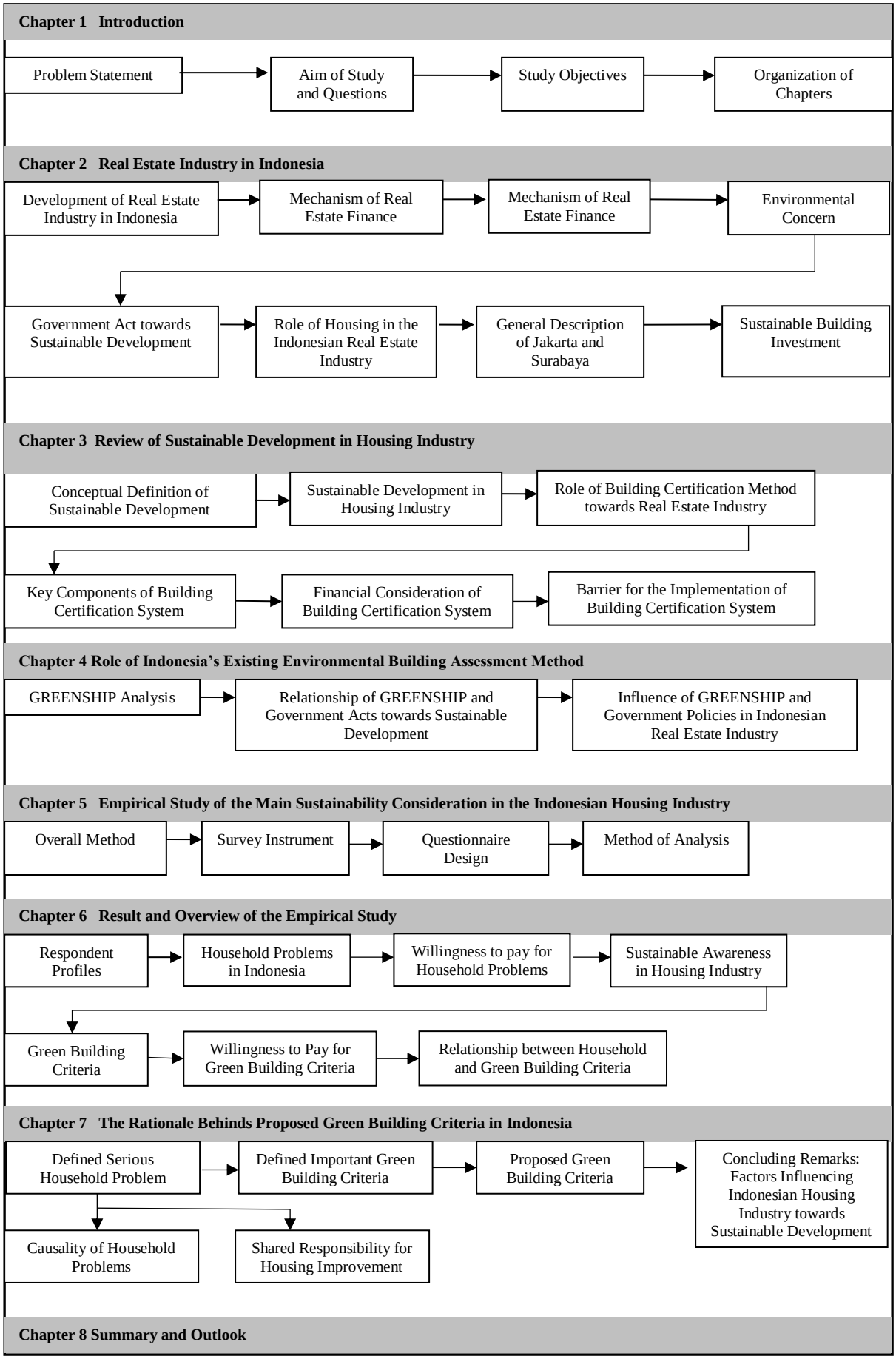

Figure 1: Research Flow Chart

2 Real Estate Industry in Indonesia

2.1 Overview

Development of the construction and real estate industry can bring massive transformation to the economy and society of a country. However, construction activity and operation of buildings has been accused of having a relatively large impact on the environment considering the size of their overall contribution to the total economy. Therefore, it is important to reconsider the way this industry does business. It is clear that there is a need to re-evaluate construction and real estate processes so that environmental principles, methods and approaches shape the whole enterprise. Indonesia urgently needs to go through this reform of its construction and real estate industry because its development has largely been uncontrolled and unprincipled, taking relatively little consideration of the environment and its essential contribution to a sustainable economy.

This chapter aims to describe the general economic condition of Indonesia, the contribution of the construction and real estate industry to the economy as a whole, the mechanisms of finance for the industry and actions that have been taken by relevant bodies to control development and drive it towards sustainability principles. It concludes with an analysis of the current status and identifies priorities for further change.

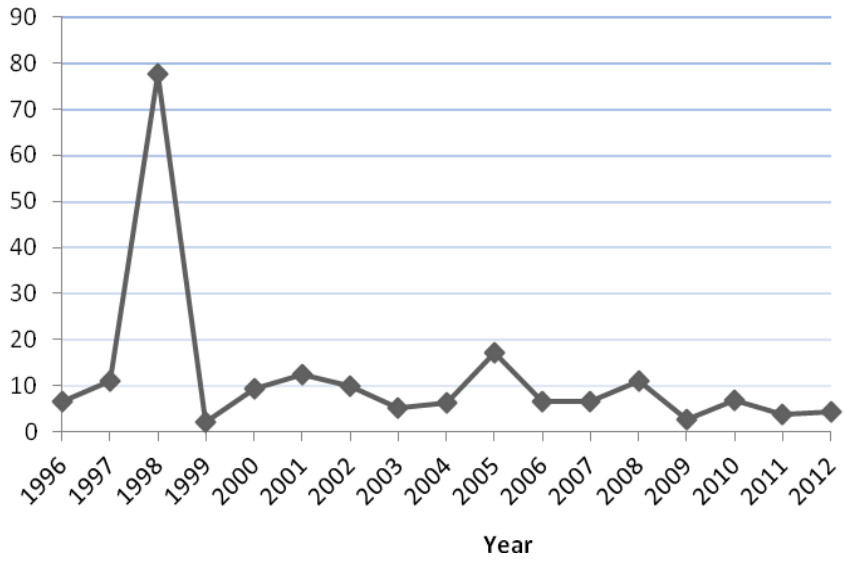

Figure 2: Indonesian Inflation Rate

Indonesia is the largest archipelago in the world consisting of approximately 17,508 islands and is located in Southeast Asia. With Jakarta as the capital city, Indonesia has a total population of more than 242 million people in 2011 making Indonesia the fourth most populous country in the world and the most populous in the Southeast Asia region, with the majority of the population living on Java Island. Decentralization in 1999 made the country's governing system more effective by transferring authority from national to local government in order to meet their specific needs and is much better suited to Indonesia with its incredibly diverse economy, society, culture and geography.

As a developing country and the biggest economy in the Southeast Asia region, Indonesia is still trying to rebuild its economic condition after the massive financial crisis of 1997-98 that hit most of the countries in Asia. Indonesia has been slowly recovering from this severe economic downturn. It enjoyed GDP growth of 6.4% in 2012 and has shown a big improvement post the financial crisis compared to most of its neighbouring countries.[8] This economic growth has successfully reduced the poverty rate from 17.8% in 2006, to 11.6% in 2012 based on the Indonesian Government's poverty line standards.[9] It has made substantial economic progress and successfully reduced the inflation rate from double to single figures and lowered government debt as a share of GDP. It expects its GDP to increase by an average annual rate of 7 percent until 2030[10].

A significant proportion of the Indonesian population is concentrated in Java due in part to the large-scale development of cities there. The diverse job opportunities offered by urbanization has led to villagers becoming increasingly attracted to move to the big city in order to increase their welfare. From 1971 until the end of 2010, the population of Java Island grew by 70 percent and this certainly compounded many environmental issues such as pollution, illegal housing, landfill in urban areas as well as a lack of young age workers in rural areas to support the agricultural sector. This in turn has created a bigger gap between urban and rural areas. Urbanization has been a key issue in big cities like Jakarta and Surabaya, with their enormous population growth. Therefore, local city governments are faced with worsening challenges to provide better infrastructure, transportation and employment. There is also growing demand for adequate and affordable housing and this has put more pressure on the government to develop an efficient housing system to protect the environment and to avoid further degradation from buildings activities.

Table 1: Indonesian Profile

Total population (2012) million	245.76
Annual population growth (2011-2012)	1.7%
Population of largest city million	10.19
Urban population (2011) million	107.88
Percentage of urban population (2011)	48
Households with improved drinking water (2011)%	55.6
Household with improved sanitation (2011)%	42.76
Household with electricity as lighting source (2011)%	94.38
GDP growth (2012) %	6.4
Inflation Rate (2012) %	4.6
Human Development Index (2011)	77
Agricultural Land (% of Land Area)	29.59

8 International Monetary Fund: IMF Survey Magazine; Countries and Regions. Indonesia. 2012
9 BPS-Statistic Indonesia: Poverty Line in Indonesia. 2014.
10 McKinsey Global Institute: The Archipelago Economy: Unleashing Indonesia's Potential. 2012

Meanwhile, local developers have been more attracted to investing in medium and large scale housing projects instead of small or affordable housing due to the low maximum price for small scale housing projects that are eligible for subsidized government mortgages. In other words, the minimum return on investment for small scale housing is a main factor that holds back developers from investing in it.

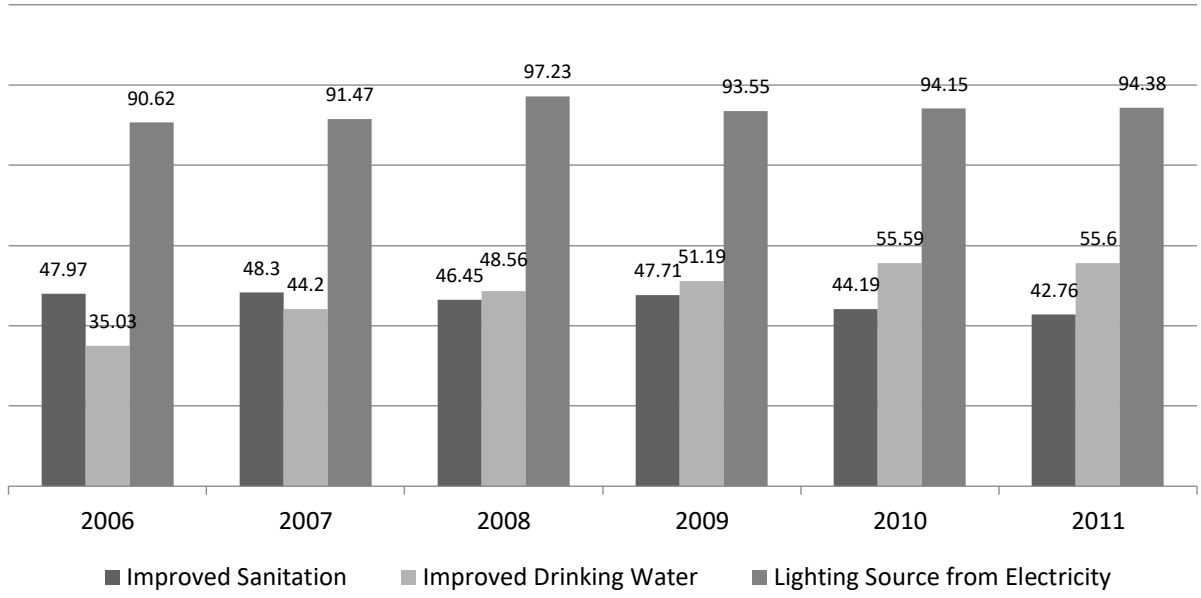

Figure 3: Percentage Households by Improved Drinking Water Source, Improved Sanitation and Lighting Source of Electricity in Indonesia

The continuing growth of the Indonesian economy will lead to the creation of a bigger consumer class that will need to be supported by adequate infrastructure and resources. In 2011, almost 95% of households in Indonesia were equipped with electricity as a lighting source, however the lack of improved drinking water and sanitation are still major problems for Indonesian households. Figure 11 shows that the percentage of households in Indonesia with access to improved drinking water decreased from 47.8% in 2006 to only 42.76% in 2011, making water supply and sanitation one of the most important priorities that must be addressed by the Indonesian government in order to improve the quality of life in Indonesia thoroughly and evenly.[11] The same problem also occurs for households in Jakarta but to more severely. The percentage of households with improved drinking water decreased from 34.81% in 2009 to 24.29% in 2011, which is more than a 10% decrease within 3 years (Figure 11). Thus it can be seen that access to the improved drinking water has been a major problem in some big cities in Indonesia, especially Jakarta due to the rapid urbanization.

Indonesia must face a number of challenges in order to improve its economy including equitable development throughout the whole territory of Indonesia. Since its geography is so diverse and it consists of so many islands, stretching 5200km from east to west and 1870km from north to south, it is much more likely to suffer from uneven development than other rapidly developing countries. Infrastructure development and housing construction in order to support the economic development of the country can tend to cause a variety of negative impacts on the

[11] Asian Development Bank: Country Profile Indonesia. https://www.adb.org/countries/indonesia/main

environment. In Jakarta, for example, the transformation of green land into office buildings and shopping centres has reduced the number and extent of rain water catchment areas. This is one of the main causes of flooding in some of Indonesia's big cities. Therefore, there is a need to focus more attention on environmental sustainability in order to improve the development of the country as whole.

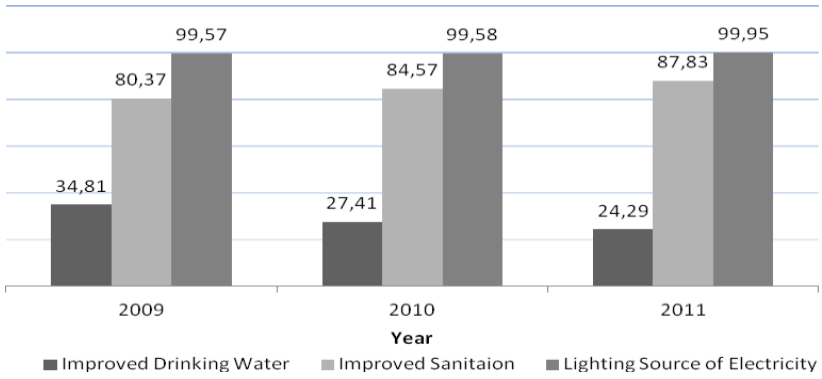

Figure 4: Percentage Households by Improved Drinking Water Source, Improved Sanitation and Lighting Source of Electricity in Jakarta

2.2 Development of Construction and Real Estate Industry in Indonesia

The construction and real estate industry is one of the largest industries in Indonesia, contributing almost 10 percent of the country's total gross domestic product. It provides a large number of jobs for unskilled, semi-skilled and skilled worker and makes a big contribution to the national economy. Inputs from other industries like materials, tools and equipment to support the ongoing construction is just one way in which activity in the construction industry generates multiplier effects for other sectors of the economy and stimulates employment and demand in other areas.

The construction and real estate industry generally grows in the same direction as the overall economic development of a country. In Indonesia, the growth of the construction and real estate industries is a reliable indicator of the growth of the economy as a whole. As well as this increasing activity in the construction and real estate industry encourages increased activity in other industries. However, oversupply in the property sector can lead to falling prices which can generate negative effect for the national economy[12].

The development of the construction and real estate industry in Indonesia reached its highest point before the monetary crisis hit the country in 1997 where the inflation rate was almost 80 percent. Massive development was largely funded from domestic and foreign debt. New banks were created by the private sector to provide credit for domestic businesses, an action which ended with the liquidation of several private banks by the government. This condition led to a serious problem when the exchange rate of the rupiah fell drastically against foreign currencies, making it impossible for Indonesian debtors to pay off their debts and interest

[12] Wuryandani, G.: Finance Behaviour in Property Industry. Bank Indonesia. 2005.

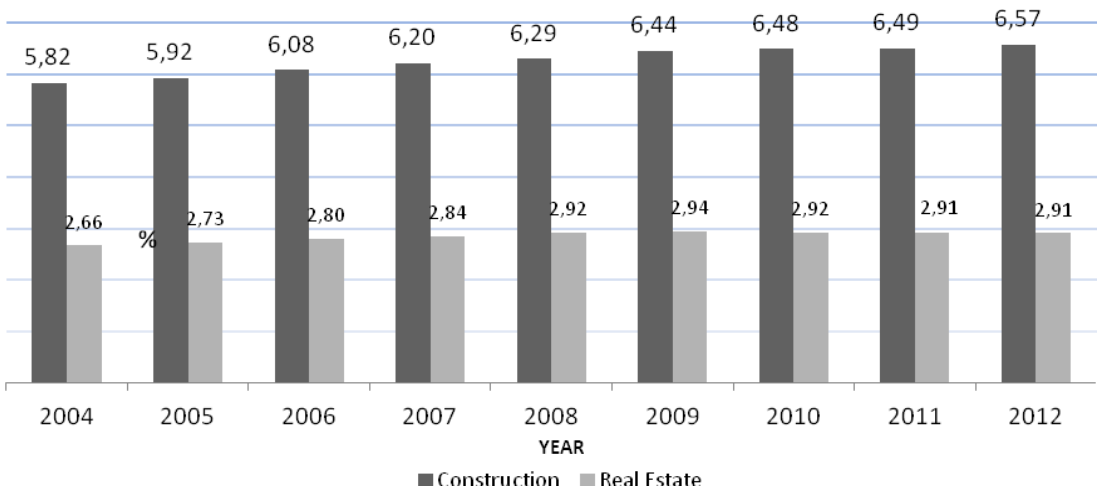

Figure 5: The Contribution of the Construction and Real Estate Industries in Indonesia

An improved political and security situation in the country after the crisis further enabled the development of the national economy where the value of completed construction building projects rose by more than 350 percent from 2004 to 2011, demonstrating the positive improvement of the construction and real estate sectors in Indonesia. In Jakarta, the stock of commercial and residential property such as office buildings, shopping centres/malls and apartments increased by 24 percent between 2008 and 2012. However, this number is still relatively small compared to the demand for new buildings each year, especially for residential purposes. In 2010, the shortage of housing properties reached 13.6 million with the new annual demand at about 800,000. What's more, these numbers are expected to keep rising together with the growing population in Indonesia as a whole[13].

Moreover, besides the slow post monetary crisis recovery process, investment in the construction and real estate sectors is still considered low compared to investment in other sectors such as transportation, electricity and trading.[14] There are some factors that hold back the Indonesian real estate market such as foreign ownership restrictions, high mortgage interest rates, red tape in government concerning regulations and building permits, high material costs and high tax rates. In the residential property market for example, the rising price of housing materials, high interest rates of mortgage, high down payment and the complexity of the bureaucracy are considered as the major factors that impeded the investment progress of the market[15]. Constantly increasing house prices in Indonesia are generally caused by the high price of main building materials like cement and the iron component of steel, rising on average at a rate of almost 10%, a rate that is expected to climb yet higher in connection with the rising price of fuel in Indonesia.

[13] BPS-Statistic Indonesia: Property Demands. 2010.
[14] BPS-Statistic Indonesia: Economic and Trade - Construction. 2014.
[15] Bank Indonesia: Survey Residential Property 2012 Quarter IV. 2012

2.2.1 Property Ownership in Indonesia

The 1960 agrarian regulation (No.50/1960) stipulated different categories of land titles, specifying different rights for each including the right to ownership, right to cultivate, right to build, right to use, right to rent and right to manage. However, the right to ownership can only be held by Indonesian citizen thus foreign ownership of land in Indonesia is against the constitution and land can only be held by Indonesian citizen. The 1996 regulation (No. 41/1996) stated that foreigners who reside in Indonesia or visit the country regularly for business purposes can purchase a home, apartment or condominium as long as it isn't a part of a government-subsidized housing development.[16] However, it is only limited to land-use deeds, which effectively gives foreigners the ability to lease a property for up to 70 years but prohibits them the right to actually own the apartment. These limited rights are further restricted by the fact that land-use deeds must be renewed every 25 years. These barriers against foreign ownership in Indonesia are arguably one of the key factors that hamper further international investment in the country.

Owning one's own home is by far the most common occupancy status in Indonesia, comprising 80 percent of all homes, with contract/lease occupancy making up around 9 percent. In Jakarta the percentage of housing ownership status showed just some slightly difference between the owned-house and contract/leases ownership categories, with 47% and 36% respectively in 2011[17]. This percentage shows that Jakarta has a much higher ratio of leased houses to owned house than the rest of Indonesia. This fact can be explained clearly by the greater proportion of simple flats and apartments built in Jakarta. This type of housing is preferred by consumers in Jakarta because it is strategically located in the city which can automatically reduce the time and costs of commuting to and from work – an important priority due to the city's severe traffic congestion problems.

Figure 6: Percentage of Ownership Status[18]

[16] The Indonesian Agrarian Law. The 1996 Regulation Number. 41 Year 1996.
[17] BPS-Statistic Indonesia: Percentage of Households by Province and Dwelling Ownership Status of Contracts / leases, 1999-2013.
[18] BPS-Statistic Indonesia: Percentage of Households by Province and Dwelling Ownership Status of Contracts / leases, 1999-2013.

2.2.2 Housing in Indonesia

Housing implementation in Indonesia has been determined by the government as an act to fulfilment of housing requirement as one of the human's basic needs for the enhancement and equalization of people welfare[19]. The realization of housing implementation is being conducted by national, province and local government.

Housing in Indonesia's biggest cities is quite similar overall consisting largely of landed house and flats. Landed houses can be categorized into:

- Planned house: houses that largely controlled by the developer, the concept offers a variety of residential living, geared towards middle and upper income people.
- Settlements: areas that grow independently initiated by the communities and spread organically within parts of the city, both downtown and in the suburbs. These grow naturally and tend to follow new road network and the development of areas of potential within the city.
- Slums: areas that were designated as legal settlements, but due to rapid population growth in the region, have made the area too congested to accommodate the ever growing population which results in the decreasing function and quality of the residential service.
- Squatters: housing occupying land in areas where it is not permitted, or in addition, is considered dangerous to the occupants or disruptive of the city's planning programs.

Multi-storey houses are categorized into simple flats and apartments. Simple flats are designed by the government or other providers (private, foundation, enterprises) to meet the needs of the low-income community so that they can afford cheap housing in downtown areas. Apartments, on the other hand, are specifically designed for the middle-upper income people, normally it is equipped with complimentary facilities like mall or shopping centre.

Widespread development of multi-storey houses in Indonesia's big cities has aimed to improve the efficiency and effectiveness of land utilization as well as providing open green space in urban areas by creating a complete, harmonious and well-balanced residential areas based on the principles of sustainability and environmental awareness. In addition, this development is basically suited to reduce land utilization and to prevent the emergence of slum and squatter housing. Multi-storey houses are pursued to meet the social and economic needs of society in order to improve standards of living by focusing on the fulfilment of adequate and affordable housing requirements especially for the low standard income people.[20]

Planning of multi-storey houses is generally carried out by calculation and consideration of building density, population density and total population, local spatial planning, infrastructure and other public utilities, transportation service, alternative of utilization concept development, concept of balanced occupancy and the potential needs of housing analysis. The development of multi-storey houses as public housing should meet the ecological requirements covering environmental harmony and balance function.[21]

Furthermore, owners of multi-storey houses are required to establish an association with legal entities known as PPPSRS (*Perhimpunan Pemilik Penghuni Satuan Rumah Susun*). Residents

[19] Law of the Republic Indonesia. Number 1, Year 2011 about Housing and Settlement Area.
[20] Law of the Republic Indonesia. Number 20, Year 2011 about Multi Storages Housing.
[21] Law of the Republic Indonesia. Number 20, Year 2011 about Multi Storages Housing.

associations can act externally and internally on behalf of the owner and with their authority to achieve order and peace within the buildings. [22]

In a big city like Jakarta, the need of a better housing management is really critical, due to the high rate of urbanization and the resulting increase in illegal housing. People who work inside Jakarta are mostly from smaller areas in the surrounding areas. However, due to the inefficient transportation system and traffic congestion problems, these people tend to stay inside Jakarta to avoid transportation costs. The local governments has developed some flats in order to accommodate the least wealthy segments of the population, however due to the high cost of electricity and water rates, in practice these simple flats are mostly occupied by the middle classes.

2.2.3 Building Permits

Building permits in Indonesia hold an important role in local city development and are used to ensure that building policies and regulations are adhered to. In Jakarta for example, based on the local regulation of 2010, there are two types of building permit that are required: an IMB (permit to build) and an SLF (Certificate of Worthiness). [23]

IMB is a license granted by the Government to owners of new buildings to build, modify, extend, and / or reduce the building in accordance with the applied administrative and technical requirements. IMB must be held by a building owner before the start of construction. Generally, it requires proof of land ownership, suitable city planning provision, a building layout plan, architectural drawings and structural calculations, with the drawings signed by a licensed construction planner.

SLF is a certificate issued by the Local Government for buildings which have been built and have met the eligibility requirements showing that they are in a fit state to be used. A building must have an SLF certificate before it is used. SLF certificates are issued with a validity period of 5 years for general buildings and 10 years for residential buildings. SLFs must be renewed before they reach its expiration date, by re-submitting an application for the extension along with a building assessment report made by a certified assessor.

SLF certification requires a building permit or IMB, proof of land ownership, a map of city planning, architectural drawings, structural building drawings, building installation as well as the layout of rainwater infiltration wells images and a building maintenance report by the local authority.

Along with the development of the construction and real estate industry that generates a high number of new buildings each year, local governments are forced to improve their local building regulations in order to further develop their areas and to prevent environmental degradation. Based on its requirement, SLF can be used as a tool by local governments to control the quality of buildings in order to meet the minimum updated standard of building regulations. For example, according to last updated applicable regulation, each building in Jakarta must be provided with rain water infiltration wells with the calculation of one well for every 25m^2 surface

[22] Law of the Republic Indonesia. Number 16, Year 1985 about Multi Storages Housing.
[23] Law of the Republic Indonesia. Number 28, Year 2002 about Building Regulation.

area of roof. The existence of SLF has made it possible for local governments to control the basic environmental performance and lifetime of buildings.

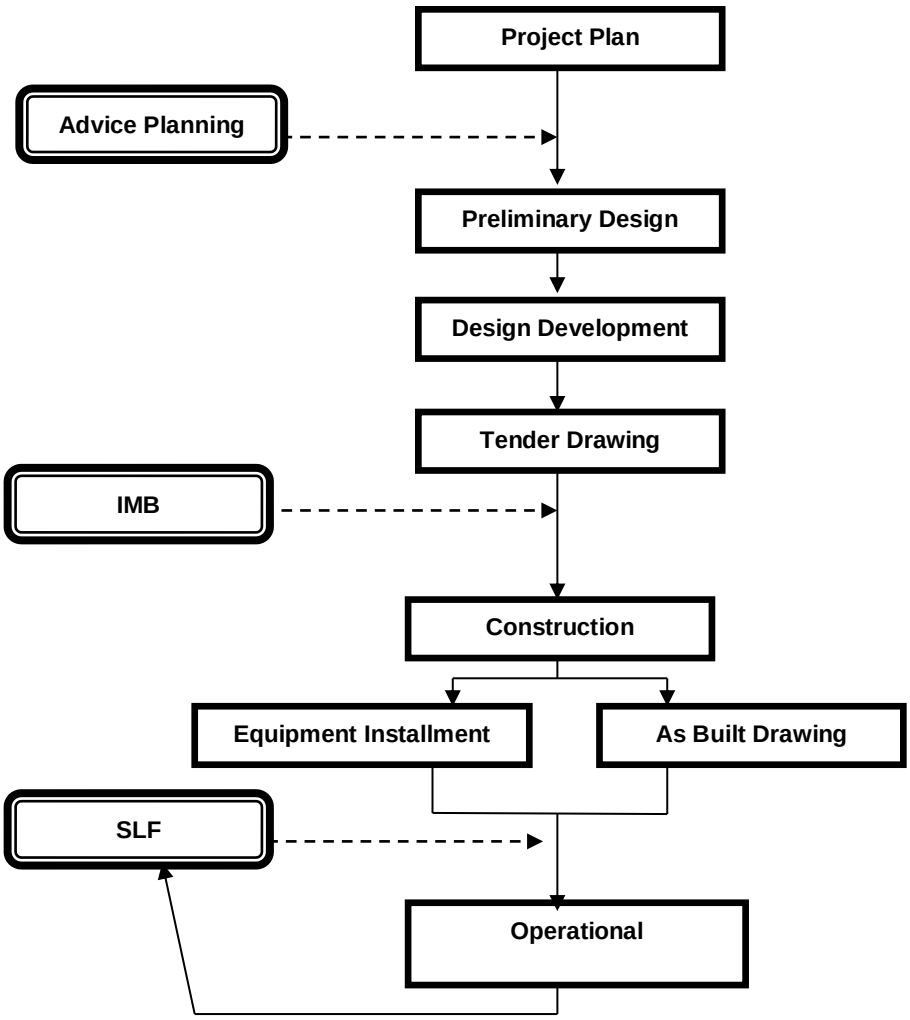

Figure 7: Building Permit Process

2.2.4 Property Tax

Property taxes in Indonesia are still considered high compare to countries in South Asia region, not only from the value of tax itself, but also the number of taxes that must be paid by both buyers and sellers are relatively more than taxes that are needed to be paid for property transactions in neighbour countries. High value and number of tax is one of factors that hampered the development of the real estate sector in Indonesia.

2.2.4.1 Land and Building Tax (PBB)

Land and Building Tax (PBB) is collected each year and applied to all taxpayers (property owners). Land and building tax or also known as PBB in Indonesia is a state tax levied on land and building due to the benefit and advantage from the owning of the land. It is mainly used as state revenue to provide facility for the local and central government. With the enacted of Act number 28 in the year of 2009, the whole management process of PBB will be conducted by local government. The amount PBB rate imposed on the taxable object is amounted to 0.5% of the Taxable Sale Value (TSV).

Basic calculation for PBB is the Taxable Sale Value (assessment value) or also known as NJKP, which is a certain percentage of the actual selling price. NJKP set as low as 20% (twenty percent) and a maximum of 100% (one hundred percent). NJKP percentage is stipulated by the Government to consider the condition of the national economy. The TSV is set at 20% of Sale Value Taxable Object (if SVTO less than 1 billion rupiah) or 40% of the SVTO (if SVTO worth 1 billion rupiah or more).

PBB= 0.5% x Taxable Sale Value (TSV)

2.2.4.2 Acquisition of Land and Building Tax (BPHTB)

Tax on Acquisition of Land and Building (BPHTB) is subjected to property buyers, the BPHTB is a levy on the acquisition of land and or buildings as resulted in obtaining legal rights and or buildings by a private person or entity.[24] The amount BPHTB rate imposed on the taxable object is amounted to 5%.

PHTB=5% x (Transaction Value-Taxes Acquisition Value of Taxable Object)*

**determined by local government*

2.2.4.3 Income Tax

Income Tax is a tax levied from the income resulted from land and building transfer. Tariff of the Income Tax from the transfer of land and building rights is amounted to 5% from the gross value of the transaction. However, for the simple houses and simple flats, the tariff is reduced to only 1% of the total gross value.

Income Tax= 5% x Transaction Value

[24] Law of the Republic Indonesia. Number 21, Year 1997 about Acquisition of Land and Building Tax. 1997.

2.2.4.4 Value Added Tax (VAT)

Value Added Tax (VAT) is an indirect tax imposed on the value of any goods or services in its circulation from producers to consumers. VAT is considered as indirect tax because the tax is not directly deposited by its insurer. VAT rate is 10% of the total value of the transaction. Simple houses that can be exempted from the VAT are houses that less than 36m2, with the selling price not more than 70 million Rupiah, first home is owned, used alone as a residence and is not transferable within a period of 5 years from the possessed time. Same exception is also valid for simple flat with the size of each residential building between 21m2 to 36m2, with the selling price not more than 144 million Rupiah.

VAT= 10% x Transaction Value

2.2.4.5 Transferable Tax

The transferable tax or also known as BBN (*Bea Balik Nama*) is tax charged to the buyer to return the name of the property in the transaction certificate from the seller to the buyer. Generally, property acquired by the developer, the biofuel tax administered by the developer and the consumer stay pay. However, if we buy a property individually, the cost of biofuel is administered solely by the purchaser or can be all taken care of by the notary. BBN tax rate varies in each region, but on average about 2% of the transaction value.

BBN= 2% x Transaction Value

2.2.4.6 Sales Tax on Luxury Goods (PPnBM)

The amount of PPnBM is 20% for luxurious houses, apartments and town houses. PPnBM is strictly subjected luxury homes, apartments, condos, town houses, and the like of the type of non-strata title with an area of 350 m2 or more and of a type of strata title with an area of 150 m2 or more.

PPnBM=20% x Transaction Value

Furthermore, there is a growing concern against new tax regulation aimed to buyers of apartment with unit price starting from IDR 5 billion which is categorized as super luxury object. This tax is also known as the super luxury tax regulation/income tax. Buyers will be required to pay tax in the amount of 5% that is deductible from their annual income tax.[25] Table 2 shows comparison between taxation for house and apartment in Indonesia.

[25] Colliers International: Jakarta Property Market Report. Research and Forecast Report. 2nd Quarter 2015. Colliers International. 2015.

Table 2: Property Taxation in Indonesia[26]

Type	Percentage	Criteria	
		Apartment	House
Transfer Tax (BPHTB)	5.0%	all types	all types
VAT (PPN)	10.0%	all types	all types
Land Registration	0.2%	all types	all types
Luxurious Tax (PPN BM) *	20.0%	>= 150 sq m	>= 350 sq m
Super Luxurious Tax/Income Tax (PPH 22)	5.0%	unit price > IDR5 billion or unit size > 150 sq m	land & building price > IDR5 billion or building size > 400 sq m
Total	40.2%		

2.3 Mechanisms of Construction and Real Estate Industry Finance

A survey conducted by Bank Indonesia in 2012 showed that 80% of end users/consumers chose bank credit mortgages to finance their property transaction, especially for small scale housing. The lowest mortgage interest rate that has been set by the government provided more advantages for low income consumers to access the credit facility. About 11.33% of consumers chose to finance their housing transaction with gradually cash deposits and the rest chose to pay in hard cash. With the majority of finance coming from mortgage, mortgage interest rate and down payment play an important role in mortgage credit investment and housing development as whole.

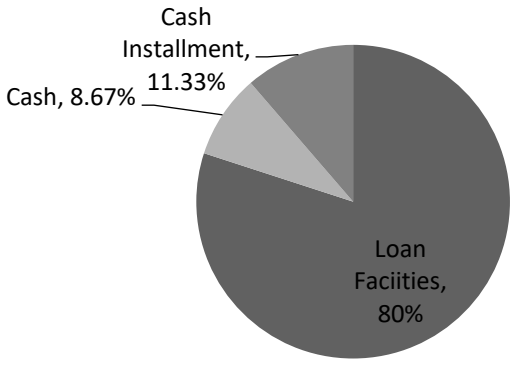

Figure 8: Consumer Financing Sources (Survey conducted by Bank Indonesia)[27]

[26] Colliers International: Jakarta Property Market Report. Research and Forecast Report. 2nd Quarter 2015. Colliers International. 2015

[27] Bank Indonesia: Survey Residential Property 2012 Quarter IV. 2012.

Developers on the other hand chose to use their own private funds to finance their property transaction, with more than 50% of the capital coming from these internal sources of finance and 32% from banking loans. However, this survey also shows that about 10% of developers earned their investment funds from consumer advance payments.[28] This type of funding method began to evolve among property developers in some big cities in Indonesia, where occupancy is firstly sold before the building is erected. This funding concept gives advantages such as reducing the investment risk for the investor.

Customer advance payment is retained by the indent concept where the housing concept is sold before the construction process. This concept is widely implemented by both private and public housing projects. Local governments in some big cities prefer to develop indent concept for small scale of housing in order to have enough occupant when the building is ready to be occupied. This condition will help preventing investment loss due to growing number of unoccupied houses. Beside it, immediate occupied houses can help developer or investor to file complain to the contractor if there is damage occurs during the period of guaranty time.

Indent property payment is usually conducted between buyer/consumer and developer directly or with bank as the intermediary side. Indent property that is held by bank is normally categorized as indent mortgage, where the down payment must be stored before the construction of the building. However, the transaction between the consumer and developer is only bounded by purchasing agreement, where the purchasing deeds can only be done after the building is completely constructed. Bank Indonesia, as the central bank, issued some property credit policies to increase the growth of housing credit by reducing the rate of mortgage, but at the same time increased the required down payment for housing credit to 30% for houses greater than $70m^2$ to avoid a property investment bubble. This increased down payment requirement for this type of housing is meant to prevent middle and upper-income society from using mortgage facility for non-consuming purpose, like leases/contracts to a third person.

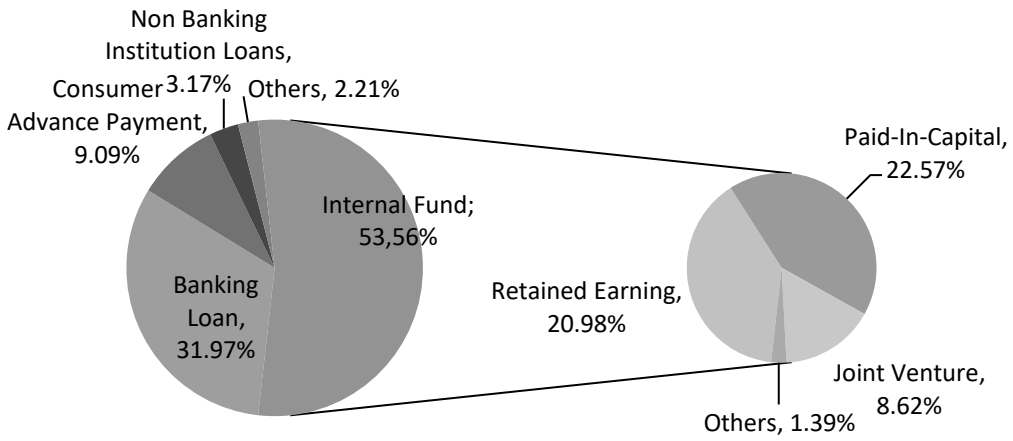

Figure 9: Developers Financing Sources (Survey conducted by Bank Indonesia)[29]

[28] Bank Indonesia: Survey Residential Property 2012 Quarter IV. 2012.
[29] Bank Indonesia: Survey Residential Property 2012 Quarter IV. 2012.

The secondary market for residential property in Indonesia is dominated by large and middle scale houses. However, the tendency of the consumer financing sources in the secondary market showed no difference with the primary market where more than 70 percent of the consumer chose to use the mortgage facility (KPR) and 16.13% finance through cash, with the rest using gradual cash deposits to purchase their houses[30].

Mortgage facility is still becoming the first option for consumer to finance their residential property, regardless new or existing houses transaction. This has showed that bank policies in mortgage interest rate hold big influence in the market growth of residential property in Indonesia.

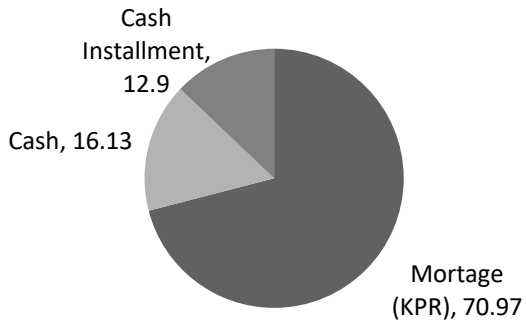

Figure 10: Consumer Financing Sources on the Secondary Market (Survey conducted by Bank Indonesia)

2.3.1 Mortgage

Mortgage or KPR (*Kredit Pemilikan Rumah*) in Indonesia is a credit facility provided by banks to individuals who want to buy or repair their houses. In Indonesia, mortgages are categorized into two types: subsidized and non-subsidized mortgages. A subsidized mortgage is a loan regulated by the government for a specific income level of society in order to meet their needs for housing or the improvement of existing property. Subsidized mortgages are intended for middle and low income people and in general the limitations set by the government are appropriate for the income level of applicants and the credit duration. A non-subsidized mortgage is a credit facility that is intended for the entire community where the mortgage provisions are set by the bank, so the determination of the amount of credit and interest rate policies are decided solely by the banks[31].

Mortgages are categorized as a consumer type of credit so it can only be used for consumptive activities where collateral/guarantee is required in order to complete the credit application. The guarantee can take the form of the house itself or a house that is already owned. Compared with other consuming loans like motor vehicle and multiple purpose credits, the housing credit is more highly prioritized by banks in Indonesia.[32]

[30] Bank Indonesia: Survey about Secondary Market. 2014.
[31] Bank Indonesia: Indonesian Mortgage Regulation (KPR).
[32] Bank Indonesia: Banking Survey, 2010-2012. 2013.

The mortgage market in Indonesia is dominated by banks, including state owned, private, regional and foreign banks. House and apartment ownership credit/mortgage make up the majority of the total value of property loans in Indonesia, followed by construction and real estate credit in second and third positions. In 2012, the value of mortgage credit comprised about 57 percent of the total property credit of Indonesia. However, this number is still considered low when compared to the growing demand for housing in Indonesia as a whole.

At the beginning of 2013, the growth of credit in construction, real estate and mortgage had begun to slow down compare to the year before. The slow growth of credit in house and apartment mortgages is essentially a consequence of the low credit distribution to the construction and real estate sectors. The high risk of construction industry is one of factors contributed to the shortage of construction finance as whole.

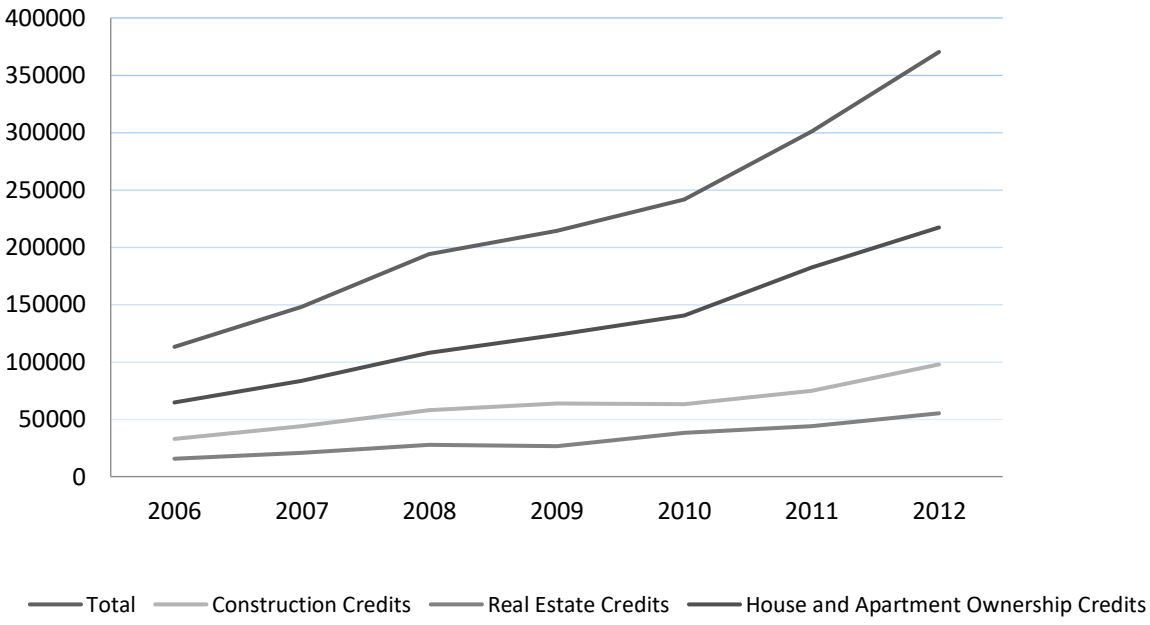

Figure 11: Outstanding Value of Property Loans in Indonesia by Type of Utilization

2.3.2 Secondary Mortgages Corporation

The rapid growth in mortgages sector has created an opportunity for banks to provide more mortgage products, however the long term credit facility for mortgage is normally funded by short term third party funds with the essentially fluctuated interest. This condition will create specific risks for banks like Maturity and Repricing gaps. The maturity gap is a gap between the source and use of funds, where mortgage as long term type of credit is funded with the short term fund putting bank in high liquidity risk. Furthermore, the repricing gap is a gap between the interest rate fluctuation of the source and use of funds, where the repricing of deposit interest rate is done monthly but the repricing of mortgage interest rate is done every 6 months or more. These risks have hampered banks from investing in mortgage facility even though it is potentially profitable.

Mortgages are a form of long-term loans past due for payment between 10 years to 30 years, while on the other side of the source of funds used by banks in mortgage financing is a short-term funding savings, deposits, and demand deposits. As a result of this structural imbalance, banks are reluctant to finance mortgage. SMF on the other side can be an alternative financing funding market that provides assurance to the primary banks in order to provide long term funds by issuing bonds. The collected funds from the bond issuance will be used later by SMF to provide long-term loans to banks that implement mortgage facilities.

The SMF was created by the Indonesian government to connect with Banks and other financial institution in order to provide mortgage facility. The SMF is owned by the government under the Ministry of Finance and was capitalized with Rp.1 trillion and it is permitted to reach Rp.4 trillion. In addition, SMF gained its capital by issuing long term and short term obligations to generate funds from public[33].

2.4 Environmental Concern

Geographically, Indonesia is routinely exposed to severe environmental challenges and natural disasters such earthquakes, volcanic activity and flooding. Environmental challenges faced by the Indonesian government include such things as forestry, air pollution, lack of access to improved drinking water, improved sanitation and over exploitation of natural resources.

In 2008, Indonesia was considered as the fifteenth highest CO_2 emission in the world with 37% of the emission came from electricity and heat production, followed by manufacturing industry and construction. Residential, commercial buildings and public service in Indonesia contributed about 6.28% of the country total CO_2 emission.[34] Although the building sector contributes a relatively small amount of CO_2 emission, the unsustainable development of building sector in Indonesia has created more pressing issues to the overall environmental.

Land subsidence has been reported in some of big cities in Indonesia like Jakarta and Semarang. In Jakarta, the over extraction of groundwater for both consuming and non-consuming purposes has caused land subsidence in some area of the city. In northern area especially, the land subsidence has reached approximately 60 mm each year, moreover since 1997 until 2007, the accumulation of land subsidence in some area of Jakarta has reached 80-90mm. This problem has brought bigger implication to the environmental degradation in Jakarta like flooding that happened every year especially in the lower area of the city.

Access to improved drinking water has been a main concern of the society in Indonesia especially in some big cities with relatively high population density. Obvious example can be seen in Jakarta, as the largest city in Indonesia, Jakarta has suffered from severe environmental problems like flood, land subsidence, pollutions etc. High population density in Jakarta has provoked other social issues like some illegal housing causing more and more accumulation of household waste in the watershed that took area of the river that causes water overflow rainy season due to the inability of the river to accommodate rainwater.

The development of a country is unavoidable but should be manageable in order to accomplish development with a proper vision – one that protects and preserves the environment and uses

[33] Presidential Regulation of the Republic of Indonesia No. 19/2005, dated 7 February 2005, concerning Secondary Housing Financing.

[34] The World Bank: Indonesia – Country at Glance. http://www.worldbank.org/en/country/indonesia

natural resources wisely in turn to improve the welfare and quality of human beings. In 1999, the government has acted upon the impact of development on the environment in Indonesia by issuing regulation about environmental impact assessments, also known as AMDAL (*Analisa Mengenai Dampak Lingkungan Hidup*), an environmental assessment of impacts from business and/or activities in Indonesia. AMDAL is required when planning a project if it is expected to have specific effects on the surrounding environment. It is a requirement issued by competent government authorities to obtain a license in order to conduct business or industrial activity. In practice, AMDAL aims to provide information for the public on the impact of a proposed business or activity.

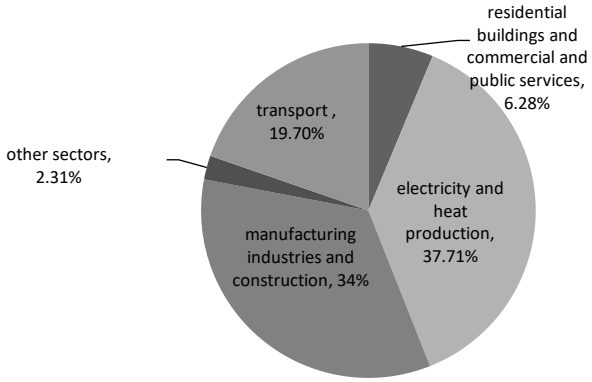

Figure 12: CO_2 Emissions in Indonesia broken down by Sources (2008)

Furthermore, Green Building Council of Indonesia has developed a rating system (GREENSHIP) to assess and to address the quality of building based on its environmental performance. The further discussion of GREENSHIP will be held in the upcoming chapter.

Indonesia has wide-ranging laws regarding utilization of natural resources and protection of the environment. However, the government tends to be reactive rather than proactive is this area, issuing regulations only after a significant problem has already occurred and been brought to their attention so that they are often a few steps behind where they need to be. More critically, the body of regulation that results from this piecemeal process tends to be ad hoc and fragmented, rather than representing a clear-minded, coherent and strategic policy. For example, requirement of environmental impact control is only applied for buildings that can produce some significant impacts as it is stated in The 2002 Building Regulation (No.28/2002)[35]. Weak enforcement of these laws and the development of a more proactive and strategic environmental regulation reform agenda remain key challenges for the government as it seeks to improve attitudes towards the environment in society as a whole.

[35] Laws of the Indonesian Republic Number 28 Year 2002. Building Regulation.

2.5 Government Acts Toward Sustainable Development in Indonesia

2.5.1 Conventional Building Regulation

Indonesian building regulation have been developed according to the need of the building industry requirement. Based on the existing law concerning building regulation in 2002, there have been several articles available that pointed out the importance of good balance between building and its surrounding environment. Furthermore, this conventional building regulation has already covers other criteria of green buildings in general such as health including sanitation and building materials, comfortability and safety requirements for the building users. However, a more detail indicators and measurement of the quality is still lacking from this regulation. Following table shows the articles of the Indonesian building regulation (Law Number 28/2002) that can be included or considered for the green building concerns.

Table 3: Green Building Aspects covered by Indonesian Building Regulation (Law Number 28/2002)[36]

Article	Requirements
15	Environmental Impact Control
16	Building Reliabilities: safety, health, comfort and convenience.
17	Building Safeties: structure and fire protection
21	Building Occupant's Health: air circulation, sanitation and lighting
26	Comforts: air comfort, spatial comfort and noise control
27	Conveniences: Reachable public transport and facilities

2.5.2 Green Building Regulation

Ministry of Public Works and Housing (PUPR) disseminates the Ministerial Regulation of PUPR Number 02 / PRT / M / 2015 on Green Building to support the action of greenhouse gas (GHG) emission reduction caused by the management of building. Buildings are estimated to have consumed more than one-third of the world's resources, 12% of total water supply, and accounted for nearly 40% of total emissions (IPCC Fourth Assessment Report on Climate Change, 2007).

With the publication of PUPR Regulation on Green Building, the arrangement on the building sector becomes clearer. In addition to climate change mitigation demands, these ministerial regulations consistently seek to realize sustainable building structures in accordance with Law No. 28 of 2002 on Buildings.

[36] Laws of the Indonesian Republic Number 28 Year 2002. Building Regulation.

2.5.3 Building Assessment Method and Certification

Green building assessment method and certification system has been developed as well in Indonesia by Green Building Council Indonesia (GBC Indonesia) as a non-governmental institution that is fully committed to community education in applying environmental best practices and facilitating the transformation of a sustainable global building industry. Founded in 2009 by professionals in the design and construction sector of buildings that have concern for the application of green building concept, GBC Indonesia aims to transform market and dissemination to society and building actors to apply the principles of green building, especially in building industry sector Building in Indonesia.

In achieving its objectives, GBC Indonesia works with construction sector actors, including construction service professionals, construction and property industry sectors, government through state-owned enterprises, educational & research institutions, professional associations, and environmentally-concerned communities. GBC Indonesia has 4 main activities, namely: Market Transformation, Training, Green Building Certification based on a typical Indonesian assessment tool called GREENSHIP, as well as cooperation programs with our stakeholders[37] Further discussion concerning GREENSHIP as the first and only green building certification system in Indonesia will be discussed on the fourth chapter.

2.5.4 Considered Indicators toward Sustainable Development

The implementation of Green Buildings in Indonesia as one of developing countries in Southeast Asia region has been facing the common problems that most of the developing countries tend to face in order to intellectually move the market force in general towards sustainability principles. The economic condition of the country and the social awareness of the importance of having an environmentally high performance buildings have most likely become the main factors hampering a country moving forward to the sustainable development. Moreover, lack of clarity in financial estimation of sustainable building investment has made it even more challenging for the government to rapidly influence the market towards it. Lack of clarity about the concept of sustainable development is believed to be one of the barriers for sustainable development progress[38]. The vicious circle of blame tends to be the main reason of why it is tremendously challenging to implement sustainable building principle in most developing country like Indonesia.

As it has been discussed on the previous chapter that non-commercial housing investment purpose in Indonesia is funded by banking credit (mortgage) which mostly supplied by the government through public banks in Indonesia. It is visibly important to discover the end user preference in housing credit in order to effectively influence the further investment towards sustainable development.

Building consumer as the end users hold an important role as whole in the practical implementation of sustainable building investment. Growing researches upon user perspective towards sustainable building development has been growing in the last decade. There is a

[37] Green Building Council Indonesia: www.gbcindonesia.org

[38] Adetunji, A., Price, A., Fleming, P.: The Barriers and Possible Solution to Achieve Sustainable Development. Centre for Innovative Construction Engineering, Department of Building and Civil Engineering, Loughborough University, Leicestershire.

growing need to understand the basic and advanced requirement of building user related to sustainable building investment. However, the basic question remains the same whether users are willing to pay for sustainable building and what criteria are most likely important for building user in order to invest in sustainable building.

2.6 Role of Housing in Indonesian Real Estate Industry

Universal Declaration of Human Rights article 25 has described housing as part of an adequate living standard. It stated that the right to housing is the economic, social and cultural right to an adequate shelter.

'Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control.'[39]

Housing as Human Rights was later described in the 1991 General Comment no 4 on Adequate Housing by the UN Committee on Economic, Social and Cultural Rights. Moreover, in 2006, The Yogyakarta Principles stated that everyone has the right to adequate housing, it stated:

a) take all necessary legislative, administrative and other measures to ensure security of tenure and access to affordable, habitable, accessible, culturally appropriate and safe housing, including shelters and other emergency accommodation, without discrimination on the basis of sexual orientation, gender identity or material or family status;

b) take all necessary legislative, administrative and other measures to prohibit the execution of evictions that are not in conformity with their international human rights obligations, and ensure that adequate and effective legal or other appropriate remedies are available to any person claiming that a right to protection against forced evictions has been violated or is under threat of violation, including the right to resettlement, which includes the right to alternative land of better or equal quality and to adequate housing, without discrimination[40]

Housing in Indonesia holds a more promising business investment from time to time, the crucial time after monetary crisis back in 1998 that caused real damage to the housing price has led the government to be more selective in Indonesian building investment regulation. Together with the growing demand for a proper housing especially in big cities like Jakarta and Surabaya, Indonesian government has established more sufficient type of housing investment through mortgage and subsidies in order to provide more housing and most importantly proper living condition for the society.

As it has been described on the previous chapter, housing in Indonesia has been described as a basic and need of every Indonesian citizen. This rule has somehow enhanced the necessity of a proper housing investment in Indonesia. Indonesian government on this term focusing to provide more sufficient housing for low income society by establishing some new policy for

[39] Universal Declaration of Human Right. Article 25. 1948

[40] The Yogyakarta Principles: Principles on the Application of International Human Rights Law in Relation to Sexual Orientation and Gender Identity. Principle 15. The Right to Adequate Housing. 2007.

mortgage rate and down payment systems, that favour low income society to an easier housing investment. Construction of affordable housing has been developed in many cities through the subsidies program of government providing houses below average market prices in order to accommodate low income society for a better living condition. [41]

Joko Widodo as the new elected president in Indonesia since 2014 introduced a one million housing program that meant to deliver more units of housing for low income society in Indonesia. This program has been implemented as National Movement that needs to be achieved with 13 provinces as ground-breaking.[42] The Indonesian housing program was basically developed targeting two million housing units yearly, with one million units provided by Indonesian government and one million units by private developers as commercial housing. Low income society here is described by Ministry of Public Housing as community with monthly income less than 2 million rupiah [43]. Indonesian Act of 1992 number 4 about Housing and Settlement has described housing as the basic of human needs in order to improve well-being as a necessity and obligation of the Indonesian government that must be met. National Housing (*PERUMNAS*) was founded in 1974 as an act of commitment by Indonesian Government to provide adequate housing in Indonesia as whole.

PERUMNAS is a State-Owned Enterprises (SOEs) in the form of Public Corporation (Perum) where the shares are owned by the Government. Housing was established as a government solution to provide adequate housing for the middle to the lower income society. The company was founded based on Government Regulation No. 29 of 1974, amended by Government Regulation No. 12 of 1988, and refined through Government Regulation No. 15 of 2004 dated May 10, 2004. Since it was founded in 1974, PERUMNAS always act as a pioneer in the provision of housing and neighbourhoods for the lower middle income people.[44]

Development of housing in Indonesia can never be separated from distinctive housing related issues such as limitation of government to provide housing facilities and infrastructure, the increasing of slums extent, lack of solid institutional and organizational housing and settlement development, the increasing number of household that have no proper housing, the gap (mismatch) in housing finance, the low housing efficiency, as well as limited housing finance and subsidy mechanisms that allow the misdirected in housing investment as whole.

2.7 General Description of Jakarta and Surabaya

Jakarta and Surabaya as two largest cities in Indonesia are covered by the empirical study as the closest sampling of urban living condition together with their housing development. Jakarta as the largest and most populated city in Indonesia can represent several household issues faced by people living in big cities of developing countries.

[41] Nugroho Tri Utomo.: Affordable Housing Finance Policies on Indonesia. Ministry of National Development Planning Republic of Indonesia. 2014.
[42] Detikfinance.: Government's plan to build one million houses per year. http://finance.detik.com/properti/2800149/1
[43] Indonesian Government Act. Public Housing. Number 5/PERMEN/M/2007. 2007
[44] Perum Perumnas. http://perumnas.co.id/sejarah-perumnas/

2.7.1 Overview of Jakarta

Jakarta is the capital city and the largest city in Indonesia, officially Jakarta is a province with its official name is Special Capital City District of Jakarta (*Daerah Khusus Ibukota Jakarta*). The province is grouped into five cities and one regency. Special Capital City District of Jakarta is headed by a governor and each of the cities is headed by a major. For administrative purposes, the municipalities of Jakarta consist of Central Jakarta, West Jakarta, South Jakarta, East Jakarta, North Jakarta and Region of Thousand Island which is collection of 105 small islands locating on Java Sea. As the most developed city in Indonesia, Jakarta can be used as an example or model for cities in other Indonesian cities in handling issues such as population, transportation and environmental issues.

2.7.1.1 Physical Features

Jakarta is located on the northwest coast of Java with total land area about 664 km^2 and 6,977.5 km^2 of water with 40% or about 240km^2 of it lies lower than the sea level, particularly the northern area. It is located on the northwest coast of Java with the topographical slope between 0° and 2° in the northern part and 0° and 5° in the southern part. The city is transferred by 13 rivers discharging in the Java Sea. Canal floods were made to control the water flow from the upstream and to regulate the quantity of the water coming into the city. South and East Jakarta bordered with Depok City, Bogor District, Bekasi City and Bekasi District, to the west are Tangerang City and Tangerang District (Figure 19).

Figure 13: Map of Jakarta

The first canal was West Canal Flood also known as Kali Malang was built in 1922 and the second canal or East Canal Flood was built in 1973 to solve the flooding problem due to the local rainfall and the flow from upstream in the eastern Jakarta, this second canal is also intended as the infrastructure for water conversation, ground water recharge and water transportation.[45]

The northern part of Jakarta is a plain land with most areas are actually below sea level and therefore subject to frequent flooding. The southern parts of the city however are hilly, and consequently designated for reservoirs. Ciliwung River divides the city into western and eastern principalities.

Land subsidence is one of the major problem in Jakarta, causing by extreme ground water extraction, construction loading from massive buildings, compressible alluvium and tectonic motion, this problem has been leading to serious building and infrastructure damage. [46]The massive development of real estate industry has transformed lot of green area in Jakarta into hard surface area that won't allow water absorption, this problem will lead into bigger problems like flooding and land subsidence due to the lack of water that can be seep into the ground to replenish the extraction of ground water. Moreover, land subsidence has generated inland seawater intrusion causing destruction of groundwater basin.

There are several direct and indirect impacts of land subsidence in Jakarta that influence infrastructure, environmental, economic and social aspects of the city. Direct impacts occur mostly on the infrastructure of the city such as cracking of permanent constructions and roads, tilting of houses and buildings, 'sinking' of houses and buildings as well as breaking of underground pipelines and utilities. Meanwhile, environment, economic and social aspects have been influenced by indirect impacts such as frequent coastal flooding, increased inland sea water intrusion, increase in maintenance cost of infrastructure, disruption to economic activities deterioration in quality of living environment and life disruption to daily activities of people [47]

2.7.1.2 Population

As the most populous city in the country, Jakarta was inhabited by more than 10 million people back in 2011 and the number has been increasing since then (Figure 2). As the centre of business in Indonesia, Jakarta suffers from the high number of urbanization, the attraction of big city life style and the variety of job fields have attracted more and more young people from the rural area to migrate to Jakarta for a better living standard. This massive urbanization has led Jakarta into an over populated city with severe problems like illegal housing, landfill, high criminality etc.

The population composition of DKI Jakarta in 2014 is dominated by productive age population (15-64 years) which is around 71.8 percent. Percentage of unproductive population (0-14 years) and non-productive or through retirement in 2014 continues to increase. This condition is like the two sides of the coin, that is, on one side it indicates the improvement in the health status of the community, whether the population is not productive or children / young age and also the

[45] The official Site of Jakarta Capital City. http://www.jakarta.go.id

[46] Abidin, H.: Land Subsidence of Jakarta (Indonesia) and its relation with Urban Development. Springer Science + Business Media. B.V. 2011.

[47] Abidin, H.: Environmental Impacts of Land Subsidence in Urban Areas of Indonesia. FIG Working Week 2015. From the Wisdom of the Ages to the Challenges of the Modern World Sofia, Bulgaria, 17-21 May 2015.

age of the population in Jakarta, but on the other hand, the burden must be borne by the productive population The more severe especially in older people (advanced age) where the health costs are getting higher.[48]

The growth rate of Jakarta's population is getting lower compare to the last decades, but the number of population still keeps raising up. Central Jakarta is the most populous area following by West Jakarta, South Jakarta, East Jakarta and Thousand Islands. Population number in Jakarta is particularly higher during the working days due to the number of people who work inside Jakarta but come from some surrounding areas, making Jakarta population increase comparing to the weekend.

2.7.1.3 Employment and Poverty

The number of people working in DKI Jakarta is mostly absorbed in the formal sector, such as government offices both central and regional, private companies and other business entities. During the last five years the number of formal workers tends to increase, from 62.09 percent in 2010 to 71.65 percent in 2014. While the informal workforce tends to decline from 37.91 percent to 28.35 percent in the same period. Increasing the proportion of labour in the formal sector will have an impact on the welfare of workers.

In the period 2013-2014, the unemployment rate in Jakarta shows a declining trend of 9.94 percent to 9.84 percent. The figure of 9.84 percent means that in 2014 out of 1000 working age population in DKI Jakarta 98 of them are unemployed. The highest open unemployment rate in 2013 is found in people living in North Jakarta area of 9.67 percent, although the figure is 0.66 points lower than the previous year. While the lowest unemployment in 2013 is in the Thousand Islands at 6.03 percent where it is known that most of the people work as fishermen.

Determination of the number of poor people in macro is determined by the determination of Poverty Line, it is used as a boundary to classify the population into poor or not poor. The poor are people who have an average monthly per capita expenditure below the poverty line. In 2014 poverty line in DKI Jakarta is about Rp. 447,797,00, which is an increase of about 40 thousand rupiah compared to the previous year. This resulted in the increased percentage of poor people for about 0.37 points to 3.92 percent position. The poverty rate in Jakarta for a decade is in the range of 3-4 percent only and it is already at the bottom (hard rock) so it is very difficult to expect the number of poor people to drastically decrease. The problem of poverty is not just the number and percentage of poor people, another dimension to note is the depth and severity of poverty. In addition to being able to minimize the number of poor people, poverty reduction policy also must reduce the depth and severity of poverty. The Poverty Depth Index has decreased from 0.63 in 2013 to 0.39 in 2014. The Poverty Severity Index decreased from 0.17 to 0.07. The decline in the values of these two indices indicates that the average expenditure of the poor tends to be closer to the Poverty Line, and the inequality in the expenditure of the poor is also narrowed.[49]

[48] Central Bureau of Statistic for DKI Jakarta Province. Regional Statistic of DKI Jakarta Province 2014.
[49] Central Bureau of Statistic for DKI Jakarta Province. Regional Statistic of DKI Jakarta Province 2014.

2.7.1.4 Housing Development

High demand for apartments in Jakarta was driven mostly by investors who are quite optimistic about business prospects in the coming years[50]. Housing in big cities in Indonesia include single-family detached home and apartment.

Jakarta as a metropolitan city becomes a magnet for the surrounding area, which has an impact on population growth. But the addition of the population is not balanced with the area of Jakarta City. So the city of Jakarta becomes very crowded and make property prices soar. The conversion of green open space to concrete can be seen also from the large percentage of housing that is not the ground floor (concrete). Since 2011-2013 as many as 99 percent more concrete-floored houses, only slightly left for water absorption. In terms of quality of residential buildings in Jakarta is relatively good. This can be seen from the number of buildings that have walled walls (92.48 percent), roof tiles (47.55 percent), private latrines (77.86 percent) and almost all housing facilities can enjoy electricity and drinking water from plumbing or packaging (bottled water).

The number of households with septic tank users for stool disposal is 93.76 percent by 2013. Increased awareness will result in reduced pollution of river and lake water. But there are still some things need to be the attention of the Provincial Government of Jakarta that is Waste Disposal Installation (WWTP). Most residents of Jakarta still dump liquid and solid waste directly into the sewer that will empty into the river or the nearest lake so the river water is still very dirty. Meanwhile, the narrower land in Jakarta makes has forced the local government take steps to provide flats at an affordable price that is by utilizing the land that is not so broad with open space facilities and sports venues. In 2013 the number of flats in Jakarta as many as 48 locations consisting of in Jakarta there are 15,615 units. Most of the Simple Flats are located in East Jakarta (15 locations) and North Jakarta (13 locations).[51]

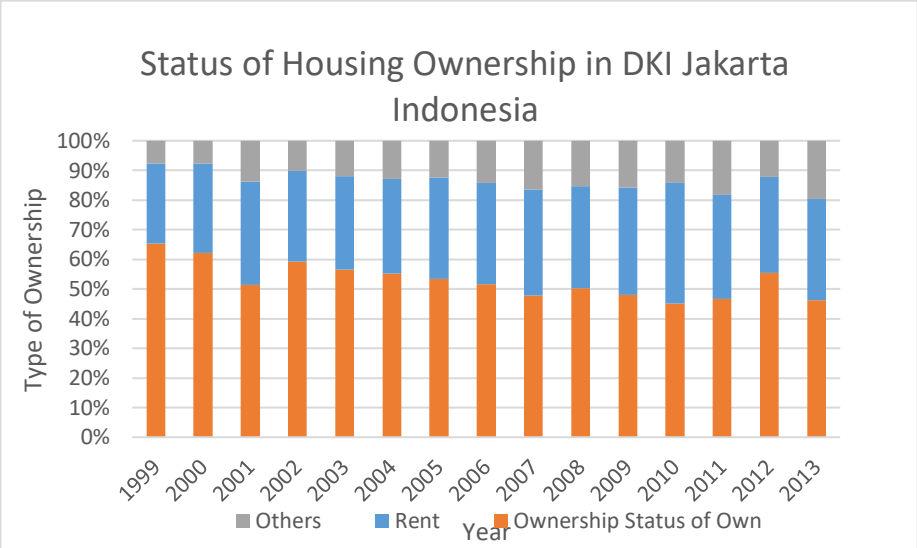

Figure 14: Status of Housing Ownership in Jakarta

[50] Colliers Indonesia. Jakarta Property Market Report. 2014.
[51] Central Bureau of Statistic for DKI Jakarta Province. Regional Statistic of DKI Jakarta Province 2014.

2.7.2 Overview of Surabaya

As the second largest city in Indonesia, Surabaya is also the capital city of East Java Province and the home of business activities in Indonesia with a tropical climate like other big cities in Indonesia in general containing two seasons in a year which are rainy and dry seasons. Rainfall in Surabaya averaged 165.3 mm. The highest rainfall above 200 mm occurred in the period January to March and November to December. The average air temperature in Surabaya ranges from 23.6 ° C to 33.8 ° C.

To serve the needs of clean water, the local government through PDAM is able to supply clean water almost to all areas of Surabaya. Several rivers are used as raw water source for clean water needs. The water gate located in several rivers in Surabaya is also used to provide clean water to the society. Meanwhile, electricity in Surabaya is served by PT PJB whose head office is also located in Surabaya. In the case of public administration services in Surabaya, municipalities have adopted an electronic-based public service system, such as providing a One Stop Service Integrated Service (PTSP) system to accelerate licensing services in Surabaya. In addition to PTSP, online licensing system is also applied by the municipality for efficiency in licensing, so that residents do not have to queue in obtaining licensing in Surabaya. Several awards were successfully received by Surabaya in terms of public services, such as the Future Government Awards 2013 in 2 fields at once, namely data centres and digital inclusion set aside 800 cities across Asia-Pacific.

2.7.2.1 Physical Features

Surabaya is located 796 km east of Jakarta, or 415 km northwest of Denpasar, Bali. Surabaya is located on the northern coast of eastern Java Island and facing the Madura Strait and the Java Sea. It covers an area of about 350.54 km² with a population of 2,765,487 people (2010). The Surabaya metropolitan area of Gerbangkertosusila with a population of about 10 million, is the second largest metropolitan area in Indonesia after Jabodetabek.

Figure 15: Map of Surabaya

Surabaya is located on the northern coast of East Java province. Its territory is adjacent to Madura Strait in the north and east, Sidoarjo regency in the south, and Gresik regency in the west. Most of Surabaya area is lowland that is 80,72% with height between -0,5 - 5m SHVP or 3 - 8 m above sea level, while the rest is hilly area located in West Surabaya (12,77%) and South Surabaya (6.52%). In South Surabaya area there are 2 slopes of slopes that is in the area of Tongue and Gayungan whose height between 25 - 50 m above sea level and in West Surabaya area has a contour of bumpy hills. The soil structure in Surabaya consists of alluvial soils, river and coastal sediments, and in the west there are hills containing high lime. In Surabaya there is the Kali Mas estuary, which is one of two Brantas River shards. Kali Mas is one of the three main rivers that divide parts of Surabaya along with Kali Surabaya and Kali Wonokromo. Rice fields and moorlands are located in the western and southern areas of the city, while the Tambak area are in the eastern and northern coastal areas.

2.7.2.2 Population

Surabaya is the second most populous city in Indonesia, after Jakarta, with 2,765,908 recorded in the chartered city limits in 2010 census.

Table 4: Number of Household and Population in Surabaya in 2010

Region	Number		Population of Household's Member
	Household	Population	
Central Surabaya	84585	320233	3,79
North Surabaya	127095	473562	3,73
East Surabaya	211961	745807	3,52
South Surabaya	184004	676876	3,68
West Surabaya	102346	383318	3,75
Total	709991	2599796	3,66

2.7.2.3 Economy

Surabaya's strategic location which is almost in the centre of Indonesia and just south of Asia makes it one of the most important hubs for trading activities in Southeast Asia. As a metropolitan city, Surabaya became the centre of economic, financial and business activities in East Java and beyond. As a trading centre, Surabaya is not only a trade centre for East Java but also facilitates areas in Central Java, Kalimantan and Eastern Indonesia. Surabaya and the surrounding area is the most rapid economic development in East Java and one of the most advanced in Indonesia. In addition, Surabaya is also one of the most important cities in supporting Indonesia's economy. Most of the population is engaged in services, industry and trade. Surabaya is a fast growing trading centre. Major industries include shipbuilding, heavy equipment, food processing and agriculture, electronics, home furnishings, and handicrafts.

2.7.2.4 Housing Development

As it can be seen on the following figure, status of housing ownership in Surabaya during the period of 1999 to 2013 doesn't show much of numerous change.

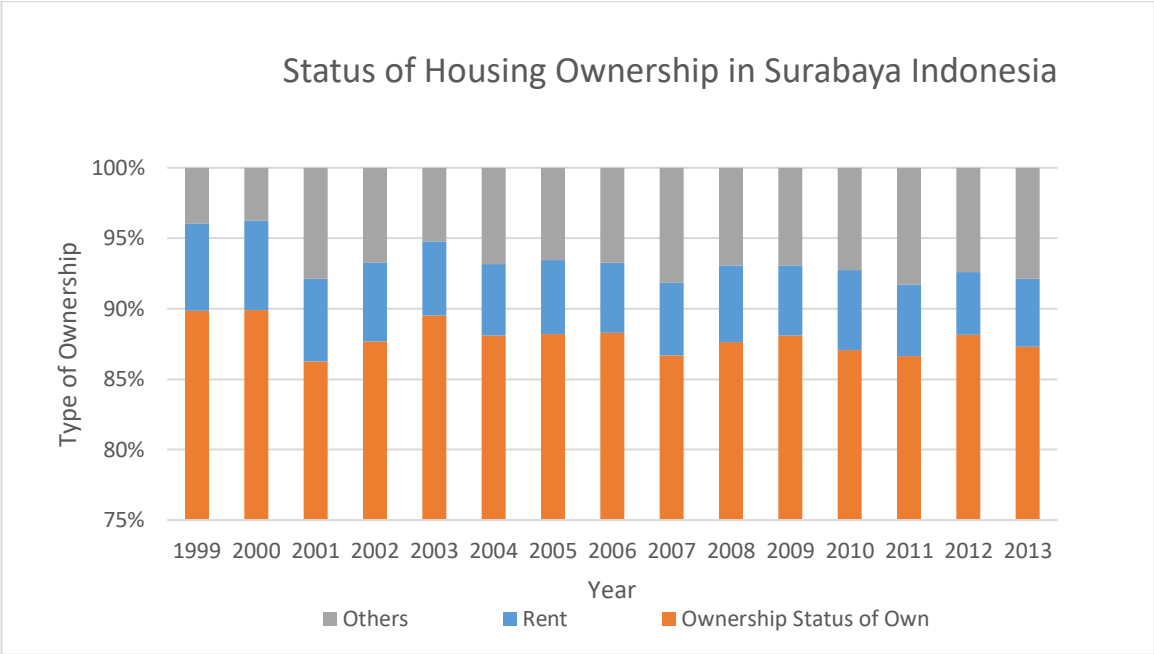

Figure 16: Status of Housing Ownership in Surabaya (1999-2013)

After Jakarta, Surabaya is one of the biggest business centre activity in Indonesia, the Central Surabaya is dominated by middle to upper class apartment projects. Meanwhile, area like west Surabaya provides more class variation of apartments (low to upper class). End-users are allowed to have options for both rental and buying according to their cash flow condition. [52]

2.8 Concluding Remarks

Rapid urbanization in Indonesia needs to be taken seriously. As well as the rapidly growing population in Indonesia that is leading to over population in some large cities, such as Jakarta, urbanization has also created a bigger gap between urban and rural areas causing productivity to decrease in the agricultural sector. This problem occurred because most people of productive age left rural areas to work in the cities.

The amount of new housing needed in urban areas is increasing year on year. In Jakarta for example, local government needs to come up with a better and more efficient financial system in order to provide a sufficient number of affordable houses for low income people that mostly cannot afford to have adequate housing with improved drinking water, sanitation and electricity as the lighting source.

[52] Colliers International: Surabaya Property Market Report. 1st Half Year 2014. Research and Forecast Report. 2014

The high demand for housing caused by ever growing populations in big cities like Jakarta has generated a serious concern in society about the impact of all the construction activity required to create sufficient housing. The growing housing stock produced by the construction industry is always accompanied by increased facility and infrastructure development. This massive development often results in the development of Greenfield that destroys biodiversity and natural habitation.

Indonesia as a developing country suffers from a lack of the experience in sustainable development concepts and implementation. At the same time, current evidence of environmental problems in the country needed to be taken instantaneous, therefore it is a challenge for the Indonesian government to introduce and prevail the importance of environmental awareness into every layer of society all over the country. Moreover, a well-organized system is needed to monitor and control the implementation of specific policies and regulation over environmental protection in the country.

With the growing concern of the environmental protection among the society in Indonesia, there have been many concrete actions taken in order to protect the environment in general by reducing the impact of construction activities and building operations. Indonesian green building council has launched a building rating and certification system called GREENSHIP to improve the environmental performance of Indonesian buildings. However, from the time it was launched in 2009 until now, there have only been eight buildings implementing the green building concept by GREENSHIP.

Indonesia expects to increase the number of new local building regulations concerning environmental performance and to issue a ministerial regulation about technical guidelines for green building in 2013. However, various economic levels of the society can be factor that slows down the development of the green building regulation especially in some poor area with low regional gross domestic product. This leads to the limitation for the government in enforcing the implementation of the regulation in every type of building. In Jakarta for instance, the local government has issued a new green building regulation to improve the environmental performance of new and existing buildings. However, it is only limited to specific sizes of buildings (>5000m^2 only).

Furthermore, the image of green building is still considered by the majority of Indonesian society as an expensive and unnecessary investment. Interviews conducted with several local developers in Surabaya showed that housing consumers did not consider environmental performance as a main requirement or criterion for their future houses due to the high initial cost of green building investment.

Ethical considerations of environmental awareness are still the only reason behind the investment in green buildings, especially from the individual end user. However, lessons learned from other industrial sectors like the manufacturing industry showed that local companies have improved the quality of their manufacturing business by obtaining some international standardization like ISO etc. as a way to compete in the global market that generally require a high standard of quality with a correspondingly improved responsibility for the environment. The same thing can be implemented in the construction and real estate sector by changing the market dynamics to the direction where environmental performance is a main requirement of adequate housing.

Social awareness for the importance of environmental sustainability is still relatively low within Indonesia. There is little awareness or understanding of its importance amongst the poorer and less educated echelons of society. Furthermore, most simply don't have enough money to choose to build sustainably if they wanted to. Therefore, the government can only hope to enforce the implementation of green building regulations for the middle and upper classes. The only possible mechanism available to the government that they could use to direct the poorest within Indonesia towards making environmentally sustainable development decisions would be to offer financial incentives as a positive reinforcement, e.g. preferential mortgage rates for new buildings that meet strict environmental criteria. And of course, there is nothing to stop the government offering similar incentives to the middle and upper consumer classes. Such a scheme would undoubtedly need huge capital backing and thus the support of international funding institutions. However, it could have a dramatic positive effect on the dynamics of the market pulling them towards sustainable practices through powerful financial incentives.

3 Review of Sustainable Building Development

3.1 Introduction

The importance of building environmental performance has been widely recognised. Construction process and the building operation consumed large amount of natural resources and discard pollutions to the surrounding environment, putting building industry as one of the highest energy consuming and emission disposal in the world. Growing concern of the damaging impacts of building have generated global movements in order to protect the environment from any further degradation caused by building activities.

Building assessment method were originally developed to measure and assess some specific aspects of buildings such as construction and operational costs, however the assessment has been improved with the additional consideration of the environmental impact of building through its life cycle. Moreover, the term of sustainable building has been added as the main consideration of building assessment method and lastly it goes further to an integrated system covering issue such as water, energy, natural resources etc. to its main assessment components [53]. The assessment was initially proposed to state the difference between high performance building and conventional building, validating the benefits of sustainable building and its impact to the environment. These tools are also known as sustainability building assessment tools consisting of rating and certification system to rate and to outline the environmental performance of buildings in the market. Along with its implementation, high environmental performance building or also known as green building has been appeared as building method implementing sustainable development as its basic planning principle [54].

Building Research Establishment Environmental Assessment Method (BREEAM) was launched in 1999 as the first environmental building assessment method in the world. With 250,000 certified buildings, BREEAM has become the foremost building assessment method in the world focusing in energy demand minimising. The launch of BREEAM in the United Kingdom has driven the development of more building assessment methods all over the world. LEED or Leadership in Energy and Environmental Design was developed by the US Green Building Council to assess both new construction and existing buildings in some categories with major credit categories such as Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, and Indoor Environmental Quality. LEED was created to define measurement standard for green building, encourage awareness in the benefits of green buildings and to transform the building market.

In addition to BREEAM, LEED is the most widely used system. It has set itself the task of setting globally accepted standards for buildings that are termed "green" in terms of sustainability. With the introduction of LEED, a global acceptance of standards for measuring sustainability was achieved through performance criteria. Thus, architects, builders and all persons involved in the construction of a building are given an instrument which makes the impact of their activity on the building directly measurable and comparable to properties of different classes of use. To make this possible, the USGBC has developed rating systems. LEED has developed various ratings for different types of use. In order to obtain a LEED

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[53] Lützkendorf, T and Lorenz, David P.: Using an Integrated Performance Approach in Building Assessment Tools. Building Research and Information, 34 (4), 334-356. 2006

[54] Berke, Philip R and M. Manta Conroy. Are we planning or sustainable development? An evaluation of 30 comprehensive plans. Journal of the American Planning Association 66 (1): 21-33. 2000

certification seal, a building must meet certain criteria through the life cycle of a property. These criteria are divided into six main categories, with certain criteria being referred to as prerequisite and others as subcategories (electoral point, credit). A building with a LEED badge will be awarded only if all prerequisite criteria are met, a certain number of points from the subcategories (electoral points), and a minimum number of electoral points in a category[55]. Furthermore, many others assessment methods have been developed to meet specific local needs of countries all over the world with majority adopted BREEAM, LEED and GREENSTAR as their basic principle of sustainability assessment.

There had been a need to develop a more globally assessment system that can be used to assess buildings all over the world in order to have the same component of criteria applied for building certification. Green Building Tool (GBTool) was the first assessment method that enables adjustment through regional variation by changing the proportion of the weighting system. However, the subjectivity of the users in weighting adjustment to suit local needs might hamper the origin goal of sustainability. This subjectivity of the weighting system adjustment is also known as one of the weakness of the GBTool[56].

There are growing concerns in the implementation of environmental assessment methods, such as lack of proper weighting system consideration and the limitations that reduced the effectiveness and usefulness of the assessment method. Therefore, it is important to discover the basic component and role of the building assessment method in order to generate a more useful method covering the needs of buildings actors as whole.

This chapter aimed to give overview about the existing ongoing environmental building assessment methods with sustainable development as the basic principle. It provides overall analysis of building assessment methods such as key components, role and the barrier of its implementation. Lastly, this chapter delivers concluding remarks as the overall analysis of the existing environmental assessment methods.

3.2 Conceptual Definition of Sustainable Building Development

Sustainability is the main focus of Building Assessment Method. Hence it is important to recognise the basic principle or concept of this term. Along with the continuously development of advanced technology, living standard and problems that occurred due to these changing, there is an urgent need to objectively deliver the actual principle of sustainability in order to cover the entire development as whole. What is sustainability, where does the term come from and what is the main idea behind it are the basic questions that have to be answered in order for the term to be intelligently used and applied to solve the upcoming issues.

The concept of sustainability has been widely known among global society. In 1962, in the book Silent Spring by Rachel Carson showed the first indication that bring together the term of environment, economy and social well-being connectivity, followed by the establishment of Environmental Defence Fund (EDF) in 1967 that aimed to pursue legal solutions to environmental damage. Subsequently, many more matters toward the principle of sustainability

[55] Vgl. Zimmermann, Josef: Immobilienprojektentwicklung. Vorlesungsskriptum zur gleichnamigen Vorlesung am Lehrstuhl für Bauprozessmanagement und Immobilienentwicklung an der Technischen Universität München.

[56] Crawley, D., Aho, I. Building environmental assessment methods: application and development trends. Building Research and Information. 27 (4/5), 300–308. 1999

started to globally rise[57]. The term of Sustainable Development was basically popularized in 1987 by the report of the World Commission on Environment and Development also known as Bruntland Report that piles the social, economic, cultural and environmental issues as well as the global solutions.

3.2.1 Etymology of Sustainability

The word 'Sustainability" is derived from the Latin *sustinere* (*tenere*, to hold; *sus*, up). *Sustain* can mean "maintain", "support", or "endure" which mean "capable of being continued at a certain level"[58]. The word maintain here can is highly related to time value, which can be understood as continuously process. The history of sustainability traces human-dominated ecological systems from the earliest civilizations to the present time. This history is characterized by the increased regional success of a particular society, followed by crises that were either resolved, producing sustainability, or not, leading to decline. In early human history, the use of fire and desire for specific foods may have altered the natural composition of plant and animal communities. In the 21st century, there is increasing global awareness of the threat posed by the human greenhouse effect, produced largely by forest clearing and the burning of fossil fuels.

3.2.2 Global Definition of Sustainable Building Development

Brundtland Report in 1987 stated Sustainable Development as "development that meets the needs of the present without compromising the ability of the future generations to meet their own needs". Two main concepts could be extracted from this definition which are: concept of needs, which pinpoint on the need of world's poor, to which overriding priority should be given. The second concept is the idea of limitation, which imposed by state of technology and social organization to meet the present and future needs[59].

The term of Sustainable Development has been introduced widely to its most significance since then. This term of Sustainable Development by Brundtland Report promoted development that covers three main aspects such as environmental, social and economic sustainability.

This concept later on developed as the Triple Bottom Line concept focusing on the environmental, social and financial performances. Sustainable development promotes a financially sustainable condition with respect to environmental consideration as well as social responsibilities. Environment is the primary idea of sustainability, everything has to be cleverly managed in order to serve a better environmental ailment. Moreover, environment is known as the basis of sustainable development which provides an ideal condition due to the dynamic growth of economic and social progression that often create an unbalanced or injustice environmental condition in general.

Furthermore, according to DuBose et al, "sustainability offers a way of interacting with our world which reconciles the ubiquitous human desire for a high quality of life with the realities of our

[57] Sustainable Development Timeline. The International Institute for Sustainable Development (IISD). 2012.
[58] Onions, Charles, T.: The Shorter Oxford English Dictionary. Oxford Clarendon Press. p. 2095. 1964
[59] International Institute for Sustainable Development (IISD): Sustainable Development. www.iisd.org/topic/sustainable-development

global context. It calls for unique solutions for improving our welfare that do not come at the cost of degrading the environment or impinging on the wellbeing of other people".[60]

3.2.3 Academic Definition of Sustainable Development

Department of Construction Project Management and Real Estate Development defines Sustainable Development (Lehrstuhl für Bauprozessmanagement und Immobilienentwicklung an der Technischen Universität München) as *"a future-oriented, inherently viable and enduring development process for ecological balance, economic security and social justice. I.e. ensuring the future ability to face requirements subject to modification"*. This means that sustainability is the guarantee for the future ability to successfully meet the changing requirements. In this sense, the idea of sustainability also means a return on the risk in the development, construction and operation of buildings. The goal of sustainable construction is, above all, the orientation of real estate development primarily to values such as functionality with regard to the optimization of the business processes of the users (reduction of the risk of vacancy or loss of rental income), reduction of the life cycle costs in their relation to the income in the sense of conserving resources, increase The economic useful life and integration of the property in urban development under ecological and sociological aspects[61]. Sustainable construction aims at minimizing the consumption of energy and resources as well as minimizing the burden on the natural environment for all phases of the lifecycle of buildings from planning, construction, use and renewal to deconstruction[62]. The absolute value of the life cycle costs must be measured against the values (traffic value, quality of residence, etc.) achieved by them. The sole demand to reduce lifecycle costs is not a criterion for sustainability [63].

Furthermore, in the extreme case, "life cycle costs = 0" means that there is no investment at all and therefore no building activity takes place. The original function of real estate would no longer be fulfilled. In order to meet the objectives of sustainable construction, the following criteria must be met:

- Sustainable use of energy resources
- Sustained use of public goods (clean air)
- Use of environmentally friendly building materials
- Special consideration of the environment and cosiness
- Sustainable building operation

The goals of sustainable construction are the hallmarks of buildings that have been built in the sense of sustainability. Since the early 1990s, the term "green building" has been used for these buildings.[64]

[60] DuBose, J.R. and Pearce, A.R. (1997) The Natural Step as an assessment tool for the built environment. Proceedings Second International Conference on Buildings and the Environment, CSTB and CIB, Vol. 2, Paris, June, pp. 595-602.

[61] Vgl. Zimmermann, Josef: Immobilienprojektentwicklung. Vorlesungsskriptum zur gleichnamigen Vorlesung am Lehrstuhl für Bauprozessmanagement und Immobilienentwicklung an der Technischen Universität München.

[62] Vgl. Bundesamt für Bauwesen und Raumordnung: Leitfaden des nachhaltigen Bauens, 2001.

[63] Vgl. Zimmermann, Josef: Immobilienprojektentwicklung. Vorlesungsskriptum zur gleichnamigen Vorlesung am Lehrstuhl für Bauprozessmanagement und Immobilienentwicklung an der Technischen Universität München.

[64] Vgl. Zimmermann, Josef: Immobilienprojektentwicklung. Vorlesungsskriptum zur gleichnamigen Vorlesung am Lehrstuhl für Bauprozessmanagement und Immobilienentwicklung an der Technischen Universität München.

3.3 Sustainable Development in Construction and Real Estate Industry

The implementation of environmentally sustainable “green” practices has become a priority for many of industries, and organizations are keen to develop sustainable business models to bolster their green credentials. The question in how to integrate environmentally responsible principles into real estate initiatives and provides up to date and practical advice on incoming legislation and new policy initiatives has become the main concept that is needed to be applied.

In the contemporary global economy, architecture, landscape architecture, and urban planning and design must confront the complex mechanisms of finance and economics. Real Estate and the Built Environment engages both by considering design and investment as integrally connected.

Sustainable real estate development (or Green real estate) is a thrilling new way to make property healthy and energy-efficient, with better indoor air quality, lighting and temperature controls. All kinds of commercial and home properties can be built or refurbished with green features. Important new evidence implies that green property frequently delivers superior finance returns and market performance. Also, turning green helps property owners and backers ‘future evidence’ their real estate to address new energy conservation laws being implemented in the U.S. And around the planet by countrywide, state, provincial and local governments. Green or sustainable real estate is international and undying.

From the traditional buildings to such surprising examples of 21st century design, sustainable property is built to respect the encircling environment. In the western world, green or sustainable property pertains to a range of construction systems that render the finished structure efficient, with superior natural light and indoor air quality. The utilizing of green or sustainable construction generally generates energy savings of 30 percent or even more.

This is a crucial result, because buildings are a significant power source costs, electricity use, and emissions that will harm air quality. Construction costs increasingly reasonable green real estate is sometimes a projected 2 percent more to make than typical property, but growing industry experience continues to drive down costs. Experienced developers can regularly build to green or sustainable standards for a similar cost as typical construction. The data suggests that green or sustainable development real estate often delivers enhanced performance in the market than traditional construction due to high appeal to renters and home purchasers, quicker allowing and executive approvals, shorter lease-up times, lower operating costs and the achievement of top tier leases.

3.4 Role of Environmental Building Assessment Method Toward Sustainable Development in Real Estate Industry

Building assessment method were developed to promote a better building design, construction, operation, maintenance as well as deconstruction toward the principle of sustainable development through implementation of a better environmental, social and financial integration.

Most of developed building assessment method are generally based on their local regulations, policies and standards.[65]

Building environmental assessment methods were originally developed as a voluntary tool to help building owner to establish a higher environmental performance of their buildings through certain level of accomplishment. Furthermore, building environmental assessment methods provide a structure for environmental issues, better organized statement of performance measures; which demonstrate commitment to environmental strategy and a prospect to label innovative materials and products[66]. Development of information exchange and better collaboration among stakeholders are highly needed for sustainable building practice, hence building environmental assessment methods have been considered to be very valuable in this regard [67]. Meanwhile, even though many researches have been conducted which pinpoint the benefits of environmental building certification system, they are still lacking from a better understanding of the contribution of this particular certification system concerning its achievement of broader sustainability targets such as real estate and construction industry as a whole [68].

Building environmental assessment aims to measure the environmental performance of buildings, which can be long term beneficial and provide a better position in the construction and real estate market through increasing demands for a higher building quality. So far there have been numerous numbers of existing building environmental assessment methods all over the world aims to increase the performance of buildings with the adjustment to their local circumstances and stakeholders' needs [69].

Building environment assessment methods cover numerous range from residential and different type of commercial buildings such as office buildings, shopping centres, hotels etc. which influence process of building design, construction and operation. These methods were originally developed specifically to prevent further environmental degradation by ensuring an efficient use of natural resources, however over the time, the next generation of assessment methods have evolved to a broader coverage beside the environmental consideration like social and economic concerns [70].

3.5 Criteria, Indicators and Weighting System of Environmental Building Assessment Methods

Green building criteria represent the form of environmental matter that are influence by building design and construction aspects as well as the resource used. The majority of assessment methods include the following key criteria: energy and CO2 emissions, ecology, land use,

[65] Bragança, L., Mateus, R., Koukkari, H.: Building Sustainability Assessment. Sustainability. www.mdpi.com/journal/sustainability. 2010.

[66] Cole, R.: Building environmental assessment methods: redefining intentions and roles. Building Research and Information, 33(5), pages 455-467. 2005

[67] Cole, R.: Motivating Stakeholders to deliver environmental change. Building Research and Information, 39(5), pages 431-435. 2011.

[68] Irish Green Building Council (IGBC): Building Environmental Assessment Method for Ireland. IGBC Exploratory Study. UCD Energy Research Group - University College Group.

[69] Hourigan, N.: The Development of a Building Environmental Assessment Method for Ireland. MArchSc thesis in the School of Architecture, Landscape and Civil Engineering, University College Dublin. Available in UCD Architectural Library. 2009.

[70] Todd, J.A., Crawley, D., Geissler, S., Lindsey, G.: Comparative assessment of environmental performance tools and the role of the Green Building Challenge. Building Research and Information 29 (5),324–335. 2001

transportation, pollution, materials, management, health and indoor environment, renewable energy, water efficiency as well as waste management. Moreover, a certain level of performance (indicator) will be credited to measure level of achievement. However, due to lack of clear target for sustainable building in general, a misconceiving could be made by the building designer through design that meets the requirement of green building methods in order to achieve points available on each criterion offered rather than holistically towards sustainable development principles[71]. Criteria concerning energy efficiency and consumption is typically considered on every building assessment method, making it one of the most important matter in the system as whole.

On the next level, since as it was mentioned before that building assessment methods are mostly based on their local building regulations, it is necessary to have certain indicators which represent the quantity and quality measurements of each criterion[72]. Indicators work to show the performance of the assessed buildings towards sustainable principles covering environmental, social and economic criteria.

Furthermore, weighting system is an important part of a building assessment method, it defines the level of importance of every criteria and indicators covered by the method. These weighting system are normally predefined based on their local contexts, which basically will pinpoint the most considered necessary criteria according to their local environmental condition[73].

Table 5: Weighting System of DGNB

DGNB	Weighting (%)
Ecological Quality	22.5
Economic Quality	22.5
Sociocultural and functional Quality	22.5
Technical Quality	22.5
Process Quality	10.0
Location Quality	-

DGNB has defined six sustainability aspects that include the environmental, resource, health, economic values, social and cultural values. Sustainability aspects, which are referred to as theme groups or main criteria groups, are based on ecological quality, economic quality, sociocultural and functional quality, technical quality, process quality and quality of the site. These six thematic groups, which are first-level in the DGNB structure, are divided into one or more criteria groups. These, in turn, are made up of individual criteria. Each criterion is defined by indicators which can be used to describe the specific criterion. The weighting of the six defined thematic groups is shown in Table 5. The first five theme groups, which relate to the quality of the objects, are combined with an overall result. The sixth topic group, the quality of the site, is not included in the object evaluation, “so that each object can be assessed

[71] Cole, R.: Building Environmental Assessment Methods. A Measure of Success. IeJC. May 2003.
[72] Ebert, T., Eßig, N.,Hauser, G.: Green Building Certification System: Assessing sustainability, International system comparison, Economic impact of certifications. Edition Detail Green Book. 2011.
[73] Ebert, T., Eßig, N.,Hauser, G.: Green Building Certification System: Assessing sustainability, International system comparison, Economic impact of certifications. Edition Detail Green Book. 2011.

independently of the location"[74]. This topic is presented separately in the course of certification and is graded with a separate note. Through this approach in the evaluation, DGNB certifications of different objects remain comparable regardless of the location, but provide additional information on the situation and the risks at the micro location, the image and condition of the location and the neighbourhood, traffic connections, proximity to usage-specific facilities, as well as information on the media and developments involved. The structure of the seal of quality is divided from the respective protection target into the four levels: thematic groups, criteria groups, criteria certificates and indicators. At the moment, the six thematic areas are subdivided into 10 criteria, and these are further subdivided into 49 criteria. The criteria are described on the basis of the so-called "Criteria", which describe the previously defined protection objectives in more detail.[75]

Due to the weightings, each criterion flows very differently into the evaluation. In order to promote an overall high-quality building quality, basic levels are defined for all thematic groups which differ in their height for an award in bronze, silver and gold. For a gold certification, a building in each of the five theme groups must have a minimum basic level of 65%. In addition to this minimum requirement, a total filling level of at least 80% must be available for gold certification. Similarly, for a silver award, a single topic group may not be worse than bronze (50% fulfilment), where a total of at least 65% is required. For a bronze award, a single theme group cannot be less than 35% satisfied, but a minimum of 50% is required. The total fill level is alternatively indicated with a note.

3.6 International Building Environmental Assessment Methods

Existing building environmental assessment methods such as BREEAM from the United Kingdom, LEED from the US as well as DGNB (Deutchse Gesellschaft fur Nachhaltiges Bauen) from Germany were developed with different designs including area of coverages, criteria, indicators and weighting systems. Following discussion will pinpoint a more specific comparison of these existing methods. Building environmental assessment as has been discussed before, normally cover three different areas which are environment, society and economy. Following table categorized BREEAM, LEED and DGNB into these three areas based on criteria they cover on each of their system. As it can be seen, all the methods cover the need of a better environmental condition as well as society.

DGNB is the only assessment method that covers economy area, by emphasised it through its part of economical quality. The consideration of economy area by DGNB is aimed to reduce building life cycle cost, which compromise or destroy the basic concept of sustainable development as mentioned before, which is the sole demand to reduce lifecycle costs is not a criterion for sustainability. Furthermore, zero life cycle cost means that there is no investment at all and therefore no building activity takes place, therefore the original function of real estate would no longer be fulfilled.

Investment in green building with sustainable development principle means an investment that is financially sustainable for both investors and end users of buildings. A clear financial

[74] Deutsche Gesellschaft für Nachhaltiges Bauen e.V. (Hrsg.): Das Deutsche Gütesiegel Nachhaltiges Bauen – Aufbau – Anwendung – Kriterien. 1. Auflage, Januar 2009, S. 10

[75] Vgl. Zimmermann, Josef: Immobilienprojektentwicklung. Vorlesungsskriptum zur gleichnamigen Vorlesung am Lehrstuhl für Bauprozessmanagement und Immobilienentwicklung an der Technischen Universität München.

mechanism approach that can bring win-win situations to all is the only way to push the construction and real estate development in Indonesia towards principles of sustainability.

Table 6: Comparison of Existing Building Environmental Assessment Methods

	Environment	Society	Economy
BREEAM[76]	Pollution Land use & Ecology Energy Waste Material Water Transport	Health & Wellbeing Transport	
DGNB[77]	Ecological Quality	Socio Structural and Functional quality	Economical Quality
LEED[78]	Material & Resources Energy & Atmosphere Water efficiency Sustainable site	Indoor air quality	

3.7 Concluding Remarks

Sustainability has been known as an idea, principle and concept of living system, thus there is more than just one simple definition of it. Sustainability covers the environment as its basic foundation to compile a solution within the interaction of economic and social constituent of living. In general, the principle of sustainability is widely known as a principle that promotes a living system which balancing the number of environmental product consumption not more than what the environment can provide at the present time.

Ecologically sustainable development is a major concern and embodies both environmental protection and management. The concept of sustainable development is broad. Generally, sustainable development concerns attitudes and judgment to help insure long-term ecological, social and economic growth in society. Applied to project development, it involves the efficient allocation of resources, minimum energy consumption, low embodied energy intensity in building materials, reuse and recycling, and other mechanisms to achieve effective and efficient short- and long-term use of natural resources. Current environment assessment methods do not adequately and readily consider environmental effects in a single tool and therefore do not assist in the overall assessment of sustainable development.

Construction is one of the largest end users of environmental resources and one of the largest polluters of manmade and natural environments. The improvement in the performance of

[76] Building Research Establishment (BRE). (2011). What is BREEAM? http://www.bre.org

[77] Deutchse Gesellschaft fur Nachhaltiges Bauen (DGNB) (The German Sustainable Building Council). (2011). Excellence Defi ned. Sustainable building with a systems approach, DGNB brochure. Internet: DGNB. Available at http://www.dgnb.de

[78] United States Green Building Council (USGBC). (2012a). BREEAM Equivalency for LEED. Internet: USGBC. Available at: http:// www.usgbc.org

buildings with regard to the environment will indeed encourage greater environmental responsibility and place greater value on the welfare of future generations. There is no doubt that environmental building assessment methods contribute significantly in achieving the goal of sustainable development within construction. On one hand, it provides a methodological framework to measure and monitor environmental performance of buildings, whilst on the other it alerts the building profession to the importance of sustainable development in the building process.

However, existing environmental building assessment methods have their limitations as examined in this paper reducing their effectiveness and usefulness. There is a requirement for greater communication, interaction and recognition between members of the design team and various sectors in the industry to promote the popularity of building assessment methods. The inflexibility, complexity and lack of consideration of a weighting system are still major obstacles to the acceptance of environmental building assessment methods. In the sustainability index stakeholders will have the opportunity to participate in identifying the criteria and sub-criteria that concern them most in the evaluate framework. Additionally, stakeholders will also be participated to derive weights to reflect the level of importance of criteria and sub-criteria during the feasibility stage of a project.

Building developments involve complex decisions and the increased significance of environmental issues has further complicated the situation. Society is not just concerned with economic growth and development, but also the long-term effects on living standards for both present and future generations. Certainly sustainable development is an important issue in project decisions. Using a conventional single-dimension evaluation technique to aid decision-making is no longer adequate A much more sophisticated model needs to be used to handle multidimensional multi-dimensional arrays of data. The development of a sustainability index is a way to address multiple criteria in relation to project decision-making. Use of a sustainability index will greatly simplify the measurement of sustainable development, and thereby make a positive contribution to the identification of optimum design solutions and facility operation.

Building environmental assessment methods have been embraced by building design professionals, in particular by architects, and there is increasing interest by other stakeholders across many developed countries. The inclusion of life cycle analysis of materials and components will increase the interest from manufacturers and suppliers, but the method of compliance within environmental assessment methods may be contentious. However, as yet, there is little understanding about the equivalence of the methods being used internationally and with increasingly global financial and property markets, assessment methods need to be benchmarked in a clear and transparent manner.[79] There is a growing practice of environmental assessment methods aligning themselves with particular corporate targets, addressing regional commitments, using locally defined benchmarks and assessment criteria, applying differing weightings, providing little transparency and with all of these systems vying for market share, so that it is not surprising that the European Commission is giving attention to the harmonization of assessment methodologies.[80]

[79] Reed, R., Bilos, A., Wilkinson, S. and Schulte, K-W. International Comparison of Sustainable Rating Tools. JOSRE, vol 1, no 1, 2009. 2009

[80] Reed, R., Wilkinson, S., Bilos, A. and Schulte, K-W. A Comparison of International Sustainable Building Tools – An Update. In Newell, G. (Ed) Proceedings 17th Annual Pacifi c Rim Real Estate Society Conference, 16-19 January 2011. (2011).

4 GREENSHIP

4.1 Introduction

Indonesia as developing country in South Asia region that seeks for a better development has shown improved environmental awareness as the consciousness of negative impacts caused by activities of building through its life cycle. Together with the growing responsiveness in neighbour countries about the importance of built sustainable in order to protect the environment from further degradation due to massive infrastructure expansion to support the development of country as a whole, it has been clearly stated for the Indonesian government the necessity to come to its term to engender a better system for construction process and operation of buildings which most likely are responsible for environmental degradation like over exploitation of natural resources, CO2 emission, wastes, destruction of ecosystem and so on.

Green conception has become a common idea in Indonesia evidenced by the growing number of industries using the green term to perform a much more environmental friendly activities showing that the market tendency is moving to the right direction. However, the lack of clear explanation about the green concept in every aspect of life proved that there is a need to rightly explain and implement it in a satisfactory method and tool. Environmental building assessment method was designed to assess the performance of building based on the principles of sustainable development. GREENSHIP is the first and only existing environmental building assessment method in Indonesia. It was launched in 2010 by Green Building Council Indonesia (GBCI), an independent (non-government) and non-profit organization legally approved and cooperated with the Indonesian Ministry of Environment (KLH), committing to the education community in applying environmental best practices and facilitating the transformation of the global sustainable building industry[81].

GREENSHIP is specifically designed and benchmarked accordance to the Indonesian condition, laws and regulations as the differentiations from other green building assessment tools, it is a rating system used by both building actors and industrial including businessmen, architects, mechanical electrical engineers, interior designers, building engineers, as well as other actors in order to implement best practices and seeks to achieve measurable standards that can be understood by the general public along with the building users[82]. Implementation of GREENSHIP is aimed to achieve concept of green building since the launching of planning till the building operation stage[83]. Therefore, there is a need to review the main implication, role and contribution of GREENSHIP as environmental building assessment method in order to achieve a better and a sustainable development in the Indonesian construction and real estate industry.

This chapter is aimed to analyse GREENSHIP as Indonesian existing building assessment method. It discusses the general context of GREENSHIP and different type of GREENSHIP standard. Moreover, this chapter focuses on the analysis of GREENSHIP for new building standard (GREENSHIP-NB version 1.2). It describes the history of GREENSHIP-NB development, certification process, weighting system, benchmarks and the explanation of criteria included on the GREENSHIP-NB. Furthermore, this chapter provides review GREENSHIP implementation in Indonesia as well as the obstacles that can be barriers for

[81] Homepage GBCI. http://www.gbcindonesia.org
[82] GBCI: Indonesia Green Building Rating Tools for New Building (GREENSHIP-NB 1.0), GBCI, 2010.
[83] GBCI: Indonesia Green Building Rating Tools for New Building (GREENSHIP-NB 1.0), GBCI, 2010.

further development in Indonesian construction and real estate industry as a whole. It also reviews the contribution of GREENSHIP to support the principle of sustainable development in Indonesia. Finally, a selective comparison is made to compare GREENSHIP to LEED as one of the world well-known existing building assessment methods by analysing the idea behind the prerequisites or mandatory criteria on both systems.

4.2 Context of GREENSHIP

GREENSHIP is developed by Green Building Council Indonesia (GBCI), a non-for-profit organization as a member of World Green Building Council. GBCI was founded in 2009 by several parties including construction business, government, educational institution and researchers, professional associations and community care for the environment and buildings sectors. GBCI is aimed to promote the transformation of Indonesian building sector towards the principle of environmentally friendly construction.

GREENSHIP was firstly developed as rating tool for new commercial building. The improvement of the system furthermore had generated some other standards for existing building, home and interior space. Development of GREENSHIP by GBCI was based on four basic principles such as simple, applicable, implementation of available technology and use of normative local standards consisting of Constitution, Presidential Decree, Presidential Instruction, Ministerial Regulation, Ministerial Decree and Indonesian National Standard (SNI).[84] GREENSHIP is specifically designed to be as simply as possible to attract more and more buildings actors in the implementation of green building concept. For this reason, ratings of GREENSHIP were created with levels of difficulties for its ratings based on the applicability, cost and the significant influence to the environment.

Table 7: GREENSIP Standards

GREENSHIP Standards	Year Issued
GREENSHIP-NB 1.0	2010
GREENSHIP-NB 1.1	2011
GREENSHIP-NB 1.2	2013
GREENSHIP existing building 1.0	2011
GREENSHIP Home 1.0 (DRAFT)	2011
GREENSHIP Interior Space 1.0	2012

GREENSHIP-NB 1.0 is the first rating tool released by GBCI in 2010 for new construction building in Indonesia, following by GREENSHIP-EB in 2011, GREENSIP Home and GREENSHIP Interior Space in 2011 and 2012.

[84] GBCI: Indonesia Green Building Rating Tools for New Building (GREENSHIP-NB 1.0), GBCI, 2010

4.3 GREENSHIP for New Building

GREEENSHIP for new building assessment is specifically designed for commercial buildings such as office, shopping mall, hospital, hotel and apartment with total area of building ≥ 2500m^2. Design Recognition or DR (max 77 points) is the first assessment stage carried out during the planning phase of building, building design will be granted with a temporary certificate according to the design performance of GREENSHIP standardization. Final Assessment (FA) is the second assessment with maximum point of 101, granted after the building construction is done as the overall performance of building, where design and construction is fully assessed[85].

Table 8: Category of GREENSHIP-NB 1.2

Code	Category of GREENSHIP-NB 1.2	Number of Criteria	Maximum Points
ASD	Appropriate Site Development	7	17
EEC	Energy Efficiency and Conservation	5	26
WAC	Water Conservation	6	21
MRC	Material Resource and Cycle	6	14
IHC	Indoor Health and Comfort	7	10
BEM	Building Environmental Management	7	13
Total			**101**

GREENSHIP consists of six categories that considered significant and relevant as major concepts of Green Building. Each category contains of criteria with specific indicators that must be fulfilled in order to achieve available points. There are three different types of criteria in GREENSHIP-NB rating tool:

- Prerequisite Criteria are mandatory criteria that must be fulfilled and implemented in order to continue with the rest of the assessment process. GREENSHIP-NB consists of eight perquisites criteria.
- General Criteria are derived from category and can only be assessed if the prerequisite criteria on the relevant category are fulfilled. Each of general criteria has specific points awarded according to the achievement of the requirement.
- Bonus Criteria are similar with the general criteria, except the points awarded to these criteria are not included to the total points of the rating system that is used as the percentage calculation of the assessment. Bonus criteria are considered as criteria that need big effort and cost to achieve due to the lack of available technology, and if it is implemented correctly will give great (positive) impact to the environment. [86]

Different from other existing rating systems like LEED from USA where points are allocated on each criterion based on the importance level of the criterion and its contribution to the environment, GREENSHIP allocated the points based on the difficulty level of criteria achievement and the costs spent in order to meet the requirement on the criterion.

[85] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[86] GBCI: Indonesia Green Building Rating Tools for New Building (GREENSHIP-NB 1.0), GBCI, 2010.

Table 9: GREENSHIP Certification Standard

Predicate	Min Score	Min %
Platinum	74	73
Gold	58	57
Silver	47	46
Bronze	35	35

Point achievement from Bonus Criterion is a mandatory requirement of Platinum Rating, in other words, in order to achieve the Platinum Rating, a building must fulfil the requirement asked by the bonus criteria. GREENSHIP-NB has one Bonus Criterion (On Site Renewable Energy criterion) with maximum of five points awarded of the criterion completion.

Table 10: Achievement Efforts

Predicate	Easy Achievement + Low Cost	Difficult Achievement + High Cost	Additional Cost (Bonus Criteria)
Bronze	100%		
Silver	100%	1/3 of 100%	
Gold	100%	2/3 of 100%	
Platinum	100%	≥ 2/3 of 100%	100%

4.3.1 History of GREENSHIP for New Building (GREENSHIP-NB)

GREENSHIP-NB 1.2 is the most recent standard developed by GBCI for building assessment in Indonesia. The first version of GREENSHIP-NB was launched in 2010, known as GREENSHIP-NB version 1.0. The first GREENSHIP-NB was developed through four processes of forming. Started with the launch of Green Building Guidelines (Guidelines v1) by GBCI without the existence of benchmarks and points, the guidelines only consisted of some propose categories for the developing rating system[87].

Second process was the determination of benchmarks and points for the rating system by examination of six existing international rating systems including LEED from USA, BREEAM from the United Kingdom, Greenstar from Australia, Greenmark from Singapore and Green Building Index from Malaysia. The idea was to adopt categories that are suitable for Indonesian condition by discovered some common or universal categories contained in at least four of the examined rating systems (four common). Furthermore, the categories were analysed based on benchmarks from existing constitutions and regulations in Indonesia. Six categories consisting of 42 criteria with the total of 96 points was identified on this process, this process formulated

[87] GBCI: Indonesia Green Building Rating Tools for New Building (GREENSHIP-NB 1.0), GBCI, 2010.

the second version of Green Building framework for new building (GREENSHIP Green Building Framework for New Construction Version 2). [88]

The third process contained of discussion to identify data needed for the assessment, technical procedure of the assessment and the process of certification. The framework formulated on this stage is also known as the GREENSHIP Green Building Framework for New Construction Version 3. National consensus was the last forming process of the GREENSHIP rating tool where a discussion was conducted with the technical advisory group from building industries in order to polish up the rating system. Finally, the processes completed by the launching of GREENSHIP Rating Tools for New Building Version 1, 2010.[89]

Table 11: Forming Process of GREENSHIP for New Building

	Guidelines (V1)	Framework (V2)	Framework (V3)	National Consensus
Actors Involved	50 core founder	Analyst Team	Analyst Team + external groups	Analyst Team + TAG (Technical Advisor Group)
Processes	Setting of Initial Rating System Concept	Analysis and Adoption of Existing International Rating Systems	Discussion with external groups	Discussion with TAG from building industries.
Identification	Categories of Rating system	6 Categories 42 Criteria 96 Points + 5 Bonus Points	Technical procedure of the assessment and certification process	Agreement
Product	Green Building Guidelines	GREENSHIP Green Building Framework for New Building Version 2	GREENSHIP Green Building Framework for New Building Version 3	GREENSHIP Rating Tools for New Building Version 1, 2010.

The National Consensus held with the involvement of respondents from government, research institution, international organization, associations including professionals and companies, core founder, universities and educational institution and other groups such as media, banking and insurance.[90] Respondents were given four ranges of answers for the agreement of the categories: Agree, Undecided, Do Not Know or Disagree.

[88] GBCI: Indonesia Green Building Rating Tools for New Building (GREENSHIP-NB 1.0), GBCI, 2010.
[89] GBCI: Indonesia Green Building Rating Tools for New Building (GREENSHIP-NB 1.0), GBCI, 2010.
[90] Nasir, Rana Yusuf: GRENSHIP Process and Overview. Green Building Council Indonesia. 2010

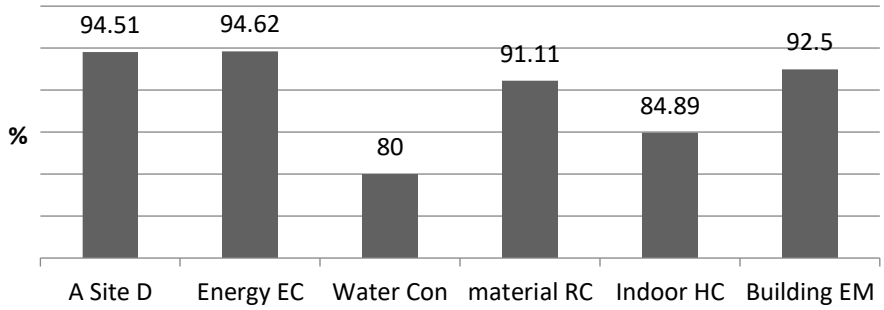

Figure 17: Percentage of Respondents Who Agree with the Categories[91]

More than ninety percent of respondents agreed with the categories of Appropriate Site Development, Energy Efficiency and Conservation, Building Environmental Management and Material and Resource Conservation. Meanwhile, only 85% of respondents agreed with the Indoor Health and Comfort category, and only 80% agreed with the Water Conservation category. However, the final points for each categories showing that Water Conservation (21 points) is the second most important in the GREENSHIP rating system after Energy Efficiency and Conservation category (26 points) showing that the percentage of the respondents who agreed with each of categories doesn't influence the importance level of categories.

4.3.2 Certification Process of GREENSHIP for New Building

Certification process of GREENSHIP-NB is started with the project registration, consultation and assessment. However, in order to start the certification process, project must meet some basic requirements of GRENSHIP-NB.

4.3.3 Weighting System of GREENSHIP-NB

Weighting system represents the performance of the rating tool as whole. Without the existence of weighting system, each criterion will be granted the same value without making an allowance for the criterion to represent the urgent needs of the local society and environment. Weighting system applied in GREENSHIP is relatively simple where each criterion from each category is given different values/points, where the number of points indicates the level of achievement difficulty of each criterion.

[91] Nasir, Rana Yusuf: GRENSHIP Process and Overview. Green Building Council Indonesia. 2010

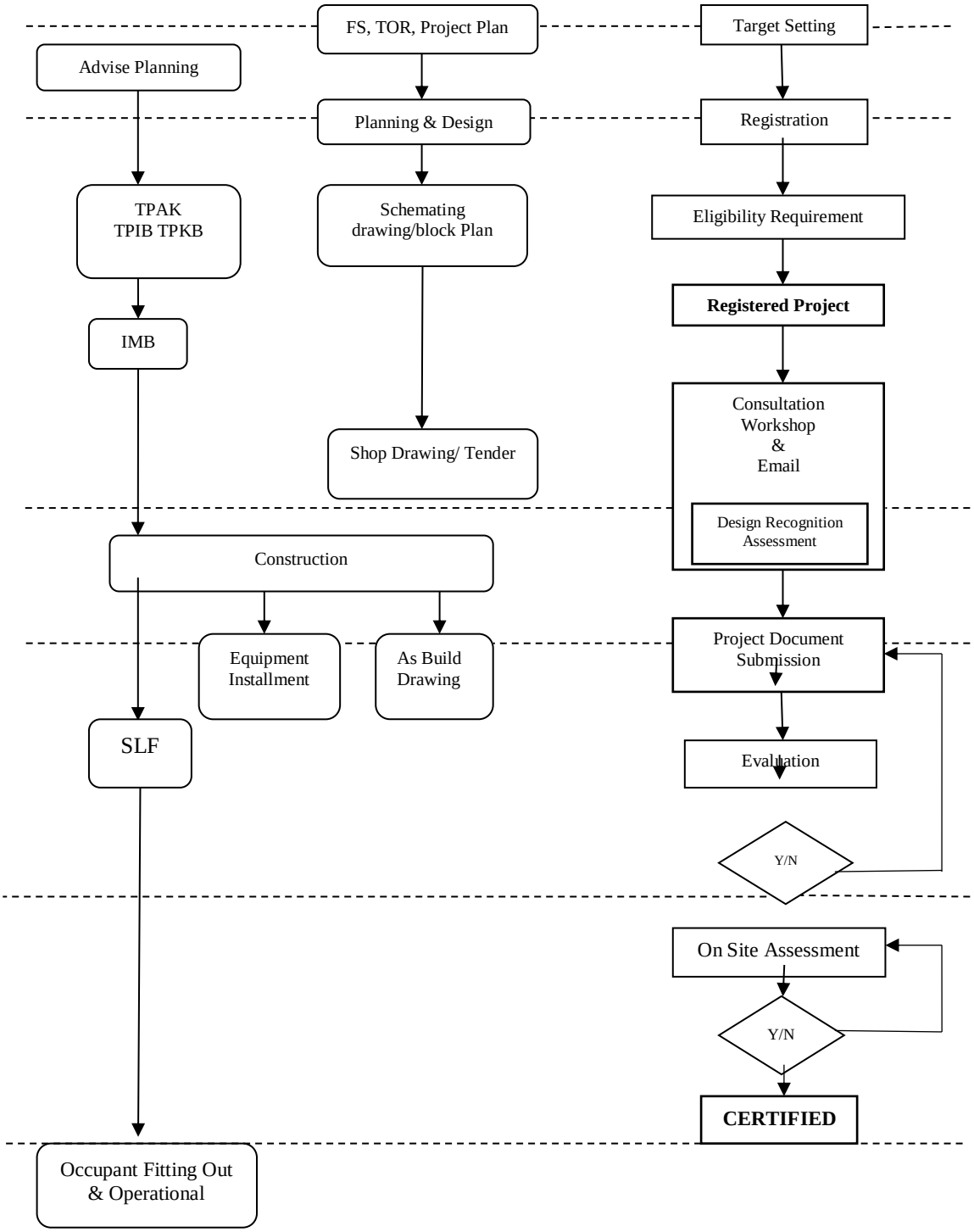

Figure 18: Certification Process of GREENSHIP-NB[92]

[92] GBCI: Indonesia Green Building Rating Tools for New Building (GREENSHIP-NB 1.0), GBCI, 2010.

Table 12: GREENSHIP-NB Points Allocation

Code	Category of GREENSHIP-NB 1.2	Number of Criteria	Maximum Points	%
ASD	Appropriate Site Development	7	17	16,8
EEC	Energy Efficiency and Conservation	5	26	25,7
WAC	Water Conservation	6	21	20,79
MRC	Material Resource and Cycle	6	14	13,86
IHC	Indoor Health and Comfort	7	10	9,9
BEM	Building Environmental Management	7	13	12,87
Total			**101**	**100**

Difficulty level is reflected on the points awarded to each criterion, criterion which relatively easy to achieve without high cost will be awarded with smaller points. Moreover, criterion which relatively difficult to achieve and requires high of cost will be awarded with higher points. However, on special case where the achievement of a criterion requires specific effort due to the unavailability of the technology will be awarded with bonus points.[93]

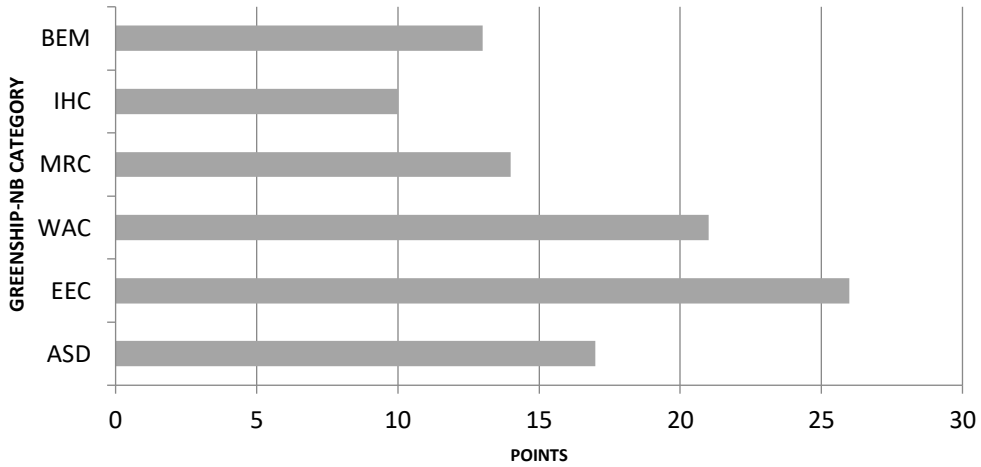

Figure 19: Category and Points Distribution of GREENSHIP-NB

This type of weighting system is similar with weighting systems of other rating tools such as LEED, Greenstar (Australia) and Greenmark (Singapore). Points awarded for each category determined the overall performance of the rating tool to deliver an environmental friendly building that is suitable to the local needs. However, there is still lack of a non-subjective for the weighting system consideration to improve the performance of GREENSHIP in overall.

GREENSHIP allocated 25.7% points (26 points) to the Energy Efficiency and Conservation (EEC) category that contains 5 criteria only. EEC is the category in GREENSGHIP with the

[93] GBCI: Indonesia Green Building Rating Tools for New Building (GREENSHIP-NB 1.0), GBCI, 2010.

least number of criteria included. As can be seen, GREENSHIP has listed the EEC category as the most important category to achieve in the rating system followed by Water Conservation category in the second place with 20.79% of point allocation.

Up to the present time, there is still no clear scientific reason behind point allocation on GREENSHIP rating system as well as the rest of existing rating system in the world. This unchangeable point allocation or weighting system can reduce the effectiveness of the rating system in order to cover buildings requirements all over Indonesia, considering the diversity of Indonesia as a whole. Most compelling evidence in Jakarta, the necessity of clean water sources is increasingly urgent[94]. Groundwater extraction for both consumption and commercial purposes has led to a serious land subsidence in some area around the city. Hence, water saving or reduction holds an urgently more important role in achieving the goal of sustainable development in Jakarta more than other cities in Indonesia.

Appropriate Site Development category comprises 16.8% of the total points allocating in GREENSHIP. This category covers the importance of site selection and green area development as well as storm water management. Given this points, ASD category gives more influence to the city development due to common problems facing by developing countries like Indonesia. Massive development in Indonesia especially in big cities like Jakarta has inflicted environmental side effects such as pollution, green area degradation, flooding etc. Therefore, roles of ASD category in big cities like Jakarta will give crucial physical impacts to the city improvement in general as well as prevention of further environmental degradation.

Material Resource and Cycle is the fourth most important category in GREENSHIP containing 13.86% of total points in GREENSHIP rating system, making it more important than Building Environmental Management and Indoor and Health Comfort categories. Comparatively, GREENSHIP put Indoor and Health Comfort category as the least important category holding seven available criteria with maximum 10 points. The importance of building users's health and comfort has been emergently considered in green building development with more and more researched conducted to improve the productivity of building users by enhance the quality of indoor environment. This circumstance of course raised another question behind the reason of point allocation in GREENSHIP rating system in choosing the specific point allocation to each of its category.

4.3.4 Benchmark of GREENSHIP-NB

GREENSHIP-NB sets benchmarks for its criteria based on the national regulation for buildings in Indonesia. Energy saving targets of GREENSHIP uses three different type of calculation such as Energy Modelling Software, Worksheet Standard GBCI and Overall Thermal Transfer Value (OTTV), where the baseline building is calculated as conventional building standard from the existing building regulation in Indonesia also known as SNI (Indonesian National Standard) also known as Indonesian National Standard. However, the reason behinds points awarded for every specific amount of energy saving on Energy Efficiency Measure category remains questionable or subjectively set without scientific explanation.

Water Conservation category on GREENSHIP-NB uses Indonesian National Standard for Planning Procedure for Plumbing System (SNI 03-7065-2005) as the benchmark estimation.

[94] Indonesia's Water Crisis. www.water.org/country/Indonesia

Where the water usage is calculated using Litre per person per day (Litre/Person/Day) calculation. The idea is to reduce the use of water from the primary water source without reducing the minimum daily need of building users.

4.4 GREENSHIP-NB Criteria and Indicators

4.4.1 Appropriate Site Development (ASD)

Development in urban area in Indonesia has been increasing together with the population growth due to the continuously progression of urbanization. There is a need of more infrastructures and buildings to support the overall development causing higher demand in land acquisition. Investment in new or undeveloped land is relatively cheaper compare to the developed land with complete facilities such as transportation, water pipelines and so on.[95] Undeveloped land in Indonesia has become more reasonable investment due to its lower price for investors. This condition has pushed investors to least prioritise the environment in the decision making process leading to the decreasing number of green land in big cities like Jakarta due to the massive transformation into buildings and infrastructures. Hence, it is important to consider site utilization in order to reduce negative impacts of city development in general.

ASD category of GREENSHIP-NB covers basic issues of site utilization and its impact such as CO2 emissions, green field degradation and microclimate. ASD category consists of one prerequisite criterion and seven normal criteria including: Basic Green Area, Site Selection, Community Accessibility, Public Transportation, Bicycle, Site Landscaping, Microclimate and Storm Water Management.

Table 13: Appropriate Site Development

	ASD CRITERIA	Points
ASD P	Basic Green Area	P
ASD 1	Site Selection	2
ASD 2	Community Accessibility	2
ASD 3	Public Transportation	2
ASD 4	Bicycle Facility	2
ASD 5	Site Landscaping	3
ASD 6	Micro Climate	3
ASD 7	Stormwater Management	3
	ASD Total Points	**17**

[95] GBCI: Indonesia Green Building Rating Tools for New Building (GREENSHIP-NB 1.0), GBCI, 2010.

4.4.1.1 ASD-P: Basic Green Area

Basic Green Area as the perquisite criterion is aimed to maintaining or expanding city's green area in order to improve the quality of the microclimate, reduce CO2, pollutants and burden on the drainage system as well as preventing soil erosion and maintaining the balance of water and ground water systems.[96] This criterion represents the needs of a better city planning in order to provide enough green area especially in big cities like Jakarta where the number of green area is decreasing due to the expansion of new building constructions that converted green area into hard/non-penetrable surface.

Table 14: Basic Green Area (P1)

	Criteria of ASD	Indicators	Point
P1	Basic Green Area (Prerequisite)	New Construction: 10% of total area Major Renovation: 50% of total open space	P

As it has been discussed before, big cities in Indonesia tend to suffer from floods problem due to the high intensity of rain in Indonesia and the condition has worsened with the less and less penetrable surface area. Furthermore, this criterion also covers the importance of CO2 reducing in order to improve the air quality.

4.4.1.2 ASD-1: Site Selection

The selection of site is really important to reduce environmental impacts caused by development in the green field area or undeveloped area. This criterion requires development of building in the area that is supported by basic facilities in order to support continuity of day-to-day activities such as road, light and electricity, telephone, drainage and clean water networks as well as pedestrian paths, fire extinguish and disposal system[97].

- Maximum of two points can be achieved from this criterion by selecting site that has at least eight of twelve facilities (see Appendix A). (1 Point) or

  Choosing a development area with KLB> 3

- Revitalization and development on negative and unused land due to the previous negative impacts of development or construction.[98]

4.4.1.3 ASD-2: Community Accessibility

Encourage development in a place that already has network connectivity and increase the use of the building to facilitate the achievement of the community in carrying out daily activities and avoid the use of motor vehicles in order to reduce the quantity of pollution. Maximum of two points will be award on this criterion based on four indicators:

[96] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[97] GBCI: Indonesia Green Building Rating Tools for New Building (GREENSHIP-NB 1.0), GBCI, 2010.
[98] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013

- There are at least seven types of public facilities within the distance of the main road as far as 1500 m from the site. (1 Point)
- Open pedestrian access in addition to the main road outside the footprint that relate to secondary roads and/or land owned by another person that provided access to a minimum of three public facilities within 300 m distance pedestrian achievement. (1 Point)
- Provide safe and comfortable facilities /access, free from the intersection with motor vehicle access to buildings directly connect with other buildings, where there are at least three public facilities and / or with mass transit stations. (2 Points)
- Opening of the ground floor of the building for a minimum of 10 hours a day in order to provide a safe and comfortable pedestrian access. (2 Points) [99]

4.4.1.4 ASD-3: Public Transportation (ASD-3)

Public Transportation criterion is awarded with maximum of 2 points aiming to encourage building users and guests to use public transportation in order to reduce the usage of private vehicles.

- Availability of public transport stops or stations within a range of 300 m (walking distance) from the gate to the building site without calculating the length of the pedestrian bridge and ramp. (1 Point) or
  Providing shuttle bus for users keep building with a minimum number of units to 10% of users still building.
- Provide safe and comfortable pedestrian path facilities in the area of building to get to the nearest public transport station according to 30/PRT/M/2006 Minister of Public Works and Facilities Technical Guidance on Accessibility in Building and Environment. (1 Point) [100]

4.4.1.5 ASD-4: Bicycle Facility

Traffic jam has becoming a big problem in most of big cities in Indonesia, especially Jakarta. Encouraging more people in using bicycle can eventually reduce the level of traffic jam as well as pollution caused by the motor vehicles. Providing more facilities for bicycle users can gradually improve and attract more building users to use bicycle as their main transportation that can lead to a healthier life style. Another role of a green building is to reduce the impact of building users activity on the environment. This criterion is aimed to providing bicycle facilities to encourage more building users to use bicycle instead of motor vehicle in order to reduce the traffic and pollution intensities. (Maximum of 2 Points)

- Availability of safe bicycle parking units with the calculation of 1 unit for each 20 building users. (1 Point)
- Availability of shower with the quantity of 1 unit for every 10 bicycle parking. (1 Point; if the first requirement is met)[101]

[99] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[100] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[101] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013

4.4.1.6 ASD-5: Site Landscaping

Site landscaping is intended to maintain or expand green area of the city in order to improve the quality of the microclimate, CO2 and pollutants reduction, prevent soil erosion and to reduce the burden on the drainage system as well as maintaining the balance of water and ground water systems.

- Availability of vegetation landscape area (softscape), free from the building area (hardscape) located above ground area of at least 40% of total land area. (1 Point)
  1 point will be awarded with every 5% increasing of the softscape (maximum 2 Points)
- The use of local plants in the province scale, amounting to 60% of the adult canopy wide landscape area at ASD 5 indicator 1. [102]

4.4.1.7 ASD-6: Micro Climate (ASD-6)

Micro Climate criterion is designed to improve the quality of the microclimate around buildings that include human comfort and habitat around the building.

- Using a variety of materials to avoid heat island effect on the roof area of the building so that the value of the albedo (reflection of solar thermal power) in accordance with the calculation of minimum 0.3. (1 Point) or
  Using green roof by 50% of the roof area is not used for mechanical electrical (ME), calculated from the broad canopy. (1 Point)
- Using a variety of materials to avoid the heat island effect in the area of pavement so that the value of non-roof albedo (reflection of solar thermal power) in accordance with the calculation of minimum 0.3. (1 Point)
- Landscape design in the form of vegetation (softscape) on the main pedestrian circulation showed a patron of heat due to solar radiation. (1 Point) Or
  Landscape design in the form of vegetation (softscape) on the main pedestrian circulation showed protection from strong winds. (1 Point) [103]

4.4.1.8 ASD-7: Stormwater Management (ASD-7)

Reduce the environmental burden of the drainage system of the quantity of storm water runoff to the storm water management system in an integrated manner.

- Reduction in load volume of rainwater runoff into the city's drainage network of the location of the building by 50%, which is calculated using rainfall intensity of 50 mm / day. (1 Point) or
  Reduction the load of rainwater runoff into the city's drainage network from the building location to 85%, based on the calculation of rainfall intensity of 50 mm / day. (2 Points)
- Showed a reduction in the burden of tackling environmental flood in from outside the building. (1 Point)
- Using technologies that can reduce the discharge of storm water runoff. (1 Point) [104]

[102] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[103] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[104] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013

4.4.2 Energy Efficiency and Conservation

Due to the tropical climate with relatively hot temperature and high level of humidity, energy consumption of buildings in Indonesia is mostly allocated to the use of air conditioning system, following by vertical transportation and lighting. Therefore, it is important to efficiently and effectively minimize the energy use of buildings in order to reduce the load of buildings activity to the environment. [105]

4.4.2.1 EEC-P1: Electrical Sub-metering

As the prerequisite criterion in Energy Efficiency and Conservation category, Electrical Sub-Metering is aimed to monitoring building energy usage as basis of the application of better energy management by installing kWh meter to measure the electricity consumption in each group of system load equipment including: HVAC system, lighting and sockets and other expenses systems.[106]

4.4.2.2 EEC-P2: OTTV Calculation

OTTV calculation is the second prerequisite criterion on EEC and is intended to encourage the socialization of a good building envelope for energy savings by calculate the OTTV calculation based on SNI 03-6389-2011 or the latest edition of the Building Sheath Energy Conservation.[107]

4.4.2.3 EEC-1: Energy Efficiency Measures

This criterion is aimed to encouraging energy consumption savings through the application of energy efficiency measures. Energy Efficiency Measures is criterion with the highest available points on GREENSHIP-NB.

- Use of energy modelling software to calculate baseline energy consumption in buildings and designed buildings. Energy saving is calculated as the difference in energy consumption of the baseline building and designed building. 1 Point is awarded for every 2.5% of energy saving, starts from the energy reduction of 10% of the baseline building, gets the value 1 value (mandatory for platinum). (Maximum 20 Points) or
- Use the worksheet calculation, 1 point is awarded for every 2% of energy saving as the result of difference between the baseline designed buildings. Energy saving is calculated from a decrease of 10% from baseline building. Worksheet is provided by or GBCI. (Maximum 15 Points) or
- Using calculations per component separately (Maximum 10 Points) [108]

4.4.2.4 EEC-2: Natural Lighting

Encourage the optimal use of natural lighting to reduce energy consumption and support the design of the building to allow use of natural lighting as much as possible.

[105] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[106] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[107] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[108] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013

- Optimal use of natural light so that a minimum of 30% of the floor area used for work get minimal natural light intensity of 300 lux. Calculations can be done manually or with software.

  (Specifically for shopping centre, at least 20% of the floor area of non-service get minimal natural light intensity of 300 lux)

- Two more points will be awarded with the availability of lux sensors for automation of artificial lighting when natural light intensity of less than 300 lux. [109]

4.4.2.5 EEC-3: Ventilation

Ventilation criterion is designed to encourage the use of efficient ventilation in public areas in order to reduce energy consumption by not conditioning (not giving AC) areas such as WC, stairs, corridors and lift lobbies, as well as equip the room with natural or mechanical ventilation. (1 Point) [110]

4.4.2.6 EEC-4: Climate Change Impact

Provide an understanding that excessive energy consumption patterns will affect climate change by submitting the calculations of CO2 emission reductions obtained from the difference between the energy needs of the building and the designed building by using a baseline grid emission factor specified in the Decree on B/277/Dep.III/LH/01/2009 DNA. (1 Point) [111]

4.4.2.7 EEC-5: On-Site Renewable Energy

Encourage the use of new and renewable sources of energy that comes from the location of the building footprint by the using of new and renewable energy sources. One point is awarded for every 0.5% of electrical power required by building that can be met by renewable energy sources (up to a maximum of 5 Points). [112]

4.4.3 Water Conservation

The growth of water demand in Indonesia has increased for about 10% each year[113]. The low quality of piped water has caused over exploitation of groundwater that led to others environmental issues like land subsidence etc. Moreover, lack of appropriate wastewater management contributes to pollution issues and the decreasing of environmental quality.

4.4.3.1 WAC-P1: Water Metering

This prerequisite criterion is aimed to monitoring the use of water as the basis implementation of better water management by installation of water meters (volume metering) at certain locations in the water distribution system, as follows:

[109] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[110] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[111] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[112] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[113] GBCI: Indonesia Green Building Rating Tools for New Building (GREENSHIP-NB 1.0), GBCI, 2010.

- One volume metering on each output of clean water sources such as groundwater or piped water.
- The volume meter to monitor water recycling system output.
- One meter is installed to measure the volume of additional water if the output of the recycling system is not sufficient. [114]

4.4.3.2 WAC-P2: Water calculation

Water Calculation is the second prerequisite criterion on Water Conservation category, it is designed to understanding water usage calculations using worksheet from GBC Indonesia to determined simulated water use during the operational phase of buildings by filling the GBCI standard worksheet that has been provided.[115]

4.4.3.3 WAC-1: Water Use Reduction

Water use reduction is aimed to increases the efficiency of water use that will reduce the burden water consumption and waste water output.

- Maximum of 80% of water consumption from the primary source without reducing the number of requirements per person in accordance with SNI 03-7065-2005. (1 Point)
- One point is awarded for every 5% reduction in water consumption of primary sources.[116] (Maximum 7 Points)

4.4.3.4 WAC-2: Water Fixtures

Water Fixtures is intended to encourage the efforts of water saving with the installation of high efficiency water features.

- The use of water features in accordance with the standard capacity under maximum discharge capacity of water output devices according to the annex, a minimum of 25% of the total obtaining of water feature products. (1 Point) or
- The use of water features in accordance with the standard capacity under maximum discharge capacity of water output devices according to the annex, a minimum of 50% of the total obtaining of water feature products. (2 Points) or
- The use of water features in accordance with the standard capacity under maximum discharge capacity of water output devices according to the annex, a minimum of 75% of the total obtaining of water feature products. (3 Points)

WC Flush Valve	<6 Litre/*flush*
WC Flush Tank	<6 Litre/*flush*
Urinal Flush Valve	<4 Litre/*flush*

[114] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[115] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[116] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013

Lavatory	<8 Litre/*flush*
Shower	<9 Litre/*flush*

4.4.3.5 WAC-3: Water Recycling

Water Recycling criterion is aimed to reduce the need for water from the main source by providing recycled water from building wasted water.

- The use of all used water (grey water) that has been recycled for flushing system and cooling towers requirements. (3 Points)

  (When using non water cooled cooling system, then these criteria are not applicable to the total value to 100)[117]

4.4.3.6 WAC-4: Alternative Water Resources

Alternative Water Resources criterion (maximum of 2 Points) is aimed to use alternative water sources that are processed to produce clean water in order to reduce the water demand from the main sources by using one of the three following alternatives:

- AC condensation water, used water ablution, or rain water. (1 Point) or
- Using more than one of the three alternative water sources above. (2 Points) or
- Using technology that utilizes sea water or lake water or river water for water supply purposes as sanitation, irrigation and other needs (2 Points) [118]

4.4.3.7 WAC-5: Rainwater Harvesting

Rainwater Harvesting criterion is designed to reduce the water demand from the main source by encouraging the use of rain water or storm water runoff as water source.

- Providing the installation of rainwater tank with a capacity of 20% of the amount of rain falling on the building roof that is calculated using the value of rainfall intensity of 50 mm / day. (1 Point) or
- Provide installation of rainwater tanks with a capacity of 35% of the above calculations. (2 Points) or
- Provide installation of rainwater tanks with a capacity of 50% of the above calculations. (3 Points)[119]

4.4.3.8 WAC-6: Water Efficiency Landscaping

Minimizing the use of water resources and soil water taps for the needs of landscape irrigation and replace it with other sources.

[117] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[118] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[119] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013

- All water used for building irrigation does not come from the groundwater sources and/or piped water. (1 Point)
- Applying innovative technologies to be able to control the irrigation water needs for proper landscaping, according to crop needs. (1 Point)[120]

4.4.4 Material Resource and Cycle

Indonesia is rich with its biodiversity and natural resources. However, over exploitation of natural resources and lack of improved resources management can lead to a serious environmental degradation.

This category is aimed to protect environment from further degradation caused by over exploitation of natural resources and irresponsible resource management. Material Resource and Cycle category contains of one prerequisite criterion and six normal criteria with maximum score of 10 Points.

4.4.4.1 MRC-P1: Fundamental Refrigerant

Fundamental Refrigerant is prerequisite criterion on Material Resource and Cycle category that is aimed to prevent the use of materials with high potential ozone depletion by not using *chlorofluorocarbons* (CFC) as refrigerants and halon as fire extinguishing agent.[121]

4.4.4.2 MRC-1: Building and Material Reuse

Use the old building waste materials and/or from other places to reduce the use of new raw materials, in order to reduce waste in landfills and extend the service life of material.

- Reusing waste materials, either from old buildings or other places, such as the main structural materials, facades, ceilings, floors, partitions, sills, and walls, the equivalent of at least 10% of the total material cost. (1 Point)
- Reusing waste materials, either from old buildings or other places, such as the main structural materials, facades, ceilings, floors, partitions, sills, and walls, the equivalent of at least 20% of the total material cost. (2 Points)[122]

4.4.4.3 MRC-2: Environmentally Process Product

Environmentally Process Product criterion is aimed to reducing the ecological footprint of the extraction process of raw materials and production process of the material.

- Using environmentally certified materials in the production process that worth at least 30% of the total material cost. Certificate is considered legitimate as long as it is still valid during construction process. (1 Point)

[120] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[121] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[122] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013

- Using materials from recycling process that worth at least 5% of the total material cost. (1 Point)
- Using renewable material with the short-term harvest period (<10 years) that worth at least 2% of the total material cost. (1 Point)[123]

4.4.4.4 MRC-3: Non-ODS Usage

Non-ODS Usage criterion is aimed to protect the ozone by using material that has no ozone depletion potential. Total score of 1 point is awarded for not using ozone-depleting substances in the whole building cooling system. [124]

4.4.4.5 MRC-4: Certified Wood

Certified Wood is aimed to protect the forests by using timbers that can be accounted for its origin.

- Using wood materials that are legally certified in accordance with government regulation on the origin of the wood (such as timber freight invoice processing / FAKO, business certificates, etc.) and free from the illegal timber trade at 100% of total cost of the wood material. (1 Point)
- If 30% of the woods are certified by the Indonesian Eco-Labelling Institute (LEI) or Forest Stewardship Council (FSC). (2 Points)

4.4.4.6 MRC-5: Prefab Material

This criterion is intended to improve the efficiency of material use and to reduce the construction waste by using minimum of 30% modular or prefabricated materials (not including equipment) of the total material cost. (3 Points)

4.4.4.7 MRC-6: Regional Material

This criterion is designed to reducing the carbon footprint of material transportation/distribution and to increase economic growth in the country by:

- Using materials that the location of its raw materials and manufacturing process are located inside the radius of 1,000 km of the project site (worth at least 50% of the total material cost). (1 Point)
- Using materials that the location of its raw materials and manufacturing process are in the main territory of the Republic of Indonesia (worth at least 80% of the total material cost). [125](1 Point)

[123] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[124] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[125] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013

4.4.5 Indoor Health and Comfort

Relatively high temperature and humidity in Indonesia are needed to be managed properly with the aim of providing a better and more comfortable working environment. Indoor Health and Comfort category is specifically designed to control the indoor air quality in order to improve the productivity of the building users.[126]

4.4.5.1 IHC-P1: Outdoor Air Introduction

Outdoor Air Introduction is the prerequisite criterion on Indoor Health and Comfort category that is aimed to maintain and improve indoor air quality by introducing outdoor air ventilation rate in accordance with the requirements for building user health by designing a room with potential for the introduction of minimum outdoor air in accordance with ASHRAE Standard 62.1-2007 or the latest edition of the ASHRAE Standard.[127]

4.4.5.2 IHC-1: CO2 Monitoring

Monitor the concentration of carbon dioxide (CO2) in regulating the fresh air inlet in order to maintain the health of the building users.

- Room with high density, ie <2.3 m2 per person is equipped with gas sensors installation of carbon dioxide (CO2), which has mechanisms to regulate the amount of outside air ventilation so that the concentration of C02 is not more than 1,000 ppm, the sensor is placed 1.5 m above the floor near the return air grille or return air duct. (1 Point)[128]

4.4.5.3 IHC-2: Environmental Tobacco Smoke

Reduce the exposure of building users and the interior surface of the material from the smoke polluted environment in order to maintaining the health of building users.

- Put up a sign "No Smoking Area around the House" and does not provide buildings / areas for smoking inside the building. When available, building / smoking area outside the building, located at a distance of at least 5 m from the entrance, outdoor air intakes, and window openings. (2 Points)[129]

4.4.5.4 IHC-3: Chemical Pollutants

Reducing air pollution from emissions of building materials that can interfere with the comfort and health of construction workers and building users.

- Using paints and coatings that contain low levels of volatile organic compounds (VOCs), marked with a recognized GBC Indonesia certification. (1 Point)

[126] GBCI: Indonesia Green Building Rating Tools for New Building (GREENSHIP-NB 1.0), GBCI, 2010.
[127] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[128] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[129] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013

- Use low formaldehyde emission levels of composite wood products and laminating adhesive, marked with a recognized GBC Indonesia certification. (1 Point)
- Using lamp material that contains mercury in the approved maximum tolerance by GBC Indonesia and do not use materials that contain asbestos. (1 Point) [130]

4.4.5.5 IHC-4: Outside View

Outside View criterion is aimed at reducing eye fatigue by providing a long distance view and as well as providing a visual connection to the outside.

- If 75% of the Net Lettable Area (NLA) facing directly to the scenery outside, restricted by transparent openings when a straight line is drawn. (1 Point)[131]

4.4.5.6 IHC-5: Visual Comfort

Visual Comfort criterion is aimed to preventing visual impairment due to light levels that are unsuitable with the accommodation power of human eyes.

- Using the lamp illumination (light level) accordance with SNI 03-6197-2011 of Energy Conservation in Lighting Systems. (1 Point)[132]

4.4.5.7 IHC-6: Thermal Comfort

Thermal Comfort criterion is aimed at ensuring comfortable air temperature and humidity in a stable conditioned room to improve the productivity of building users.

- Establish general room thermal condition planning at a temperature of 25°C and and a relative humidity of 60%. (1 Point)[133]

4.4.5.8 IHC-7: Acoustic Level

Acoustic Level criterion is designed to keep the noise level in the room at an optimal level.

- The noise level at 90% of Nett Lettable Area (NLA) is not more than or in accordance with SNI 03-6386-2000 about Sound Levels and Reverberation Time in Building and Housing. (1 Point) [134]

4.4.6 Building Environmental Management

Building Environmental Management category is designed to provide a well-planned management standard to improve and to direct the actions of building users in managing building operations in order to show the results of building in a more environmental friendly result. [135]

This category is the last category in GREENSHIP-NB that contains one prerequisite criterion and seven normal criteria with the maximal score of 13 points.

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[130] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[131] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[132] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[133] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[134] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[135] GBCI: Indonesia Green Building Rating Tools for New Building (GREENSHIP-NB 1.0), GBCI, 2010.

4.4.6.1 BEM-P1: Basic Facility for Waste Management

Basic Facility for Waste Management criterion is a prerequisite criterion that is aimed at encouraging waste separation in a simple movement that simplify the recycling process by the installation or facility to sort and collect garbage like household waste (Law no. 18 of 2008) based on the type of organic, inorganic, and B3.[136]

4.4.6.2 BEM-1: AP as Member of Design Team

This prerequisite criterion is aimed at directing the steps of a green building design at an early stage to facilitate the achievement of a design that meets the rating requirements by involving at least one expert who has been certified GREENSHIP Professional (GP), which served to guide the project to obtain a GREENSHIP certificate. (1 Point) [137]

4.4.6.3 BEM-2: Pollutant of Construction Activity

Pollutant of Construction Activity is aimed at encouraging the reduction of waste taken to landfills (TPA) and pollution from the construction process by have a construction waste management plan consisting of:

- Solid waste, by providing a collection area, separation, and a recording system. Recording distinguished by the solid waste disposed to landfill, reused, and recycled by a third party. (1 Point)
- Wastewater, by keeping the entire effluent water quality arising from construction activities so as not to contaminate the city's drainage. (1 Point) [138]

4.4.6.4 BEM-3: Advance Waste Management

Advance Waste Management criterion is designed to encourage cleanliness and waste management in an integrated manner, thereby reducing landfill burden.

- Organic waste processing building conducted independently or in collaboration with third parties in order to add benefit value and to reduce environmental impact. (1 Point)
- Inorganic waste processing building conducted independently or in collaboration with third parties in order to add benefit value and to reduce environmental impact. (1 Point)[139]

4.4.6.5 BEM-4: Proper Commissioning

Commissioning is a quality assurance process from predesign through construction, start-up, and to improve the suitability of the building owners' expectations. Carry out building

[136] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[137] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[138] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[139] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013

commissioning in a good and right way in order to reach the resulting performance in accordance with the initial plan.

- Commissioning testing procedure in accordance with the instructions GBC Indonesia, including related training to optimize functionality and performance suitability equipment / systems with planning and reference. (2 Points)
- Ensure that all adjusting measuring instrument has been installed at the time of construction and attention to the fit between designs and technical specifications related to components of proper commissioning. (1 Point) [140]

4.4.6.6 BEM-5: Submission Green Building Implementation Data for Date Base

This criterion is aimed at completing the implementation of green building database in Indonesia to sharpen standards and research materials.

- Submit data in accordance with the implementation of green building form of GBC Indonesia. (1 Point)
- A statement that the building owner will submit the data implementation of green building within 12 months after the date of certification to the GBC Indonesia and an Indonesian energy data centre that will be determined later. (1 Point) [141]

4.4.6.7 BEM-6: Fit-Out Agreement

Fit-Out Agreement is the last criterion of Building Management category with maximal score of 1 points that aimed at Implementing green building principles when fit out the building by having an agreement with the tenants to rent a building or buildings used for the POS itself, which consists of:

a. The use of certified timber to fit-out material
b. Implementation of the training will be conducted by the building management
c. Indoor air quality management practices (IAQ) after construction fit-out. Implementation in the form of Lease Agreement (lease agreement) or POS.[142]

4.4.6.8 BEM-7: Occupant Survey

Occupant Survey is aimed at measuring comfort of building users through a standard survey to influence the design and operation of building systems.

- A statement that the building owner will hold the temperature and humidity of the survey no later than 12 months after the date of certification of the results of the survey and submit a report no later than 15 months after the date of certification to the GBC Indonesia. (2 Points) [143]

[140] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[141] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[142] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[143] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013

(Note: If the result is more than 20% of respondents expressed discomfort, then the landlord agrees to make improvements no later than 6 months after the reporting survey results.)

4.5 Selective Comparison of GREENSHIP and LEED

Each country has its own specific environmental issues diverse from other countries with different geographic, climate, economy and culture. However, principles of sustainable development require global perspective as well, thus it is important to analyse the sustainability target of rating systems in order to improve the performance of them in general.

The purpose of this analysis is to conduct a selective comparison between GREENSHIP as the only existing rating system in Indonesia and LEED as one of the most well-known rating systems in the world using consensus-based approach. Principally, GREENSHIP was specifically designed by adopting category and criteria from existing rating systems in the world. There are basically wide range of differences between GREENSHIP and LEED, however this comparison only discussed about selective issues such as prerequisite criteria, sustainability targets as well as revealing of baseline used on each rating system. GREENSHIP has adopted basically main idea of LEED rating system, however the consideration of point allocation in GREENSHIP is still widely differ from LEED and the rest of existing rating systems used by GREENSHIP as basic consideration.

It is exceedingly complicated to directly and comprehensively compare the two systems since it is not the focus of this research. However, there are some important matters that should be taken into consideration to deliberately explain the performance of GREENSHIP as new rating system and its role to deliver the basic principle of sustainable development.

GREENSHIP is a relatively new building assessment method that was developed by adopting basic principles of existing building assessment method from different countries like USA, Australia, Singapore, Malaysia and the United Kingdom. However, the final appearance of GREENSHIP is considered based on building sector condition and environment of Indonesia. Therefore, it is important to generalized main principles of GREENSHIP by comparing the GREENSHIP rating system with a noted existing building assessment system.

Selective comparison of GREENSHIP and LEED is mainly aimed to examine the principle of sustainable development and the elements of building that is conspicuously in both systems. However, the comparison is not aimed to pass judgement on the environmental performance of both LEED and GREENSHIP.

4.5.1 Comparison of the Prerequisite Criteria

Prerequisite criteria are scoreless criteria that mandatorily must be met and be implemented in a category in order for the whole criteria in a category to be assessed and scored. Based on pointed prerequisite criteria, it can be conclusively said that prerequisite criteria represent the basic requirements and goals of each category.

LEED applied requirement for minimum performance of each category such as energy and water efficiency. Some certain categories cannot be implemented if some certain level of

performance is not fulfilled. For instance, a minimum 20% of water reduction has to be reached, in order to carry out the full assessment of water efficiency category. Meanwhile, GREENSHIP requires non-quantitative performance, such as instalment of metering as the basic prerequisite criteria of water and energy categories. From this point of view, LEED has made it more difficult to achieve the basic requirement of building assessment. Additionally, due to the minimum performance required by LEED, it automatically covers the prerequisite criteria of GREENSHIP, thus in order to measure water or energy reduction, some metering installations are required.

GREENSHIP uses metering and calculation for the basic prerequisite criteria on energy and water categories. Meanwhile LEED started with minimum energy performance and water use reduction as the prerequisite criteria. Hence LEED is one step further in energy and water use restriction compare to GREENHSIP, where metering is used as the basic requirement for the categories.

Table 15: Comparison of prerequisite criteria on LEED and GREENSHIP

Prerequisite Criteria	LEED	GREENSHIP
Energy	• Fundamental commissioning of building energy systems • Minimum energy performance • Fundamental refrigerant management	• Sub-Meter Installation • OTTV calculation
Water	Water use reduction (minimum of 20%)	• Water Metering Installation • Water Calculation based on GREENSHIP worksheet
Material	Storage and collection of recyclables	Fundamental Refrigerant
Indoor Quality	• Minimum indoor air quality performance • Environmental Tobacco Smoke (ETS) control	Outdoor air introduction
Site	Construction activity pollution prevention	Basic green area
Building Management	-	Basic waste management

4.5.2 Comparison of the Selective Sustainability Target and Benchmarking

Comparison between baseline of GREENSHIP and LEED is needed in addition to measure the saving targets of each system. Table XX shows an example of baseline buildings comparison between GREENSHIP and LEED based on water usage. Each method uses their local building standard and regulation as the baseline building or also known as conventional building.

Table 16: Water Usage comparison between baseline standard of GREENSHIP and LEED

	Indonesia Baseline (SNI 03-7065-2005)	GREENSHIP	USA Baseline (EPAct 1992)	LEED
Toilet	14-15 Litres/Flush	<6 Litres/Flush	6 Litres/Flush	4.8 Litres/Flush*

*Prerequisite Criteria

Basically, Indonesian conventional building sets a really high insufficient water usage. However, GREENSHIP has set up its standard to be approximately 60 percent less than the baseline building, with points awarded for every 25 percent reduction (maximum 75 percent).

Based on the benchmarking of the baseline buildings, it is clearly showed that Indonesian conventional building sets a higher minimum water usage compare to USA conventional building by 60 percent. As can be seen on the previous discussion, LEED set a 20 percent minimum water reduction as its prerequisite criteria on Water Saving Category. Meanwhile,

4.6 Review of GREENSHIP Sustainable Development Targeting

Green building rating system is aimed to improve the environmental performance of buildings toward sustainable development principle. Therefore, it is important to review the role of GREENSHIP criteria in delivering the principle of sustainable development into practices in order to maximize the benefit of GREENSHIP in Indonesian building sector.

Bruntland commission defined sustainable development as development that meets the present needs without compromising the future needs, [144]in other words, sustainable development embraces principle of development that functions continuously for future oriented. A green building rating system must be able to deliver the principle of sustainable development as a whole with the aim of improving the performance of building in ecology, economy and social aspects.

GREENSHIP was developed by GBC Indonesia by adopting criteria from several existing building assessment methods. The idea was to choosing criteria that have been included in existing methods that considered universal as well as suitable for the condition of Indonesia building sector. Hence, GREENSHIP was basically developed without comprehensive research

Hence, criteria on GREENSHIP were chosen without a comprehensive research and background that can represent the actual needs of building sector in Indonesia. This problem has led to a non-sensible criteria and indicators measurement in order to grasp the main objective of sustainable development.

[144] United Nations. Report of the World Commission on Environment and Development. General Assembly Resolution 42/187, 11 December 1987. Retrieved: 2007-11-14

A building is considered sustainable if it success to perform as an environmental friendly building as well as a financially sustainable investment and socially applicable. GREENSHIP-NB 1.2 covers six major categories including:

- Appropriate Site Development (ASD)
- Energy Efficiency Conservation (EEC)
- Water Conservation (WAC)
- Material Resource and Cycle (MRC)
- Indoor Health and Comfort (IHC)
- Building Environmental Management (BEM)

4.6.1 Resource Consumption

Buildings activities contribute large amount of energy and natural resources as well as high number of pollutants to the environment. Therefore, there is need for a better and more environmentally friendly building design in order to improve building performance which will also sustainably preserve the ecological balance as a whole.

Environmental issues comprise energy consumption, natural resource degradation and others environmental impacts. GREENSHIP-NB has covered most of the main environmental issues causing of building construction and activities, however it is important to do further analysis of the direct influence of criteria on GREENSHIP-NB to the environmental building performance.

4.6.1.1 Energy Consumption

Energy Efficiency and Conservation category is aimed to reduce building energy consumption by instalment of electrical metering as the first prerequisite criterion following with the requirement of OTTV calculation. Energy Efficiency Measures is the third criterion that has maximum available score of 20 points, this criterion is considered as the highest points awarded criterion on GREENSHIP-NB.

Energy Efficiency and Conservation category also covers others energy reduction aspects such as natural lighting, ventilation, climate change impacts and on site renewable energy. On-Site Renewable Energy criterion is considered on GREENSHIP-NB as a bonus criterion due to the lack of advance technology available in Indonesia as developing country.

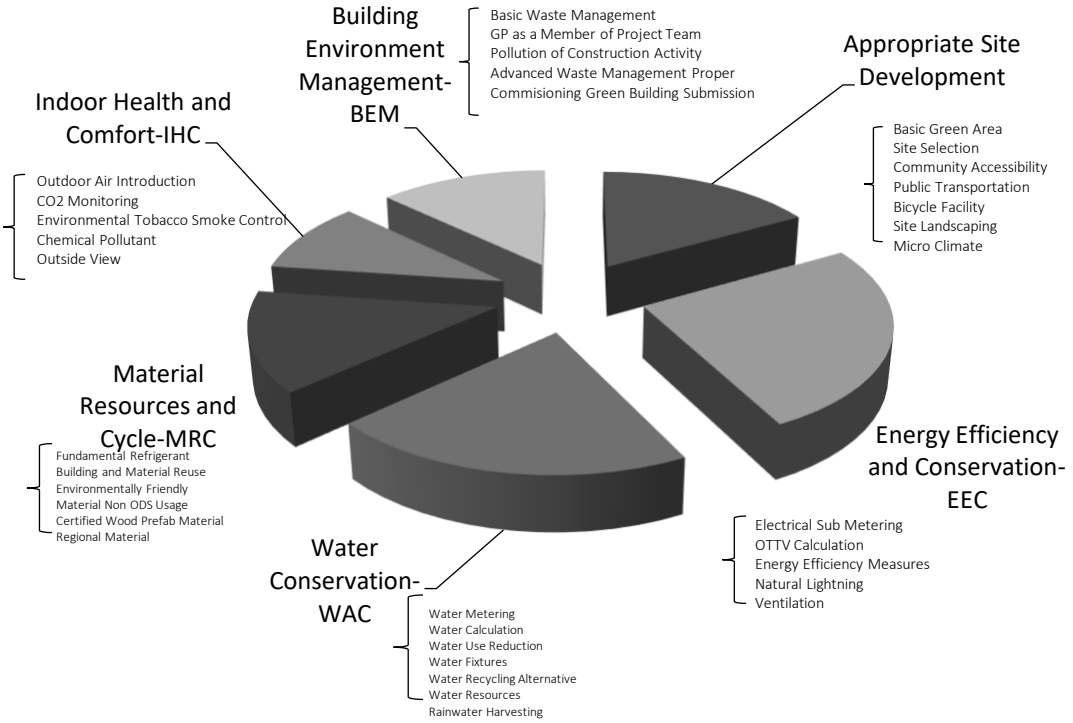

Figure 20: Criteria of GREENSHIP-NB 1.2

4.6.1.2 Natural Resources Consumption

Water consumption is the main environmental problem in Indonesia especially in big cities like Jakarta and Surabaya. In Jakarta, the low quality of piped and surface water sources has led to the over exploitation of groundwater. The continuous extraction of groundwater for households and commercial purposes has generated other environmental problems such as land subsidence that led to floods etc.

GREENSHIP-NB included water consumption as one of the category in the assessment tool. Water Conservation category contains 20.8% of total awarded points and appear as the second most important category on GREENSHIP-NB after Energy Efficiency and Conservation category. The water conservation category consists of two prerequisite criteria and six normal criteria including:

- Water Metering (P)
- Water Calculation (P)
- Water Reduction (8)
- Water Fixtures (3)
- Water Recycling (3)
- Alternative Water Resources (2)
- Rainwater Harvesting (3)
- Water Efficiency Landscaping (2)

4.7 Role and Implementation of GREENSHIP

Since the first time it was launched in 2010, GREENSHIP has certified two new buildings and three existing buildings in Indonesia. Certified GREEENSHIP buildings are required to be re-assessed every 3 years based on criteria of GREENSHIP for existing building to preserve the GREENSHIP status. The development progress of GREENSHIP certification in Indonesia is relatively slow compares to neighbour countries like Singapore and Malaysia.

Table 17: Projects within GREENSHIP Certification

GREENSHIP	Number of Projects	Achievement
Registered Project-New Building	25	
Registered Project-Existing Building	2	
Design Recognition-New Building	3	2 Platinum; 1 Gold
Certified Project-New Building	2	1 Platinum; 1 Gold
Certified Project-Existing Building	3	1 Platinum; 2 Gold

Green Building Index from Malaysia that was launched on 2009 has certified 5 non-commercial buildings, meanwhile almost 60 non-commercial buildings have been certified on design stages. Therefore, it is important to identify the role of GREENSIP as the first and only building assessment tool in Indonesia in order to improve its implementation and contribution in Indonesian building sector.

4.7.1 GREENSHIP as Design Tool

Building assessment method is originally designed to assess the performance of building toward sustainability principles. However, the implementation of building assessment method in general covers not only the final performance of building but it also has been used widely as design tools[145].

Implementation of the building assessment methods for the purpose of design tool is still considered ineffective when the introduction or the involvement of the assessment method is done and used to evaluate the performance of building design. A green building project must be defined as early as the feasibility stage, GREENSHIP as building assessment tool requires an early involvement through project development since the design stage to maximize the role of its trough complete building design. Design Recognition (DR) on GREENSHIP served as the first stage assessment to assess the quality of building design based on criteria of GREENSHIP. However, the assessed object on this stage is mainly from available bid/tender documents. Meanwhile, an early collaboration between GREENSHIP and building design is highly recommended due to the role of building assessment methods as building design guidelines.

Design Recognition can help the project team to improve the building performance by upgrading the quality of building design following the result from DR assessment. Design Recognition is

[145] Cole, R.J: Building Environmental Assessment Methods: Clarifying Intentions, Building Research and Information, 35 (5), 455-467. 1999

carried out after the building design is finalised, however it provides building design team to apply specific improvements to increase the performance of building based on GREENSHIP standard.

4.7.2 Financial Consideration of GREENSHIP

Green building is generally known as relatively expensive investment. Lack of economic consideration on existing building assessment tools can jeopardize the basic principle of a development where financial return is a mandatory to the sustainable investment[146]. Investors hold the main role in green building investment. Financially sustainable investment plan can encourage investors to invest in green building despite the fact that green building has been relatively considered as more expensive than conventional building. Same idea is also applied to the perspective of the building end users. Users as the main focus of a building development must be well considered. Rental or buying investment of buildings by the end users need a sufficient and financially sustainable investment plan in order to improve the awareness of green building as well as having a healthy investment. Nonetheless, the awareness of importance of green building that is environmentally friendly is not sufficient enough to boost the demand of green building by end users.

GREENSHIP-NB covers environmental aspects like site selection, energy efficiency, natural resource consumption and pollutant reduction but failed to provide a financial consideration of sustainable building development, consequently GREENSHIP designed building can be environmentally friendly but financially unsustainable for both investors and end users. Lack of clear financial consideration may hamper the performance of GREENSHIP in accomplish a better development of green building in Indonesia. Financial factor plays the main role in every kind of investment. An investment can be considered as sustainable when it is financially sustainable. Some building certification system like DGNB included financial consideration as Economic Quality category to be assessed. It consists of some criteria such as Building-Related Life Cycle Cost, Value Retention-Sustainability for Third Party Use, Life Cycle Cost, and Fiscal Effects on Municipality, Value Retention and Efficient Use of Space.[147]

Meanwhile, GREENSHIP and LEED excluded the financial consideration from their rating systems. There is always a necessity to astutely include the financial consideration on a rating system. Nevertheless, the target of the financial consideration has to be adjusted in order to reach a financial sustainable investment as the basic purpose of every building investment.

Reducing the life cycle cost of building is not necessarily appropriate when the comfortable of the building users might be compromised as well. Hence, the productivity of the building users could be in jeopardized. Furthermore, in the extreme case, "life cycle costs = 0" means that there is no investment at all and therefore no building activity takes place. The original function of real estate would no longer be fulfilled.[148]

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[146] Ding, G. K. C.: Sustainable construction – the role of environmental assessment tools. Journal of Environmental Management, 86, 451–464. 2008

[147] Deutchse Gesellschaft fur Nachhaltiges Bauen (DGNB) (The German Sustainable Building Council). (2011). Excellence Defi ned. Sustainable building with a systems approach, DGNB brochure. Internet: DGNB. Available at http://www.dgnb.de

[148] Vgl. Zimmermann, Josef: Immobilienprojektentwicklung. Vorlesungsskriptum zur gleichnamigen Vorlesung am Lehrstuhl für Bauprozessmanagement und Immobilienentwicklung an der Technischen Universität München.

4.7.3 Limitation of GREENSHIP

GREENSHIP was mainly developed to serve buildings in Indonesia, however, Indonesia is known as country consisting of islands that differ in number of population, economic condition, culture, social life and geographical conditions. Hence, it is difficult to meet the basic and urgent needs of every area in Indonesia. In Jakarta for example, the need of better and improved clean water is urgently high compare to the availability of electricity as the lighting source. This condition of course is widely different with some cities in east Indonesia where clean water is easy to obtain but at the same time, most of residents suffer from lack of electricity available in the area. Sustainable development is certainly a global objective but local adjustment of building assessment tool is highly required to improve the social justice as a whole.

Like the rest of existing building assessment methods and rating systems, GREENSHIP was developed with shortage of sufficient research that can support the reason behind selected criteria and indicators. The selection of criteria and indicators used in GREENSHIP is basically conducted by adopting it from existing building assessment methods in the world. Although some specific adjustment had been directed to the local condition of Indonesia, some specific research shall be done to support the effectiveness of GREENSHIP such as local geographic condition and other environmental issues. A proper reasoning behind the selecting of criteria and indicators is important to reach the main sustainable targets in order to improve the environmental performance of Indonesia and the world in general.

Water Conservation category on GREENSHIP is mainly stirred by the purpose of portable water saving. As the matter of fact in Jakarta as the largest city in Indonesia, water problem has becoming main focus of the local government where groundwater extraction has been massively used to fulfil the water demand of society both for consuming and commercial purposes. Hence, it is important to set limitation for wells created and used by the society. Given this point, GREENSHIP might fail to cover the most important and urgent environmental issue in Jakarta about groundwater extraction that has led to land subsidence and groundwater contamination.

Moreover, there is a lack of clear financial consideration to support the investment decision for sustainable building development. Investors have neither clear nor structural image about the financial advantage they might gain from a GREENSHIP certified building.

4.8 Concluding Remarks

GREENSHIP is the only existing building assessment tool in Indonesia, it has certified three new construction buildings since it was launched in 2010 by Green Building Council Indonesia. Typical main problems as building assessment tool, GREENSHIP-NB is still considered as a new rating system that seeks for better improvements. The rating tool has basically covered the general aspects of green buildings specifications but it was designed more likely based on subjective point of view, thus compromise the main principle of sustainable development as well as the basic need of Indonesia.

GREENSHIP still needs to improve the environmental performance of its rating system due to the continuously need of improvement along the way in accordance with the basic principle of sustainable development. So with this in mind, current high environmental performance buildings shall be a conventional building in the future time.

Subjectivity is still a nature character of GREENSHIP as building assessment system. The criteria and indicators chosen, point allocation and weighting system and some certain parameters were subjectively included without strong scientific reasons behind it. Environmental indicators that are attached to the criteria chosen on GREENSHIP rating system must be given a careful consideration such as local environmental issues, end users requirement, local building regulation and existing building assessment method. Furthermore, the subjectivity of GREENSHIP may hamper the main principle of sustainable development, for example, the involvement of some criteria and indicators that might not be mattered in the future time such as Proper Commissioning and Submission Green Building Implementation Data for Date Base. Moreover, same with existing building rating system, GREENSHIP still suffers from the lack of the accuracy of its scientific background in pointing the quantitative measurement of its criteria. Basically, there is no clear explanation and objective of the percentage reduction for energy and water use requiring by GREENSHIP on its rating system, hence there is a need for further research in examining the reason behind percentage used by GREENSHIP on its criteria in order to achieve certain number of points.

The National Consensus that was held by the GBCI didn't cover the importance of weighting system, thus there is still no reasonable method to guide the framework of weighting system in GREENSHIP. Specifically made to serve the need of better and more sustainable buildings in Indonesia, GREENSHIP needs to develop a more satisfactory weighting system that can be used to represent the needs of Indonesia as a whole. Point allocation in building rating system should basically covers the need of the local area served by the system. However, regional diversity in Indonesia makes it really difficult for any rating system with fixed point allocation and weighting system to covers the need of the whole country. Even though sustainability is a global term, but the urgent need of each area must be firstly met in order to improve the environmental performance of Indonesia as a whole. Therefore, there is an urgent need to adjust the rating system based on the type of area such as urban and rural areas.

GREENSHIP is originally designed by adopting ideas and principle from some existing building assessment systems in order to serve local needs of Indonesia as a developing country, therefore it is important to carefully consider the nature of environmental issues raised in Indonesia without jeopardize the basic principle of sustainability.

Eventually, GREENSHIP has included a criterion to address the perspective of end users, however this criterion (Occupant Survey) only required a statement from building owner to conduct a temperature and humidity survey at least 12 months after the certification date and an agreement from building users to do some improvement when minimum 20% of respondent showed any discomfort related to the subject mattered. This criterion doesn't cover the further requirement of end users, where from the life cycle cost perspective, users is the center of building development. Hence, it is urgently important to address more issues based on the perspective of occupant as end users of building, as well as the source of cash flow through the full life time of a building.

5 Main Sustainability Consideration in the Indonesian Housing Market

5.1 Introduction

Benefit of an investment generally consists of three benefits combination such as periodic cash flow, residual cash flow from appreciation and a potential tax shelter. These three benefits must be considered for every form of investment and must be shown for a valuation model of the investment to the investor in particular.[149]

Living condition, communities and culture can be improved by a well functioned building[150]. A better environmentally performance of building is however not necessarily sustainable if the building itself failed to fulfil the preference of the building users[151] and later lead to the failure of generating a healthy cash flow in long term due to the lack of enthusiastic building customer. Financial consideration stands under economic pillar of sustainability three bottom lines. Hence, there is a crucial need to identify these particular issues in order to have a better understanding of customer perception and preference regarding sustainable building investment. Therefore, the preferences of the end user connected to sustainable building investment should be highly considered as an important information that can influence decision in how to generate a better and more financially sustainable investment.

A form of questionnaire model is developed to identify the main sustainability consideration in Indonesian real estate industry, particularly housing industry. This questionnaire is set to pinpoint two main questions regarding development of housing in Indonesia towards principle of sustainability such as awareness of Sustainable development and the end user preferences related to sustainable building criteria. End user is the targeted respondent holding an important role in a sustainable investment as whole. The term Green building is used to represent the sustainable building in general due to the familiar term for Indonesian building end users.

This particular chapter describes the methodology employed in this research. It describes reasoning behind the design of the survey and questionnaire, and the procedures for conducting the study, including details about the participants, how the data was gathered, and the statistical analyses undertaken.

The Questionnaire consists of three parts; General Information, Awareness of Sustainable Development Concept and Preferences of Sustainable Building Criteria in Practice.

5.2 Overall Method

This empirical study is both quantitative and qualitative in nature in order to identify owner and end user requirement and the prospective sustainable features toward housing in Indonesia. The survey is conducted with questionnaire based model throughout four months' period from the September 2014 to December 2014.

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[149] Miles, Mike E. Real Estate Development; Principle and Pprocess, Fourth Edition. Urband Land Institute. 2007

[150] Baird, G., Gray, J., Isaacs, N., Kernohan, D. and Mclndoe, G.: Building Evaluation Techniques, New York: McGraw-Hill. 1996.

[151] Cole, R.J. Reconciling Technological change and Occupant Expectations, Culture and Environment, Oxford: Blackwell. 2003.

5.2.1 Sample Frame and Target Population

The survey targeted housing industry in Indonesia. It is aimed to identify potential occurrence problem facing by household in big cities which present the housing condition in urban area of Indonesia. Jakarta as the largest city is used as the population target that represents housing condition of big cities in Indonesia. Furthermore, Surabaya as the second largest city in Indonesia after Jakarta is used as the control and comparable result.

Targeted population for this empirical study cover the end users of residential building or housing in Jakarta and Surabaya. Potential buyers are also considered as end users. As it has been discussed in the previous chapter, the status of housing ownership in Indonesia is still dominated by ownership status of own and followed by ownership status of rent. In 2011 for example, the comparison between housing ownership statuses of own and rent was approximately about 79% and 8.68% in Indonesia as whole. These numbers however have different proportion in Jakarta as big city with 46.63% for ownership status of own and 35.3 for rent. The high price of property in Jakarta is believed to be the reason why rental is more a suitable option for people who live or/and work there. Therefore, in the future discussion it will be distinguished between end users that own and rent their current houses.

5.3 Survey Instrument

Questionnaire based model is chosen here as the data collection method. This methodology was considered as an appropriate technique to investigate the aims of this research and gave several advantages such as respondent anonymity, lack of interviewer bias, Efficiency in collecting information from a large number of respondents, Possibility for very large samples, flexibility of information, a wide range of data can be collected and can be used to study attitudes, values, beliefs, and past behaviours as well as ease of application[152].

Both web-based and paper base questionnaire are used here to collect data from the potential respondents. Paper-based questionnaire was distributed through public places like offices, shopping malls, gym and banks as well as through local contractor and developer offices. In the other hand, web-based questionnaire was distributed through social media and emails targeting respondents with reliable access to internet.

5.4 Questionnaire Design

The survey questions were directly tailored to investigate potential household problems, end-users housing preferences and their understanding of sustainability. Initially, it was proposed to only identify end user's preferences and their understanding of sustainability, however later on the survey was improved to first of all identify the common household problems in Indonesia and the willingness of building users to pay in order to solve related problem and furthermore to improve the living condition in general.

The questionnaire was divided into four parts such as general information, housing preferences, potential household problems and sustainable/green building.

[152] Gilham, Bill.: Developing a Questionnaire, 2nd Edition. Continuum International Publishing Group. 2007.

5.4.1 General Information

General information of the questionnaire covers general information of the respondent such as age, city of residence, marital status, children own, education and monthly income. Each question is provided with multiple choices of answer, except children own question that only required yes and no answer.

Multiple choice items contain a stem and a set of options. The advantageous of using multiple choice on this first part of the questionnaire is that respondents are given a much more efficient way to answer by choosing one of the available answers instead of having to write down their answers one by one. It is also helpful in preventing answer bias because respondents are forced to choose only from the available answers.

5.4.1.1 Age

Age information is considered in this research to identify the age range of the respondents and later on will be used as one of the requirements for mortgage application. Here, age of respondents is categorized into six groups of age.

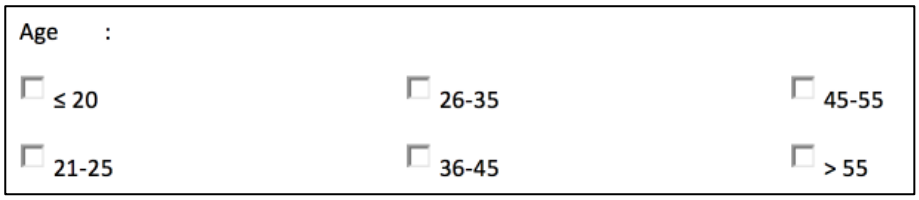

Figure 21: Age Grouping

Like in most countries, Banks in Indonesia also lay down some guidelines about minimum and maximum age of mortgage applicants. Maximum age of mortgage applicant normally represents the age of the applicant by end of mortgage duration. Several banks in Indonesia for example give a higher maximum age of applicant for entrepreneurs than normal employee based on the consideration of retirement age. The average maximum age of the mortgage applicant by the end of mortgage duration is 55 for employee and 50 for entrepreneur. The closer the age of mortgage applicant to their retirement age, the higher mortgage they have to pay due to the limited duration of the mortgage which is influenced by their age at the first place.

5.4.1.2 Gender

Figure 22: Example of Multiple Choice for Gender Classification

Gender identification is important in social research in order to identify specific idea such as cultural belief, roles and values in society. However, on this research, the question regarding gender is used to identify the difference level of income, mortgage application and household problems.

In Indonesia and as other developing countries, women are still struggle with discrimination and lack of education. Evidences in Indonesia showed that women are having difficulty to go on with their career as they progressed with their private life like having children.[153] Additionally, governmental regulation only gave women in Indonesia a total of 3 months' maternity leave which is divided to 1.5 months before and after the birth of their child, it is stated on the Indonesian Labour Law 2003 Number 13, Article 82.

5.4.1.3 City of Residence

This questionnaire is designed to cover two different cities in Indonesia. Jakarta as the capital city with the most populated area in Indonesia and Surabaya as the second biggest city in the country as the city comparator. The objective of using Surabaya as comparator city is to identify whether there is a significant difference between respondent's perspective as well as problems that have to be faced in each of urban areas.

Table 18: Cities Information

	Jakarta	**Surabaya**
Population (2010):		
City	9.607.787	2.765.487
Metro	30.214.303	7.302.283
Area km2:		
City	661,50 km^2	350,50 km^2
Metro	17.132,00 km^2	2.787,00 km^2

Surabaya as the capital city of East Java province is located in the east part of Java Island. It is known as the second biggest city and one of the busiest port in Indonesia. The development of Surabaya has led the city to a relatively advanced city in Indonesia. However, with the continuously development, Surabaya has shown some environmental problems due to the increasing number of industries in the city. Even though the city hasn't faced the exact level of environmental problem like Jakarta, it is believed that the common problems have the same roots such as flooding, water deficiency and traffic as well as garbage management.

Based on previous explanation about Surabaya, a comparative research will be applied with Jakarta and Surabaya as the comparative objects. The aim of the comparative research is to make an objective judgement regarding real estate development particularly housing industry in both cities.

[153] Dian Mariska, Women Career and the Factors influencing in Construction Industry. 2007. The 1st International Conference of European Asian Civil Engineering Forum", (1st EACEF) Pelita Harapan University.

5.4.1.4 Area of Living

Develop human settlement consists of four different kinds of settlement such as urban, suburban, rural and exurban which are different from each other based on the number of population. This research is targeting respondents living in urban, suburban and rural area.

Moreover, it is important to define above mentioned settlement in both Jakarta and Surabaya in order to avoid any misunderstanding and misinterpretation from the respondent concerning the basic principal of the developed human settlement they are living in.

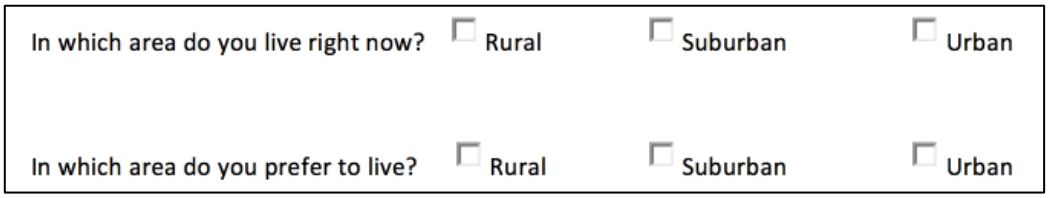

Figure 23: Area of Living

Figure 23 shows questions regarding living area of respondents and their actual preferences regarding this concerned human settlement. These two questions are aimed to identify and to group respondents into their living or settlement categories in order to relate it later with their main existing environmental problems.

Table 19: Population Density of Greater Jakarta in 2014[154]

Urban (Population Density: > 10.000/km^2)	Suburban (Population Density: 3.000-10.000/km^2)	Rural (Population Density < 3.000/km^2
Central Jakarta	Bogor	Tangerang Regency
West Jakarta	Bekasi	Bogor Regency
East Jakarta	Tangerang	Bekasi Regency
North Jakarta	South Tangerang	Thousand Islands
South Jakarta	Depok	

Since there is no clear or exact rule in dividing the settlement area in the Greater Jakarta, the grouping on this research will be based on the population density. The same grouping will also be applied to the city of Surabaya, but of course with some adjustment of the population density rules, due to the number of population difference between the two cities.

[154] BPS-Statistic Indonesia: Population Density of Greater Jakarta. 2014.

Table 19 shows division of Urban, suburban and rural area based on the population density in the Greater Jakarta. Meanwhile, Table 15 show the same content for Surabaya.

Table 20: Population Density of Surabaya (Metropolitan) 2014

Urban (Population Density: > 5.000/km^2)	Suburban (Population Density: 1.000-5.000/km^2)	Rural (Population Density < 1.000/km^2
Central Surabaya	Mojokerto	Lamongan
West Surabaya	Gresik	Bangkalan
East Surabaya	Jombang	
North Surabaya	Sidoarjo	
South Surabaya		

5.4.1.5 Type of Housing

Type of housing in Indonesia can be separated as single detached home and apartment. Single home or also known as single family residence is type of housing where the house stands alone as residential building. However, in Indonesia single home can stand beside other single houses with walls as the separator. Meanwhile, apartment is type of housing which built together in one building.

Figure 24: Type of House

5.4.1.6 Size of House

Bank Indonesia as central bank in Indonesia categorized size of housing for mortgage application purpose into three categories consist of Type 1 for houses with total size is smaller than 21m^2; Type 2 for middle size house with size range from 22-70m^2; and Type 3 for houses with size >70m^2.[155]

[155] Bank Indonesia: Coding of Bank Indonesia Regulation. Management, Risk Management. 2013

Figure 25: Size of House

5.4.1.7 Status of Ownership

Status of ownership for housing in Indonesia consists of ownership status of own and ownership status of rent.

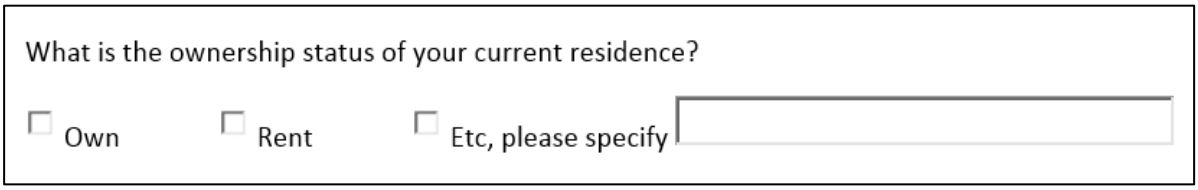

Figure 26: Status of Ownership

5.4.1.8 Mortgage Information

This section is designed to explore the decision of home buyers regarding their transaction. As it has been discussed before, the financial sources of end user's housing transaction are dominated by banking mortgage, it is necessary to identify the type of chosen transaction selected by end users to finance their future home in order to see the government and developer's ability to influence the market force towards sustainable development.

If the premise is true that the financial source of housing in Indonesia depends on the mortgage system, the government can eventually influence the transaction itself through application of governmental policies that can favour Indonesian real estate development towards a better and more sustainable direction.

Here respondent is asked regarding their financial source. Taken into account that respondents who fill these section are those who consider buying instead of renting.

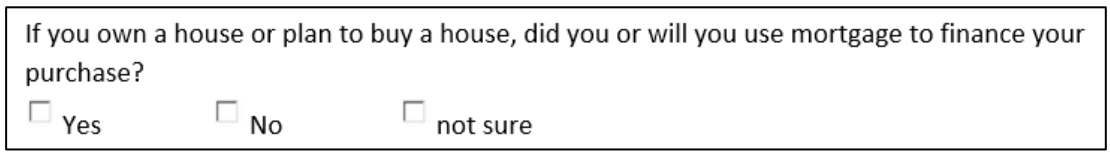

Figure 27: Mortgage Information

5.4.1.9 Type of Bank for the Mortgage Application

As in most countries as well as in Indonesia, type of bank consists of private banks and public banks. In Indonesia, some public banks were created in order to accommodate mortgage for the society especially those with limited modal/capital.

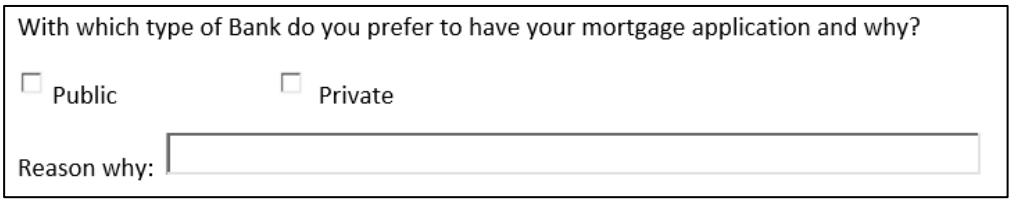

Figure 28: Type of Bank

5.4.2 Housing Preferences

Indonesia as developing country still suffers from several household problems that might risk and compromise people's health quality. Problems such as difficulty to access clean and drinkable water, waste management and electricity have led to a serious society problem that should not be underestimated. Based on the perspective that a home can be described as a sustainable home when it meets the requirement of its future tenant as a specific demand that encourage investor and developer to invest in such type of home. It is more than necessary to identify the end-user's basic preferences and requirement of housing in order to provide a more suitable housing design in the future.

Together with the tremendous development of housing and infrastructure in the urban area, there is a move of the housing pattern from urban to rural area due to the limited supply of land in the urban area as well as the repetitively growth in land pricing.

In the developing country like Indonesia, the social regulation toward housing and land use are still in general dwelling with the effort to protect the land from the hazardous activities, rather than to protect natural habitat from its future degradation especially in the rural areas. Therefore, the continuously movement of housing development would threat natural habitations in the rural area due to the lack of regulation to prevent it from happening. Strong act of regulation tends to be done after occurrence of problems rather than to generate the preventive act through it. Hence, it is hard to avoid the existence of future problems with the current regulation.

Tendency of housing developers to open new housing region in the rural area basically based on several considerations such as lower land prices, lower level of competition with other developers, less stringency of the regulation and lower rate of the Land and Building tax.

Generally speaking, the willingness of building users to pay for something to be repaired is mostly higher than the willingness to pay for something to be improved. Based on their economic situation and household cash flow, it is necessary to put all expenses in order according to their necessity to be taken care of. Important to realise, the fundamental idea of a sustainable house should have covered the basic household problems such as garbage management, clean water sources, healthy sanitation system and suitable electricity capacity

5.4.3 Potential Household Problems

As in other developing countries, Indonesian housing industry still face the difficulty for its development due to existing household problems that basically hamper both environmental performance and individual health in the country. Based on the assumption that big cities like Jakarta and Surabaya suffer from common environmental problems for their housing development, several household problems will further be listed on the questionnaire in order to identify the most severe problems facing by housing end users in Jakarta and Surabaya. Moreover, respondents will be asked to rate their willingness to pay in order to improve particulars problems they are facing.

Following household problems are adopted from the questionnaire developed for assessing demand and willingness to pay concerning solid waste disposal and collection service which developed as a guidance pack for the private Sector participation in municipal solid waste Management in Switzerland[156]. Furthermore, these problems are also carefully cross-checked selected based on literature review of Indonesian environmental problems.

5.4.3.1 Difficult Access to Drinkable and Clean Water

As it has been discussed in the previous chapter that Indonesia still suffers from a problematic environmental issues especially in the urban area with relatively high density of population. Jakarta for example as the capital city of the country and the most populated city in Indonesia have been facing a serious problem to access clean and drinkable water in the last decades.

Report from the United Nation about access to basic sanitation showed that most developing and poor countries in Africa and Asia still suffer from bad access to clean water, this problem increased the risk of diarrhoeal and other diseases fatal to children. At the same time, rapid urbanization without the support of medical facilities and waste management is believed to have magnified the bad situation into a worse one[157].

Heavy rainfall in Indonesia has visibly showed that Indonesia has enough water supply in general. However, in urban areas with high population density like Jakarta and Surabaya, clean water is much harder to be accessed due to the low quality of water infrastructure and distributing system.

In Jakarta for instance, clean water is accessed through some sources like PDAM (*Perusahaan Daerah Air Minum*) as the local water supply company and groundwater. The difficulty and complicated bureaucracy as well as expensive water tariff for accessing PDAM water has forced people in Jakarta to use groundwater as their main water source.

Water supply in Jakarta has always been a big problem for the entire society. Not only that the piped water has relatively high price, the quality of piped water is also low. The initial cost for water piped installation in Jakarta tend to be so expensive, hence people prefer to get their daily water need by underground water extraction. Difficulty in accessing clean water in big cities have become one of common environmental issues facing by high population density area. Middle to upper-class neighbourhoods have the advantageous to enjoy a good access to piped water provided by the local water company, 24-hours/day access is available for running the

[156] Levine, S.: Guidance Pack: Private Sector Participation in Municipal Solid Waste Management, Swiss Centre for Development Cooperation in Technology and Management, St. Gallen, Switzerland, 2000

[157] World Health Organization (WHO): Health through safe drinking water and basic sanitation. www.who.int

daily household need. In contrast, it is common to find some area where the water only flows out of the water pipe for several hours a day. This of course intricate enough when the water flow time is during unsuitable time of the day. People living in the deprived neighbourhoods have to suffer from the lack of piped water accessibility, forcing them to use communal ground pumps to access groundwater without dubious water quality that mostly contaminated by insufficient waste disposal system[158].

In 2011, only 55% of total Indonesia household have the access to improved drinking water pipe, meanwhile the rest of household still relied on other water sources such as rain water, groundwater and bottled water. Therefore, it is important to identify the seriousness of this specific problem in order to promote a better or improved water access for sustainable housing concept, where it is necessary to not only for having the ability to access clean water but also the ability to apply a water efficiency system in it.

Sources of drinking water in Indonesia are coming from nine major sources such as Pipe Water, Pump, Bottled Water, Protected Well, Unprotected Well, Protected Spring, Unprotected Spring, and River as well as Rain Water. Figure 29 showed comparison between sources of Drinking Water in Indonesia as whole and in Jakarta. It can be seen that in Jakarta, bottled water is the main source of drinking water chosen by most households, followed by pump and piped water. Therefore, improvement in water accessing is highly important in order to give a better quality standard of living in the related city.

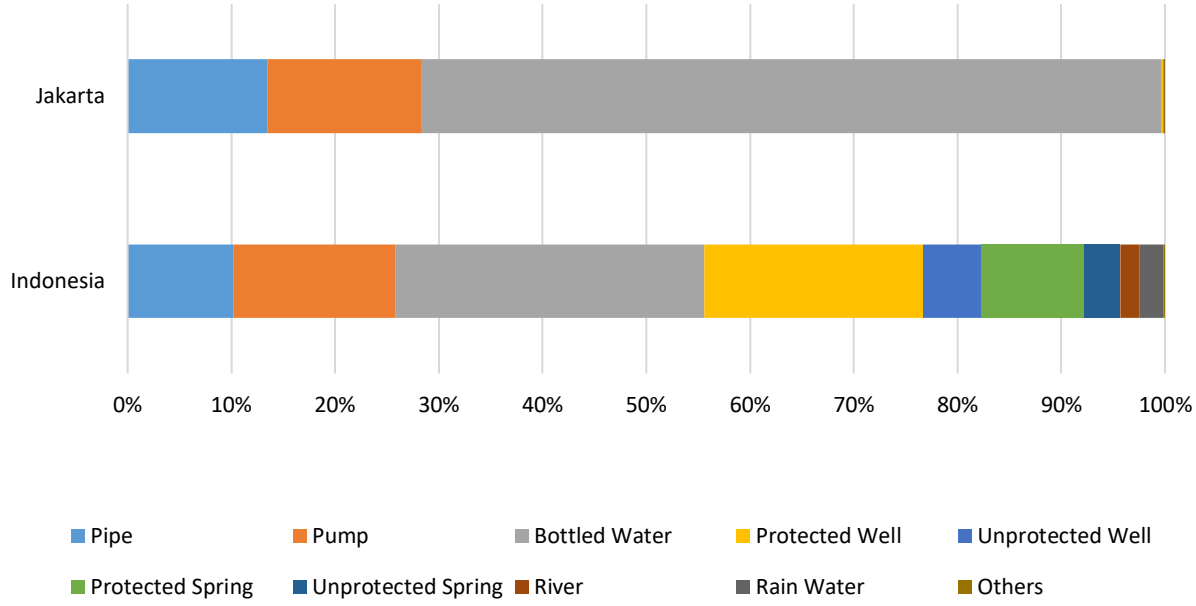

Figure 29: Percentage of Households in Indonesia based on Source of Drinking Water, 2014

158 Special Unit for South-South Cooperation: Jakarta, Indonesia. Case Study (Water). www.esc-pau.fr

5.4.3.2 Poor quality of drinking water

Water quality is described by the condition of the water regarding its suitability for specific purpose of use including its chemicals, physical and biological characteristic[159]. Indonesian Governmental Regulation Number 20, 1990 about Water Pollution Control has classified water into four different categories according to their parameters such as physic, chemical inorganic, chemical organic and microbiologic. First category (Group A) is drinkable water without the need of processing, Group B is raw water used as drinking water that need to go under specific process. Group C is water for fisheries and livestock and Group D is water used for agricultural, industrial and hydropower[160].

Beside water problem like difficulty to access clean water or drinkable water, household in Indonesia suffer from relatively serious quality of drinkable water. Metal contamination from old water piped system, inadequate waste disposal, sea water infiltration to the groundwater void have caused difficulty for people to run their daily household and have forced people to buy a better quality of water from local vendor with 10 to 15 times more expensive than normal residential water tariff provided by the local water company (PDAM).[161]

In Jakarta, percentage of household with access to drinking water is 92% in 2013[162], however the quality of the water is still below the standard required for a safe drinking water. Meanwhile in East Java with Surabaya as the capital city, percentage of household with access to drinking water is only 74% in 2013[163].

Another point is that in Surabaya for example, there is no proper drinking water pipeline available to provide the city with good quality of drinking water that are not prone to any contamination due to several ongoing constructions like excavation of the road etc. that might risk leaking. Communications and Information Agency of East Java Province stated that river water is the main source of raw water that is used for human consumption, regardless it will later be treated into drinking water, it is still below the standard. Complains received from the society showed that the water which come out from their pipeline is still not drinkable. This problem occurs both from the high concentration of the industrial waste that has been loaded directly to the river as well as waste from households. In addition, waste from agriculture is believe to aggravate the quality of raw water in Surabaya.[164]

5.4.3.3 Inadequate disposal of residential wastewater

Wastewater in Indonesia which derives from the household activity such as washing, kitchen, toilet, shower etc. needs to be taken more seriously by Indonesian government in general. Water management issue showed increasing potential of further degradation in Indonesian household especially in big cities where population density is relatively high. With that in mind, inadequate of wastewater disposal in a big amount of volume will literally contribute to river pollution where uncontrollable wastewater just being dumped into the river. Next table showed

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159 Diersing, N.: Water Quality: Frequently Asked Questions." Florida Brooks National Marine Sanctuary, Key West, FL. 2009.
160 Indonesian Governmental Regulation Number 20, 1990 about Water Pollution Control
161 Special Unit for South-South Cooperation: Jakarta, Indonesia. Case Study (Water)
162 BPS-Statistic Indonesia: Access to Drinkable Water in Jakarta.2013.
163 BPS-Statistic Indonesia.: Access to Drinkable Water in East Java
164 Communication and Information Agency of East Java Province: Main Report: “Water Quality of Surabaya’s River is the most dangerous”. 2015

quality of river water in Jakarta based on the local Environmental Management Agency (BPLD Jakarta).

Table 21: River Water Quality in Jakarta[165]

Quality Status	Pollutant Index					
	2004	2005	2006	2007	2008	2009
Good	0%	0%	3%	0%	0%	0%
Low Polluted	3%	5%	9%	0%	0%	9%
Moderate Polluted	16%	16%	10%	6%	12%	9%
High Polluted	81%	79%	78%	94%	88%	82%
Total	100%	100%	100%	100%	100%	100%

On Table 21, it can be seen that in 2009 there was factually no river in Jakarta that is categorized into good or zero pollution, while 82% of rivers in Jakarta are highly polluted. This number explained the fact that river water cannot and should not be used as drinking water source in Jakarta. Meanwhile, while quality status of ground water in Jakarta is still slightly better than the

River water, the percentage of good ground water in 2009 was only about 23% of total available ground water in whole Jakarta. This fact has leaded most of Jakarta's residents into depending on the bottled water for their daily water consumption.

Table 22: Ground Water Quality in Jakarta[166]

Quality Status	Pollutant Index					
	2004	2005	2006	2007	2008	2009
Good	18%	16%	7%	25%	23%	23%
Low Polluted	33%	33%	55%	43%	48%	41%
Moderate Polluted	28%	35%	13%	20%	16%	19%
High Polluted	21%	16%	25%	12%	13%	17%
Total	100%	100%	100%	100%	100%	100%

In Indonesia, water pollution mainly occurs from the fact that there are only few households using a proper Waste Water Treatment Plant. The lack of clear regulation regarding this matter and low implementation of the existing regulation are believed to be the main barrier for this matter.

[165] Jakarta Environmental Management Agency (BPLD Jakarta)
[166] Jakarta Environmental Management Agency (BPLD Jakarta)

5.4.3.4 Inadequate disposal of human excreta

Inadequate disposal of human excreta is often found in poorest area of cities in poor and some of developing countries. This problem often leads to a serious contamination of both ground and water in the surrounding area[167].

Table 23: Percentage of Households in Jakarta by Type of Toilet Facilities in 2013[168]

Facilities of Human Excreta Disposal	**%**
Private Facility	79.19
Shared Facility	16.30
Public Facility	4.37
Unavailable	0.14
Total	**100**

As it can be seen on the previous Table, in Jakarta for example, almost 80 percent of the society have their private facility for the disposal of human excreta, nevertheless it is necessary to identify whether there is negative impact from the relatively small percentage of inadequate disposal of human excreta to the surrounding area.

5.4.3.5 Flooding and inadequate drainage of storm-water

Jakarta as the capital city which is passed by three big rivers and basically located in a lower basin making the rain water from other higher lands to accumulate through the city before it goes to the sea. This fact is also worsened by the continuously development of the city where more and more green area is replaced by hard surface which led to the massive reduction of water absorption.

Meanwhile, stormwater is mainly generated from the rain water which goes through house roofs, paved areas and roads. It is highly dependent on the rainfall volume in the local area and the catchment of river upstream as well as the surface shape of the related area. Just like the wastewater from household activities, solid material could also be found in the stormwater when the path of stormwater run-off is not free from both debris and pollutants. Lack of green area available in most of big cities like Jakarta and Surabaya contributed greatly to the frequency and water quantity of flooding due to the inability of stormwater to penetrate into the ground.[169]

[167] Harvey, P.A., Baghri, S., Reed, R.A.: Emergency Sanitation: Assessment and programme design WEDC, Loughborough University, UK. 2002.
[168] BPS-Statistic Indonesia: Percentage of Households in Jakarta by Type of Toilet Facilities in 2013.
[169] United Nation Environment Programme. Environmentally Sound Technologies in Wastewater Treatment for the Implementation of the UNEP Global Program of Action “Guidance on Municipal Wastewater”. 2004.

Figure 30: Map of Flooding in Jakarta 2014

5.4.3.6 Poor access for motor vehicles

An adequate infrastructure for motor vehicle is always important to support the activities of cities all of over the world, in particular large cities like Jakarta and Surabaya. Until 2010, road construction had a growth of 0.01% per year in Jakarta whilst the growth of vehicle is almost 10% per year[170]. Thus, there is an extreme imbalance between available vehicles and the infrastructure to accommodate it. Furthermore, lack of infrastructure means the existing ones have to take higher load of vehicles which will often lead to the decreasing of the infrastructure quality and more importantly it will end with further degradation environmental performance like bad air quality due to the enormous amount of traffic standing on a bad road condition.

Meanwhile in Surabaya, Department of Public Transport stated that there are four factors influencing the premature road damage in Surabaya which include rain, not so optimal drainage, inappropriate use of roads and lack of good quality of road work. These factors contribute to the road accessibility by motor vehicle.

5.4.3.7 Lack of public transport

Report by Department of Transport in Jakarta showed that in 2011the percentages public vehicle in the city is only 1.5% from the total of 6.7 Billion available vehicles. Lack of public

[170] United Nations Forum: Urban Public Transport System in Jakarta. United Nations Forum on Climate Change Mitigation, Fuel Economy and Sustainable Development of Urban Transport. 2010.

transport meaning people are forced to use their private vehicle in order to perform their daily activities, hence higher number of available vehicle and further environmental degradation.

5.4.3.8 Unreliable electricity supply

In Indonesia especially in big cities like Jakarta and Surabaya, unreliable electricity supply from the municipality has caused many blackout events due to either lack of generator capacities or power station blasts. Blackout caused so many negative impacts like loss of business activities and unproductivity of the society. PLN as the electricity provider has failed to meet high demand of electricity which leaded to many blackouts. In 2008, occasional blackout in Jakarta has caused economic loss by 14.000 USD per hour in greater Jakarta region. Therefore, in order to create a fast electricity supply, Indonesian government converted some of its gas and coal power plant to oil based power plant in Java Island, but this solution of course creating financial damage due to the high amount of subsidy to buy the oil for the power plant[171].

5.4.3.9 Inadequate solid waste disposal and collection service

Solid waste collection service plays an important role in waste management system. In Indonesia for example, collection of waste is managed under the regulation from ministry of home affair (Number 33, 2010). Table 24 showed the amount of solid waste in Jakarta base on its sources.

Table 24: Amount of Solid Waste in Jakarta

Source	2000		2005	
	Ton/day	%	Ton/day	%
Household	4169	65	3067	51
Market			280	5
School			308	5
Commercial	963	15	1583	26
Industry/Institution	641	10	516	9
Road and drainage	640	10	246	4
Total	6413	100	6000	100

[171] Hidayatno, A.: Communicating Complexity in Indonesia's Electricity Economics and Market Development using System Dynamic Base Game. 2012.

In Jakarta, many private companies work as waste collection contractor which provide specific residential area with a better waste collection service. This is normally conducted in wealthier areas where housing occupants are willing to pay more in order to have better and more consistent service. [172]This of course has left the less wealthy areas with less than adequate waste collection service. Table 25 showed the amount of solid waste in kg that was produced and collected in Jakarta in 2011.

Table 25: Amount of Solid Waste (kg) that had been produced and transported in Jakarta in 2011[173]

Year	Area	Production	Transported	Remaining Residual
2011	South Jakarta	742.81	739.95	2.86
2011	East Jakarta Timur	1487.23	1097.4	389.83
2011	Central Jakarta Pusat	780.53	774.4	6.13
2011	West Jakarta Barat	1503.94	1363.14	140.8
2011	North Jakarta Utara	996.65	994.75	1.9
2011	Coast side	86.71	16.67	70.4
		5597.87		

Moreover, following table shows percentage of waste sorting proportion in Jakarta's households. It can be seen that in Jakarta more than 85% of waste were not sorted according to type of waste, indicating that a better waste management is highly needed in the city.

In Indonesia, 3R or Reduce, Reuse and Recycle has been introduced to the society as an effort to improve the waste management system. However, this method has been facing a challenge from lack of society's awareness regarding the importance of waste sorting. [174]

[172] World Bank: Jakarta Case Study Overview. Climate Change, Disaster Risk and Urban Poor: Cities Building Resilience for a Changing World. www.worldbank.org.
[173] Jakarta Provincial Government: Jakarta in Numbers: Total Production Waste and transported per day According to the Jakarta City Administration. 2011.
[174] Indonesian Ministry of the Environement: Profile of Waste Bank in Indonesia. 2012.

Table 26: Percentage of Sorted and Unsorted Waste in Jakarta in 2013[175]

	2013			
	Sorted Waste			Unsorted Waste
Jakarta	Sorted & Reused	Sorted & Disposed	Total	
	3.74%	10.48%	14.23%	85.77%

5.4.3.10 Presence of litter and illegal piles of solid waste

Presence of litter and illegal piles of solid waste can be found in several places and rivers in Jakarta. Illegal dumping sites have created more and more environmental problems for Jakarta's inhabitants. Illegal dumping is a serious problem in both urban and rural areas, where people misused an abandoned property as dumping site instead of using a formal or legal dumping site set by local authority. Illegal dumping often leads to other environmental problem like contaminated of water sources such as ponds, stream and lakes.

5.4.3.11 Bad air quality

Jakarta dangerous air pollution is generally resulted from the increasing number of motor vehicle in the city176. In 2010 for example, Jakarta reached higher annual mean PM_{25} than the standard set by WHO which is 10 µg/m3[177]. This concern regarding air pollution has to be taken into consideration due to the danger of bad air quality to the health of people living in the surrounding area.

[175] BPS-Statistic Indonesia: Percentage of Sorted and Unsorted Waste in Jakarta. 2013

[176] Santoso, M., Dwiana Lestiani, D., Hopke, P.K.: Atmospheric Black Carbon in PM2.5 in Indonesian Cities. Journal of the Air & Waste Management Association, vol. 63, no. 9. 2013.

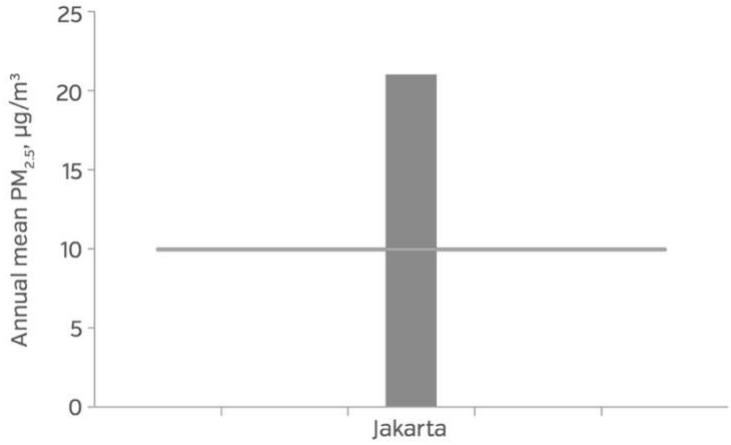

Figure 31: Annual Mean PM_{25} for Jakarta in 2010

5.4.3.12 Nuisance from solid waste disposal sites

Jakarta like most big cities in the world has more and more population over the years, which leads to bigger amount of waste disposed every day. Solid waste disposal site if it is not taken carefully would produce nuisance to the surrounding environment like air pollution etc. Open dumping system which can be found in Jakarta are known as the potential source of air pollution where dangerous gas such as ammoniac, methane, hydrogen sulphate and carbon dioxide are produced as the result of anaerobic decomposition. Therefore, for open dumping solid waste disposal site, it is important to do the closing of new waste in order to avoid air pollution from the direct exposure of waste to the air.

5.4.4 Green Building Criteria

Green building criteria are used to determine a specific standard and category that need to be fulfilled in order to reach a precise performance of sustainable building. Following criteria are selected from several existing green building certification systems, these criteria are assumed to be important for the improvement of the environmental performance in Indonesian housing industry. Green building criteria during construction like reduction of noise during construction process etc. are excluded.

Table 27: Selected Green Building Criteria

	GREENSHIP	LEED	BREEAM
Water Use Reduction			
Rain Water harvesting			
Energy Efficiency			
Electrical Metering			
Alternative Energy Source			
Renewable Materials			
Free Chemical Pollutant from the building material			
Used of Certified Woods			
Good Ventilation			
Natural Lighting and Visual Comfort			
Spatial Comfort			
Noise reduction			
Good Storm Water management			
Good Waste Management			
Green Area			
Carbon Footprint			
Reachable Public Facility			
Reachable Public Transport within 300-500m walking distance			

5.4.4.1 Water Use Reduction

Water use reduction has becoming one of the common criterion in well-known green building certification systems like LEED and BREEAM. In Indonesian green building certification system or also known as GREENSHIP, the water use reduction criterion aimed to increase water use savings by reducing water consumption and waste water output. The idea is to reduce demand of water from the local public water source which at the same time could reduce the wastewater.

5.4.4.2 Rain Water harvesting

Rain water harvesting is used by almost every Indonesian household to support their water consumption especially in areas where the public water pipeline isn't accessible, this method of course works perfectly with the climate in Indonesia where rain intensity is relative high (see

Figure 32). In Jakarta for example, where the quality of both surface and ground water is not suitable for the health standard, the harvesting of rain water could support the need of most household's activities.

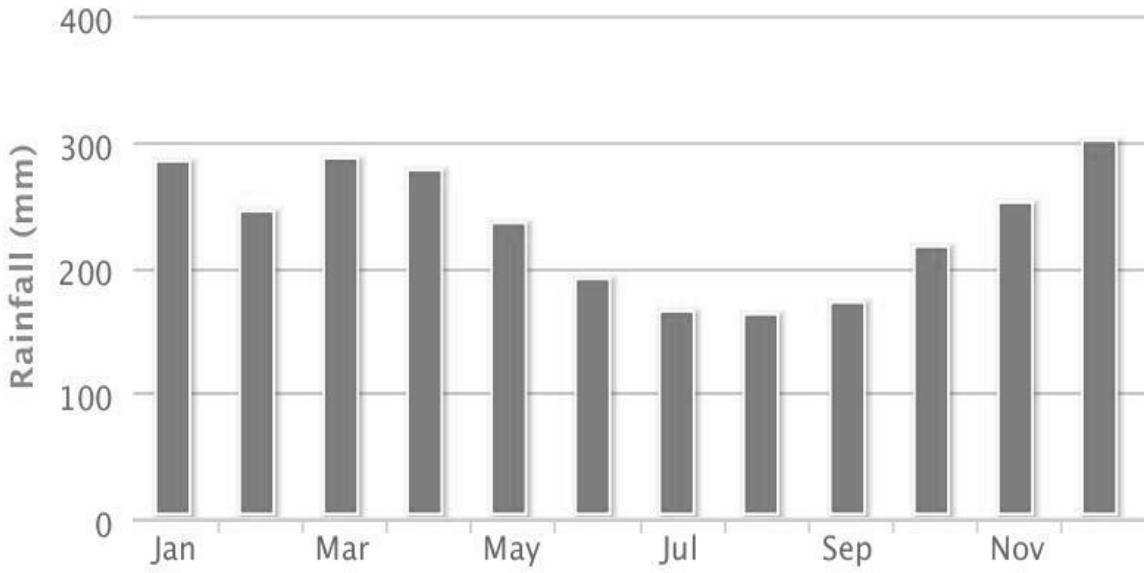

Figure 32: Average Monthly Rainfall in Indonesia from 1990-2012[178]

In GREENSHIP, this criterion was developed to reduce the water demand from the main source by encouraging the use of rain water or storm water runoff as water source. This specific sub-criterion is included under the water conservation criteria which basically support the idea of better water management for both consumption and wastewater purposes.

5.4.4.3 Energy Efficiency

The idea of energy efficiency in Indonesia is an important matter for each household. It is shown by the increasing effort from the PLN (Indonesian State Electricity Company) to promote the use of energy-saving lamps to the society. In 2008, PLN gave away 51 million energy-saving lamps to around 34 million customers in order to gain awareness of energy efficiency and further more to cut the growing demand of electricity in the country. PLN has tried as well to promote more tips to save energy through community service program.

In 2013, there are more than 77% of households in Jakarta with fully installed energy saving lamps at home. This number is expected to increase due to gaining awareness of energy saving in the city.

[178] The World Bank Group: Climate Change Knowledge Portal. sdwebx.worldbank.org/climateprotal.

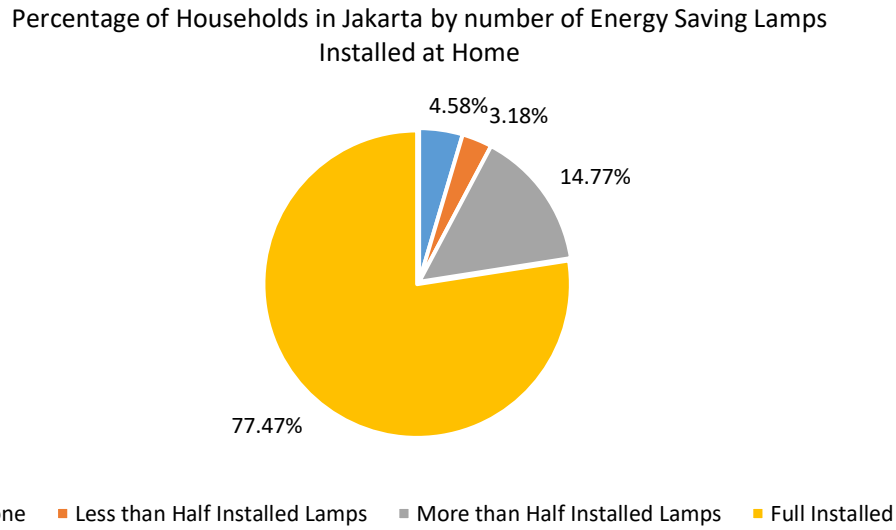

Figure 33: Percentage of Household in Jakarta by Number of Energy-Saving Lamps Installed

Energy efficiency presumes the idea of using less energy than the normal amount of consumption. This particular idea is believed to be really important based on the critical global issue concerning energy consumption, where unsustainable energy source and use contribute to negative impact for the financial matter as well as global environmental performance. This fact is supported by researches showing that energy efficiency increases the money saving and reduce the greenhouse gas emissions.[179]

5.4.4.4 Electrical Metering

In Indonesia, the use of electrical metering has been introduced to the society for quite a while, almost every household accommodating with the electricity from the municipality is required to install a metering in order to have a track of the use of electricity. Electrical metering or energy monitoring is one of important criteria for energy assessment of building. In BREEAM, energy monitoring is aimed to recognize and encourage the installation of energy sub-metering that facilitates the monitoring of operational energy consumption[180]. This particular point intends to support energy efficiency efforts by creating a benchmark of energy use and simply monitor the use of energy over period of time.

5.4.4.5 Alternative Energy Source

Topic of alternative energy source has been deliberated discussed by scientists in order to reduce the consumption of fossil fuel sources as well as to minimize the dependency to this particular non-renewable energy. Alternatives sources such as wind, solar, hydro, biomass, wave and tidal energy have been developed to solve world energy crisis.

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[179] United States Green Building Council: Green Building 101, Why is Energy Efficiency Important? 2014. www.usgbc.org.

[180] BREEAM New Construction, Non-Domestic Buildings. Technical Manual SD5073-2.0:2011. BRE Global Ltd 2011.

While approximately 80% of energy consumption for both consumptive and commercial purposes come from conventional energy source like fossil fuel and coal, the necessity to find an alternate solution for energy sources cannot be overlooked[181]. In Indonesia where the solar irradiance is relatively high, solar energy as alternative energy source has higher opportunity to develop. Therefore, it is important to identify the importance and the willingness of people to pay for this particular matter, especially from the end user perspective which can influence the total energy consumption in the country as whole.

5.4.4.6 Renewable Materials

In most of green building certification systems, renewable material is considered to be an important matter due to the high amount of raw materials using in a construction process. The big consumption of raw materials will contribute to big amount of waste at the demolition process. In GREENSHIP, this topic is aimed to extend the service life of material as well as to reduce waste in landfills.

5.4.4.7 Free Chemical Pollutant from the building material

Chemical pollutant found in building material has negative impact toward the health and productivity of building users as well as the environment. In the past decade, more and more researches have been conducted to study the influence of chemical added of building materials for human health. [182]Meanwhile, indoor air contaminants are generally resulted from chemical emission from construction materials, interior surface and household products, where bad chemical products that contain formaldehyde (human known carcinogen) could easily being exposed to the surrounding area.

In GREENSHIP, reducing air pollution from emissions of building materials that can interfere with the comfort and health of construction workers and building users could be achieved by several ways such as

- Using paints and coatings that contain low levels of volatile organic compounds
- Use low formaldehyde emission levels of composite wood products and laminating adhesive
- Using lamp material that contains mercury in the approved maximum tolerance by GBC Indonesia and no asbestos contained materials.

5.4.4.8 Used of Certified Woods

Indonesia as tropical country has wide area of rain forest which basically the main source of woods that can be used for construction purpose. However, due to raising number of illegal deforestation which contributes greatly to the environmental degradation and natural disasters like flooding, erosion and landslides, it is highly important to use woods wisely and legally. Construction industry consumes high volume of woods for the purpose of both construction

[181] Hasan MH, Mahlia TMI, Nur H. A.: Review on energy scenario and sustainable energy in Indonesia, Renewable and Sustainable Energy Reviews 16:2316– 2328. 2012.

[182] Willem H, Singer B.: Chemical Emissions of Residential Materials and Products: Review of Available Information. Environmental Energy Technologies Division. 2010.

process and interior has to increase the awareness of using certified woods from certified forests.

In GREENSHIP, certified Wood is aimed to protect the forests by using timbers that can be accounted for its origin for example the use of wood materials that are legally certified in accordance with government regulation on the origin of the wood (such as timber freight invoice processing / FAKO, business certificates, etc.) and free from the illegal timber trade at 100% of total cost of the wood material.

5.4.4.9 Good Ventilation

Good indoor air quality could be fulfilled by good ventilation available on every household. In Indonesia, where the humidity is relatively high, good or proper ventilation is highly needed to maintain the comfortability of building users. Natural ventilation is needed to provide fresh air and good air circulation indoor without the need of electrical equipment.

BREEAM as one of the leading green building certification system created a need of potential for natural ventilation criterion by setting up a standard for openable window area in each occupied space to be equivalent to 5% of the gross internal floor area of the observed room[183]. Meanwhile, on GREENSHIP good ventilation is needed to achieve outdoor air introduction and thermal comfort criteria.

5.4.4.10 Natural Lighting and Visual Comfort

Visual comfort on GREENSHIP is aimed to preventing visual impairment due to light levels that are unsuitable with the accommodation power of human eyes by using the lamp illumination (light level) accordance to specific standard, whilst BREEAM defined visual comfort criterion with the aim to ensure daylighting, artificial lighting and occupant controls are considered at the design stage to ensure best practice in visual performance and comfort for building occupants.

Natural lighting on the other hand is fundamentally necessary to provide a visual comfort and health of building users. Therefore, it is essential to accommodate houses with maximum access to the natural light and balanced artificial light in order to maintain optimal visual health and mood as well as functionality of the rooms.

5.4.4.11 Spatial Comfort

Research conducted in the UK concerning space in new homes from the perspective of the end user showed that more than 90 % of respondents think that the overall size of property is important factor for them when it comes to the decision about where to live[184]. GREENSHIP Home defined spatial comfort as criterion that is believed to provide a comfort, feasibility and health to the building's occupants of space fulfilment based on purposed activities.

Jakarta as the largest city with the highest number of population in Indonesia has to face the increasing number of population growth which lead to increasing demand for housing as the basic need. The continuous growth of building industry always comes with several impacts like decreasing of available space, which means that spatial comfort is or has to be compromised due to limited space and financial issues raised from this specific condition.

[183] BREEAM. Indoor Air Quality. 2011. www.breeam.com
[184] Commission for Architecture and the Built Environment. Space in new homes: what residents think. 2009

5.4.4.12 Noise reduction

Noise reduction in residential purposed buildings play a significant role in the comfort of users in general. Urban settlement is more prone to noise pollution due to traffic and machinery equipment compared to suburban and rural settlements. However, noise pollution could also arise from the use of air conditioning equipment that is often used in warm climate like Indonesia.

In Indonesia, some regulations have been established by the government in order to control noise pollution that might harm the human health in general. Indonesian Minister of Environment stated a standard for noise level in Indonesia in 1996 that basically covers several points concerning noise level in the residential area which is limited to the maximum 55 dB which is equal to normal standard in Indonesia for hospital, school and worship places.[185]

If it is not controlled sensibly, noise pollution could cause several health problems such as stress, cardiovascular effect, hearing loss as well as sleep disturbance.[186] Therefore, this particular criterion should be considered in order to improve quality of life as whole.

5.4.4.13 Good Storm Water management

A good storm water management is mandatory when it comes to tackling the environmental problem in urban area where most of green area are used to support the infrastructure of the city. Water storm management can prevent any contamination as well as risk of flooding in dense area. In other words, good water storm management is highly useful in preventing flooding as well as maintaining the quality of the surrounding environment[187].

Together with the development of the Urbanization, the characteristic and quality of the stormwater management have to be improved in order to preserve the environment by providing a better and more stable infrastructure for water. In dense cities example with large industries areas available, stormwater could be a source of pollutant since most stormwater flow through streets, roofs and other open surface where the chance of pollutant interaction is high[188].

As tropical country with relatively high rain intensity, good storm water management is one of the most important thing to be well managed in Indonesia. With high numbers of rivers which are mostly contaminated by different pollutant, it is exceedingly crucial to repair and to improve the whole stormwater management in order to prevent any further degradation.

5.4.4.14 Good Waste Management

In Indonesia, waste problem is quite serious due to the lack of society awareness to participate in waste management. Waste Management criterion is a prerequisite criterion on GREENSHIP which aimed to encouraging waste separation in a simple movement that simplify the recycling process by the installation or facility to sort and collect garbage like household waste, based on the type of organic, inorganic, and B3.[189]

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[185] Decision of Indonesian Minister of Environment. Decision 48, Number 11. 1996 about Standard of Noise Level.

[186] Office of the Scientific Assistant: Office of Noise Abatement and Control. U.S Environmental Protection Agency. Noise Effect Handbook; “A Desk Reference to Health and Welfare Effect of Noise”. 1981

[187] The Pocono Northeast Resource Conservation and Development Council: Stormwater Management Handbook.

[188] Pitt, R., A. Maestre, H. Hyche, and N. Togawa.: The Updated National Stormwater Quality Database, Version. Proceedings of the Water Environment Federation Technical Exposition and Conference. Chicago, IL. 2008.

[189] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013

5.4.4.15 Green Area

Big cities in Indonesia tend to suffer from floods problem due to the high intensity of rain in Indonesia and the condition has worsened with the less penetrable surface area over the time. Furthermore, this criterion also covers the importance of CO2 reducing in order to improve the air quality. In GREENSHIP, green area is considered as the prerequisite criterion which aims to maintaining or expanding city's green area in order to improve the quality of the microclimate, reduce CO2, pollutants and burden on the drainage system as well as preventing soil erosion and maintaining the balance of water and ground water systems.[190] This criterion represents the needs of a better residential planning in order to provide enough green area especially in big cities like Jakarta where the number of green area is decreasing due to the expansion of new building constructions that converted green area into hard/non-penetrable surface.

5.4.4.16 Carbon Footprint

Carbon footprint or emissions of greenhouse gases can be found on almost every household from its daily activities. Greenhouse gas emissions are produced from burning oil or gas for heating purpose, electricity generated from coal, gas and oil. Meanwhile, GREENSHIP focused on the reduction of carbon footprint generated from the material transportation/distribution by reinforce the use of materials that the location of its raw materials and manufacturing process are located inside the radius of 1,000 km of the project site (worth at least 50% of the total material cost) or/and materials that the location of its raw materials and manufacturing process are in the main territory of the Republic of Indonesia.[191] However, while it is important to reduce the carbon footprint of materials used in the building construction, it is also important to minimize the emission of greenhouse gas through the complete life cycle of building, especially from the daily household activities.

5.4.4.17 Reachable Public Facility

In BREEAM, reachable public facility or also known as proximity to amenities criterion has the aim to encourage and reward a building that is located in close proximity to local amenities, thereby reducing the need for extended travel or multiple trips. These amenities include: grocery shop, post box, cash machine, pharmacy, medical center etc. The proximity distance must be measured via safe pedestrian routes e.g. pavements and safe crossing points or, where provided, dedicated pedestrian crossing points. The distance should not be measured in a straight line, 'as the crow flies'.[192]

5.4.4.18 Reachable Public Transport within 300-500m walking distance

GREENSHIP designed this specific criterion aiming to encourage building users and guests to use public transportation in order to reduce the usage of private vehicles. The walking distance is set to be within a range of 300 meters from the building gate. However, for the end users of housing, it is necessary to adjust the distance range due to the nature of residential area which tend to be more secluded than office buildings in general.

Walking distance as the primary access between home to the nearest public transport is significantly important to the use of public transport, when the nearest public transport is not reachable within the walking distance from home, then its functionality is jeopardized.

[190] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[191] GBCI: GREENSHIP New Building V1.2 Summary, GBCI, 2013
[192] BREEAM: Transport; Proximity to Amenities. 2011. www.breeam.com

Developed cities such as Sydney, Perth and Helsinki as well as Vancouver set the walking distance from household to the nearest public transport within the range of 300-500 m. Therefore, for the purpose of this research, a walking distance within 300-500 m is set to the nearest reachable public transport. [193]

5.4.5 Green Building Investment in Residential/Housing Industry

In Indonesia, green building investment shown little development compare to other neighbour countries like Singapore and Australia. Therefore, it is important to identify the basic knowledge, understanding and the experience of building end users (occupants) concerning green building concept and investment.

5.4.5.1 Knowledge about Green Building Concept

On this point of questionnaire, respondents are asked regarding their knowledge about the nature concept of green building, whether they have ever heard about green building concept and if yes, whether they understand the concept of it.

5.4.5.2 Willingness to invest in Green Building Investment

Furthermore, respondents will be provided with some paragraph concerning the basic concept of green buildings (also known as green construction or sustainable building) which refers to a structure and using process that is environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation, and demolition as well as the benefits of such investment which include cost savings from reduced energy, water, and waste; lower operations and maintenance costs; and enhanced occupant productivity and health.

This point of questionnaire aims to identify whether the respondents really have the right understanding concerning green building and whether they are willing to invest in it.

5.4.5.3 Barrier for the Sustainable Building Development in Indonesia

The last question in the green building investment part is designed to identify barriers that keep respondents as end users from investing in green building investment. Lacks of cost consideration and implication are known the major barrier for sustainable design indicating that people tend to prefer an immediate saving more than long term saving, hence relatively higher initial cost for green building could hamper further investment in it[194].

Moreover, other research conducted in Kuwait showed that lack of knowledge and awareness concerning green building and environmental protection as well as absence of governmental action and enforcement to promote the awareness are included in factors that hamper implementation of green building in that country[195].

[193] Daniels. R, Mulley. C.: Explaining Walking Distance to Public Transport: the dominance of public transport supply. Institute of Transport and Logistics Studies. The University of Sydney NSW. Australia. 2011.

[194] Hankinson, M. & Breytenbach, A.: Barriers that impact on the implementation of sustainable design, Proceedings of Cumulus conference, hosted by Aalto University School of Art and Design, Helsinki, Finland, 24-26 May 2012, 1-11. 2012.

[195] AlSanad A.: Awareness, Drivers, Actions and Barriers of Sustainable Construction in Kuwait. International Conference on Sustainable Design, Engineering and Construction. P. 969-983. 2015.

5.5 Method of Analysis

Due to the nature of the research which based on both literatures review and empirical study, statistic is mandatory modus to analyse the result of data collection resulting from the empirical study. Therefore, following sub chapter will explain the use of two statistical types, Descriptive Statistical Analysis and Inferences Statistical Analysis.

Descriptive Statistical Analysis is type of statistical analysis where tables, graphs and summary measures are used in methods in order to organise, display and describe data.[196] Analysis of Frequency is the most common descriptive analysis is used here to show the number of times an even occurred in a research. Frequency analysis is often presented on a histogram form. Moreover, pie charts will be used as well to describe the percentage or proportion of data collection.

Inferential statistic methods are used to make prediction about population based on the sample result. On the next chapter where the result of the empirical study is analysed, the hypothesis method as one of inferential statistic methods will be used to compare two or more sets of data or variables. Hypothesis tests on this research consist of Independent Sample of T-Test, One-Way Anova (Analysis of Variance) and Cho-Square Test. The purpose of these particular tests is to define whether the mean of two or more groups are significantly different.

[196] Premm S. Mann: Introductory Statistics. Seventh Edition. EASTERN CONNECTICUT STATE UNIVERSITY. JOHN WILEY & SONS, INC. 2010.

6 Result and Overview of the Empirical Study

6.1 Introduction

Indonesia with estimated population of more than 250 million in 2014 or equivalent to 3.49% of world population has shown to be fourth world most populated country[197], making residential building industry or housing industry to be one of most important issues to be considered.

Housing represents quality of the society where furthermore will relate to social welfare of a country. As it has been discussed on the previous chapter before that the status of housing ownership in Indonesia in 2013 was almost 80 percent dominated by the Ownership status of own. However, in big city like Jakarta, the Ownership Status of Own in 2013 only cover about 46 percent of total housing, followed by Ownership Status of Rent for about 34 percent.

These numbers indicated that the housing Ownership Status in Jakarta showed different pattern than the rest of cities in the country. The relatively high cost of housing in Jakarta and the purpose of housing can become the reasons behind it, while people from suburban area around Jakarta tend to find temporary settlement inside the city to reduce their transport time from and to work, this condition furthermore will influence the type of housing ownership in this particular city.

This chapter discussed the result of the empirical study that was conducted using questionnaire as the data collection method. It is designed to identify preferences of the end user regarding housing in general and its tendency toward sustainable development in particular. Using SPSS as statistical analysis tool, this chapter presented several quantitative data analyses such as Mean, Correlation, T-Test and Analysis of Variance as well as qualitative data analysis like Chi-Square (further description is discussed on the previous chapter regarding statistical data analysis).

6.2 Respondent Profiles

The survey has 84% of response rate which collected 421 answered questionnaires out of 650 questionnaires that have been spread consisting of 350 questionnaires for Jakarta and 300 questionnaires for Surabaya (Table 28).

Table 28: Survey Response Rate

City	Number of Spread Questionnaire	Number of Returned Questionnaire	Response Rate
Jakarta	350	242	69,14%
Surabaya	300	179	59,67%
Total	650	421	65%

[197] Worldometers: Indonesia Population. http://www.worldometers.info/world-population/indonesia-population/

6.2.1 City

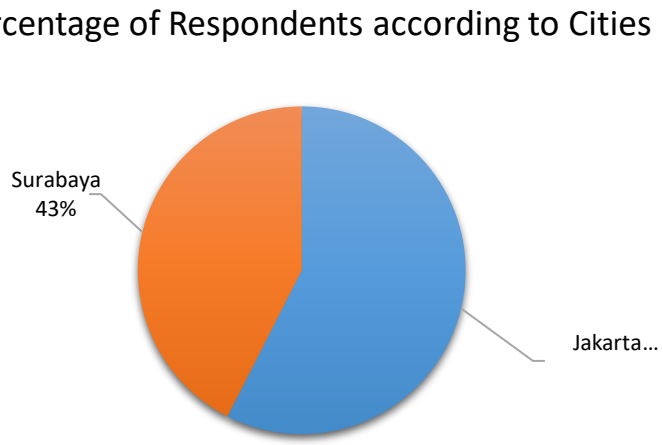


Figure 34: Percentage of Respondents based on Cities

Total number of respondents consists of 57% respondents from Jakarta or about 242 respondents and 43% from Surabaya or about 179 respondents. The percentage of respondent is still equally comparable to the number of questionnaire spread which designed according to the number of population in each city.

6.2.2 Area of Living

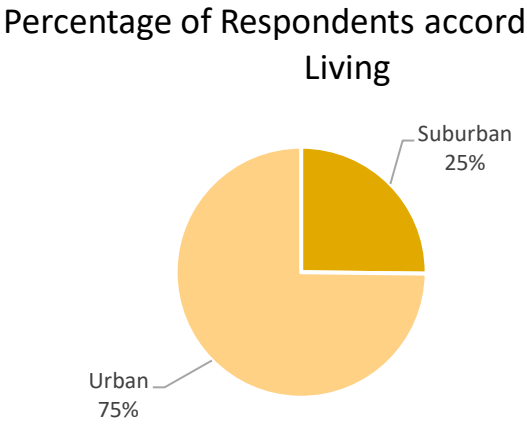


Figure 35: Area of Living

Living area on this study is divided into three categories such as: Rural, Suburban and Urban Area. Respondents are asked to choose the area of their current housing. However, result from the collected questionnaire showed that 75% of respondent are living in the urban and 25% in the suburban area. None of respondents in both Jakarta and Surabaya is living in rural area. Additionally, analysed, when the percentage of respondent is categorized according to cities, only 15% of people in Surabaya are living in the suburban area and a little bit higher percentage from Jakarta's side with 32.6% of its total respondents are living in suburban area.

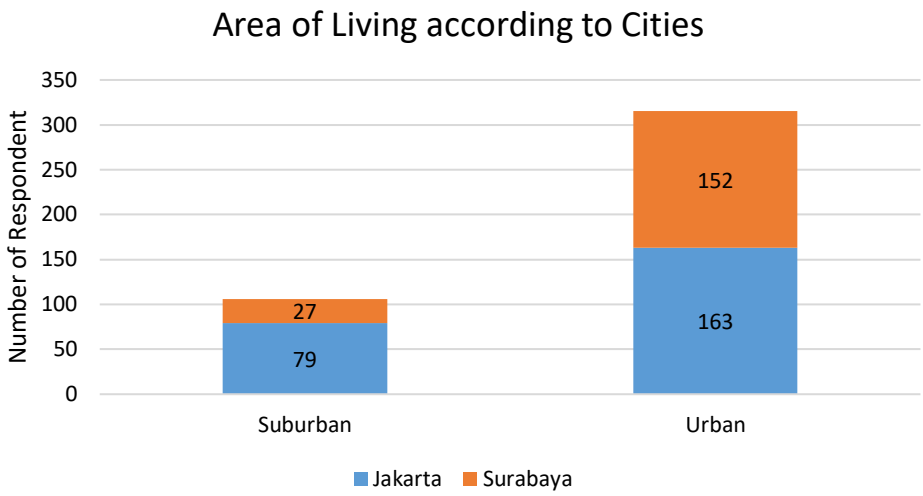


Figure 36: Area of Living According to Cities

In 2010, Indonesian Central Bureau of Statistic stated that 58% of Indonesian population lived in Java. Jakarta and Surabaya are located in Java Island that is known as the most populated island in the world[198]. In addition, it is estimated that 52% of total Indonesian population in 2014 lived in urban area[199].

6.2.3 Level of Income

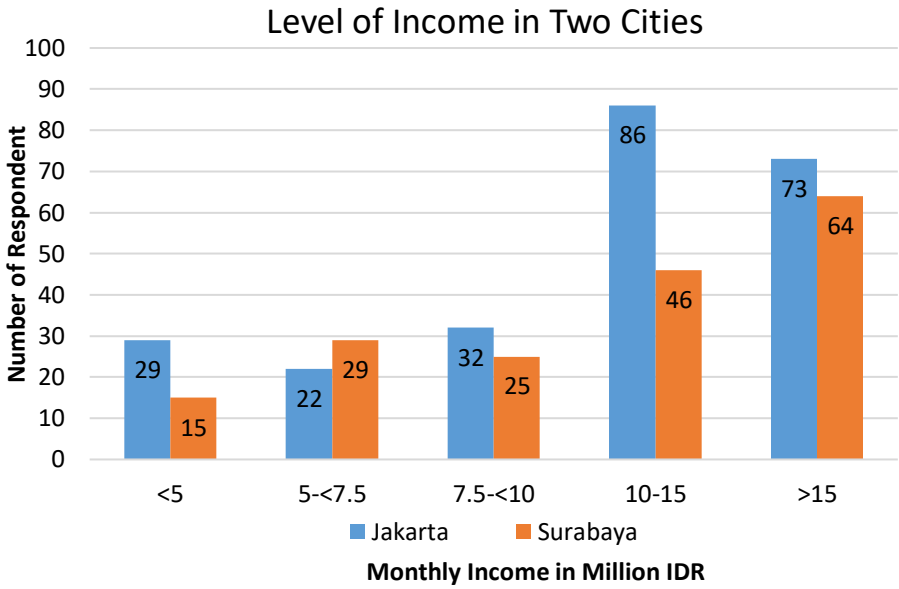


Figure 37: Monthly Income According to Cities

Beside City and living area, respondents are as well categorized into five levels of monthly income in IDR. 64% of respondents in both Jakarta and Surabaya have income level of more than 10 million IDR per month, with the comparison between level of income 10-15million IDR

[198] BPS-Statistic Indonesia. Indonesian Census in 2010.
[199] Worldometers: Indonesia Population. http://www.worldometers.info/world-population/indonesia-population/

and >15 million IDR approximately 49%:51%. Furthermore, rest of respondents consisted of 10% people with income less than 5 million IDR, 12% people with income range of 5 to <7.5 million IDR and 13.54% people with monthly income of 7.5 million to <10 million IDR per month (Figure 37).

6.2.4 Type of Housing

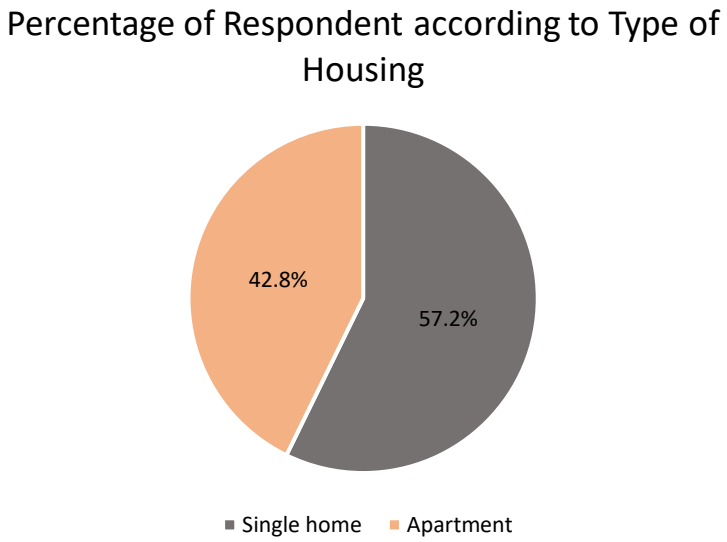


Figure 38: Respondents according to Type of Housing

Single home and apartment are the most dominated housing types in Indonesia. Approximately 57% of total respondents have single home as their housing type, and 43% are living in apartments (Figure 38).

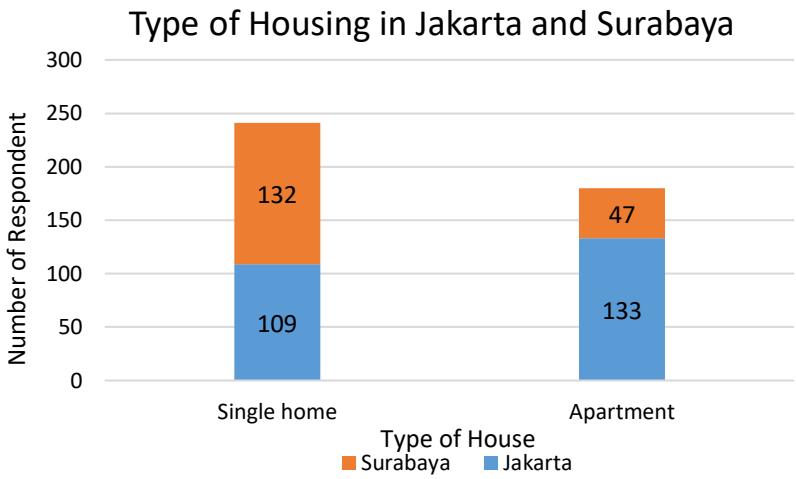


Figure 39: Type of House

Conversely, percentage of apartment is still higher than single home in Jakarta compare to Surabaya where 74% of respondent are living in single home type of housing. Limited surface

and high land value in Jakarta has caused investors to build more of high rise apartment building to fulfil housing demand in Jakarta's urban area.

Type of housing in Jakarta and Surabaya consist of two different types namely Apartment and Single Home. As it has been discussed on the Chapter 3, type of housing like apartments are often found in the urban area and i mostly built on high rise building due to high price of land value. Therefore, there is a necessity to see the proportion of housing type in suburban and urban areas. First analysis is conducted to see if there is a significant association between area of living and type of housing.

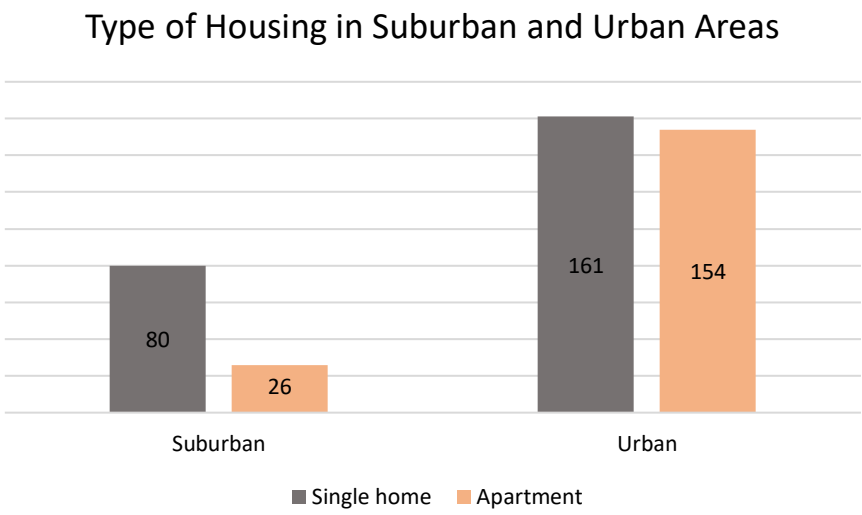


Figure 40: Type of Housing according to Area of Living

Chi-Square Test is applied here for two categorical variables from a single population. Null Hypothesis here states that there is no significant association between area of living and type of housing.

H_0: Living Area and Type of Housing are independent.
H_1: Living Area and Type of Housing are not independent.

If the p-value is less than the significance level ($p < 0.05$) then it will be concluded that H_0 cannot be accepted.

Chi-Square Test on Table 29 showed that significant value to be less than 0.05 (p <0.05), so it can be concluded that there is significant association between Type of Housing and Area of Living.

Table 29: Chi-Square Test between Type of Housing and Area of Living

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19,230[a]	1	,000
N of Valid Cases	421		

Chi-Square Test on Table 29 showed that significant value to be less than 0.05 (p <0.05), so it can be concluded that there is significant association between Type of Housing and Area of Living.

In addition, it is also essential to see respondent's housing type according to their income level, in order to see whether there is a special distribution on it. As it is displayed on Figure 41, more than 77% people with income level lower than five million are living in single home type of housing, this proportion is however lower in other income levels. Meanwhile, people with the highest level of income residing in almost the same proportion of housing type.

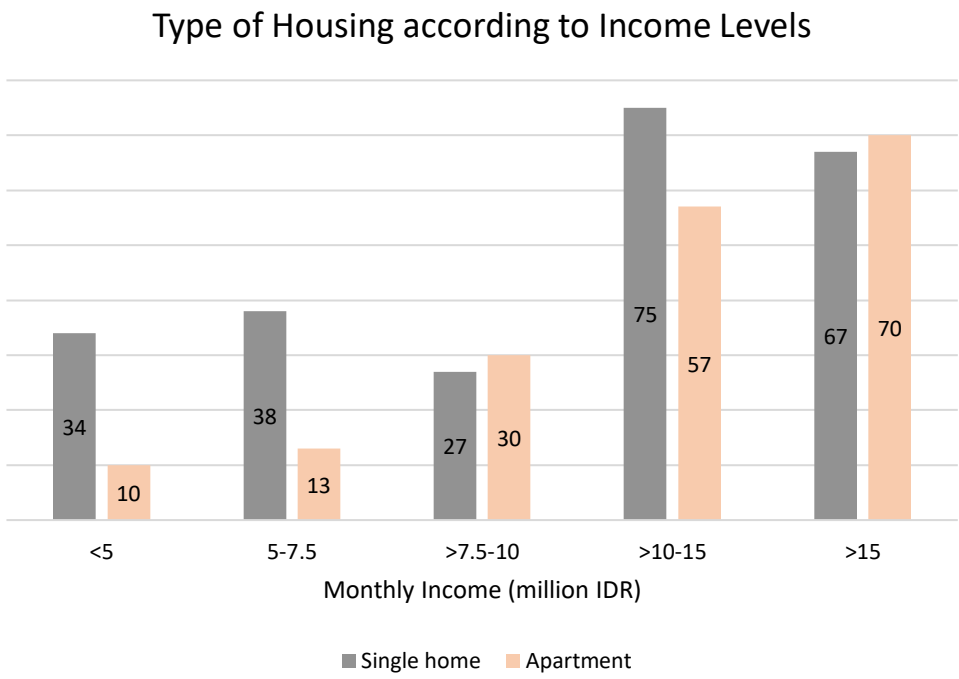


Figure 41: Type of Housing according to Level of Income

Chi-Square Test is applied to find whether there is significant association between type of housing and income level. Null Hypothesis here states that there is no significant association between area of living and type of housing.

H_0: Living Area and Type of Housing are independent.
H_1: Living Area and Type of Housing are not independent.

If the p-value is less than the significance level ($p < 0.05$) then it will be concluded that H_0 cannot be accepted. Chi-Square Test on Table 30 showed that significant value is less than 0.05 (p <0.05), so it can be concluded that there is significant association between Type of Housing and Area of Living (H_0 is rejected).

Table 30: Chi-Square Test between Type of Housing and Income Level

	Chi-Square Tests Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19,597	4	0,001
N of Valid Cases	421,000		

6.2.5 Size of Houses

Bank Indonesia as central bank in Indonesia categorized size of housing for mortgage application purpose into three categories consist of Type 1 for houses with total size is smaller than 21m^2; Type 2 for middle size house with size range from 22-70m^2; and Type 3 for houses with maximum size >70m^2. [200]

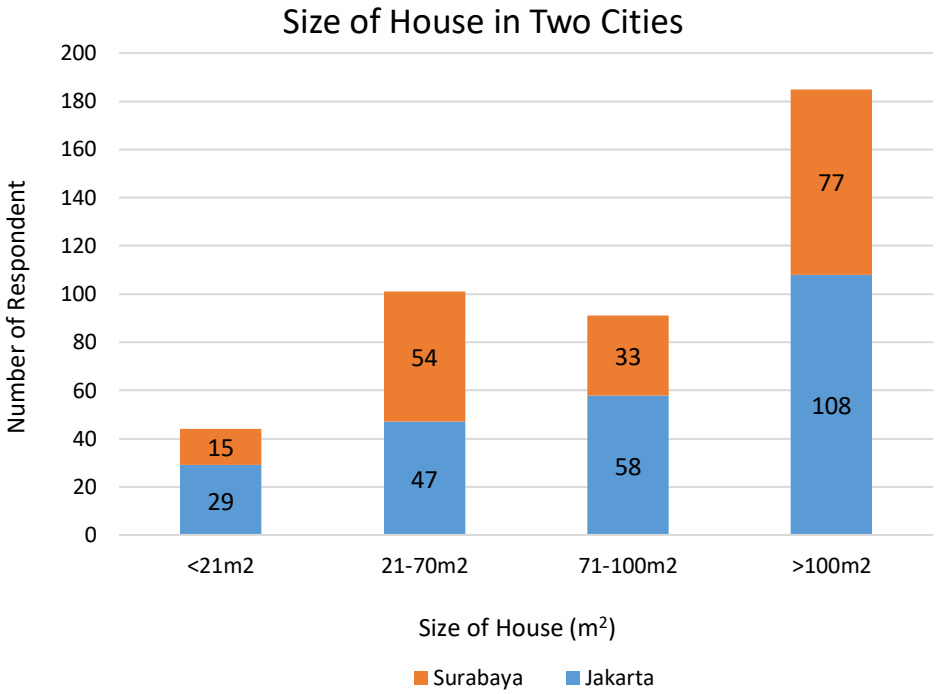


Figure 42: Size of Houses

In this study, due to the diversity of houses size in in big cities like Jakarta and Surabaya, four different sizes of house are used to categorized respondents' houses in general. Figure 42 showed that houses with size >100m^2 dominated most of respondent's answer in around 44%

[200] Bank Indonesia: Coding Bank Indonesia Regulation. Management, Risk Management. 2013

of total respondent. Houses of size 21-70m^2 are in the second place with 24% and size 71-100m2 in the third place around 22%. Only 10% of respondents are living in houses with total size is less than 21m^2. This result is however equal to the monthly income level of respondent with more than 60% are found to have relatively high income of >10 million IDR per month.

Furthered correlation analysis is conducted to explain the relationship between variables of size of houses and level of income. Null Hypothesis states that there is nonsignificant correlation between level of income and size of house.

H_0: There is no significant correlation between Level of Income and Size of House

H_1: There is significant correlation between Level of Income and Size of House

Table 31: Correlation between Level of Income and Size of House

			Size of House
Spearman's rho	Level of Income	Correlation Coefficient	,927**
		Sig. (2-tailed)	,000
		N	421

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

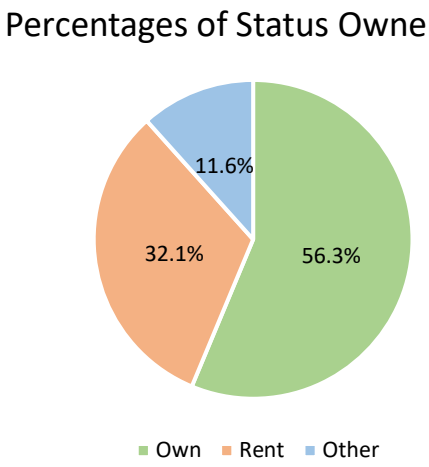
Table 31 showed Spearman's correlation with significant value < 0.05 (p<0.05) with correlation coefficient closed to 1. This result means there is a strong positively significant correlation between size of house and level of income with the increasing level of income is directly proportionate to the size of house.

6.2.6 Status of Ownership

As mentioned before in the introduction of this chapter, status of ownership in Indonesia is still dominated by ownership status of Own. Questionnaire result showed the same tendency which 56% of respondents own their houses, while 32% of respondent are living in the rented houses and the 12% rest of respondent have other type of status ownership.

Owning one's own home is by far the most common occupancy status in Indonesia, comprising 80 percent of all homes, with contract/lease occupancy making up around 9 percent. In Jakarta the percentage of housing ownership status showed just some slightly difference between the own-house and contract/leases ownership categories, with 47% and 36% respectively in 2011[201]. This percentage shows that Jakarta has a much higher ratio of leased houses to owned house than the rest of Indonesia. This fact can be explained clearly by the greater proportion of simple flats and apartments built in Jakarta. This type of housing is preferred by consumers in Jakarta because it is strategically located in the city which can automatically reduce the time and costs of commuting to and from work – an important priority due to the city's severe traffic congestion problems.

[201] BPS-Statistic Indonesia: Percentage of Households by Province and Dwelling Ownership Status of Contracts / leases, 1999-2013.



Relatively high price of housing in Jakarta's urban area is believed to be one of influenced factor for high number of rented houses in it. Other factor is that more and more people from surrounding areas outside Jakarta chose to rent houses for temporary settlement to cut the transport time and traffic jam avoidance.

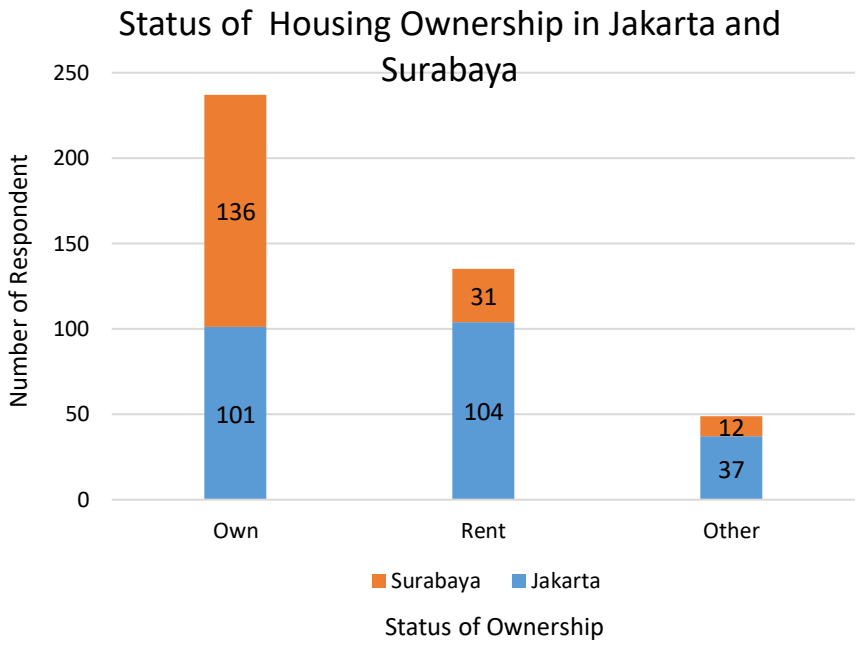


Figure 43. Status of Ownership according to Cities

In addition, it is important to see the proportion of the ownership status according to area of living. Figure 44 displayed distribution of ownership status in suburban and urban areas. More than 85% of people with status ownership of rent are found living in the urban area.

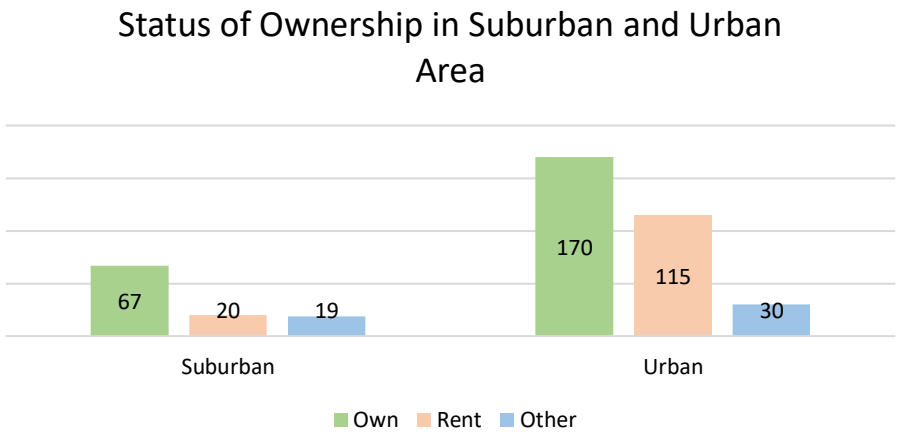


Figure 44: Status of Ownership according to Living Area

The next analysis is aimed to classified respondents based on their status of ownership according to their level of income. Almost 68% of respondents with the highest income level, 82% of the lowest income and 73% of respondent from the second lowest income level are found to own their houses. These numbers are however different in the income level of 7.5 to10 and 10 to 15 million IDR, where only 36% of people with this income have status ownership of own.

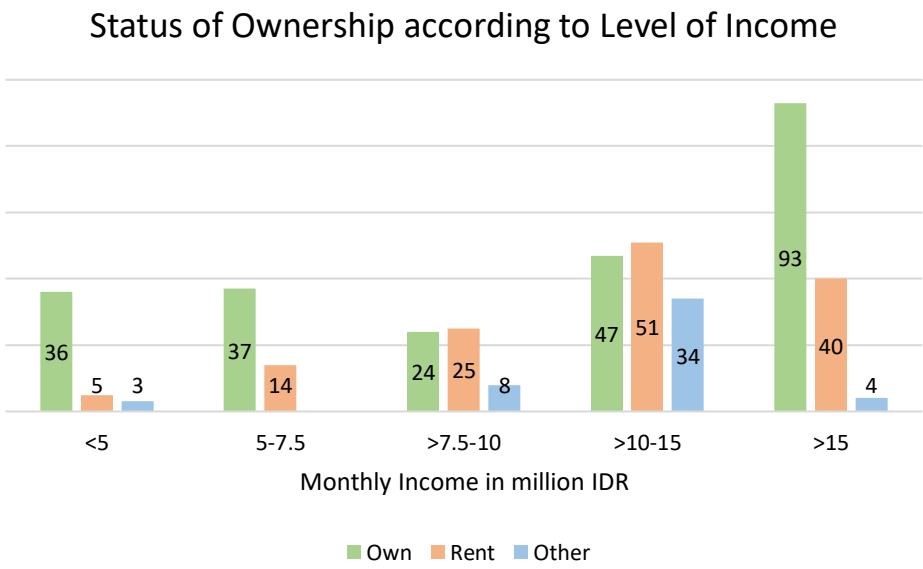


Figure 45: Status of Ownership according to Level of Income

6.2.7 Preferred Banks for Mortgage Application

As can be seen, more than eighty percent of respondent preferred to choose private banks for their mortgage application. In contrast more than seventieth percent of respondents or around 72 respondents preferred to use public banks for the same purpose. Further analysis with chi-square and non-parametric correlation are conducted to see if there are differences of preferred

banks by respondents according to their city, level of income, area of living and type of house (Figure 46).

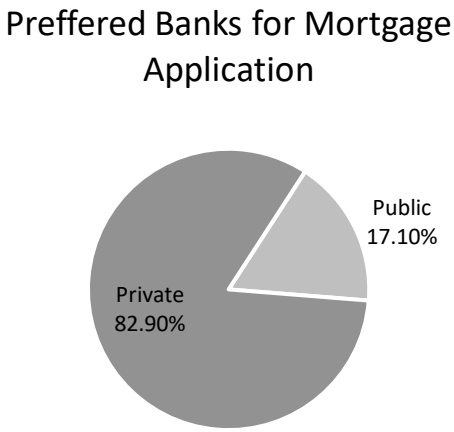


Figure 46: Preferred Banks for Mortgage Application

6.2.7.1 Preferred Bank according to Cities

Figure 47 showed that both respondent in Jakarta and Surabaya most likely favoured private banks than public ones for their mortgage application purpose. Therefore, further discussion of preferred banks according to cities is not required (Figure 47).

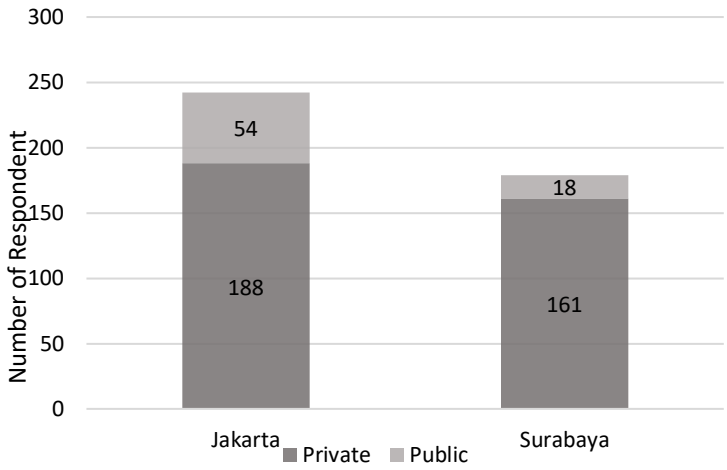


Figure 47: Preferred Bank according to Cities

6.2.7.2 Preferred Bank according to Area of Living

Suitable to the proportion of the living area, number of respondent choosing private banks is still dominant in both suburban and urban area, meaning there is no difference in banking preferences between areas of living (Figure 48).

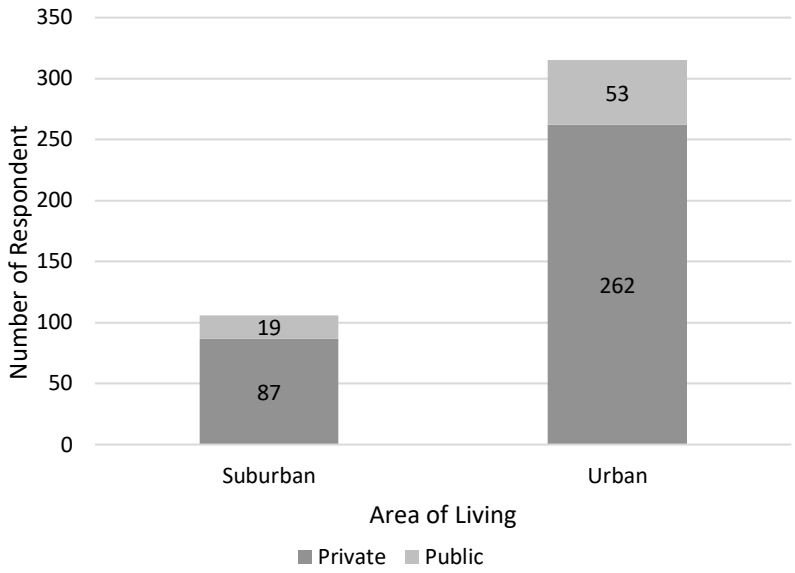


Figure 48: Preferred Bank according to Area of Living

6.2.7.3 Preferred Bank according to Level of Income

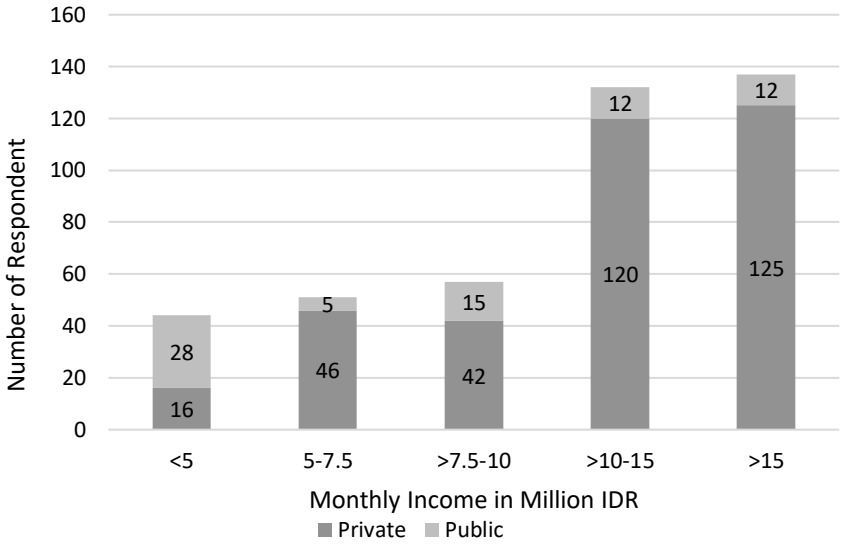


Figure 49: Preferred Bank according to Level of Income

According to the income level of respondents, it can be seen that almost 39% of respondent who chose public bank as their preferred mortgage application bank come from the lowest income level. Indonesian government is known to have generated different kind of subsidies of affordable housing for low income level of society, with this intention, it is understandable for low income level of people to favour public bank as their mortgage application.

6.2.7.4 Preferred Bank according to Type of House

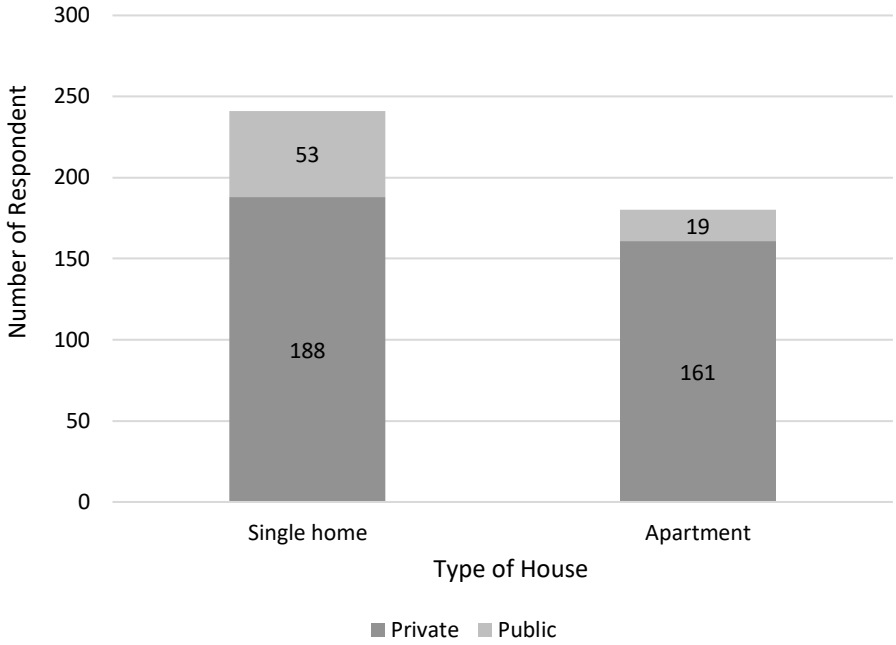


Figure 50: Preferred Bank according to Type of House

Figure 50 displayed bank preference for mortgage application by respondents based on their type of house. 74% of respondent with single home type of house chose private bank for mortgage application have single home type of house. The same pattern is also shown by the respondent who have apartment type of house, 89% of the respondent selected private instead of public banks for their mortgage application.

6.2.7.5 Preferred Bank according to Size of House

Preferred Bank according to size of house showed the same pattern with level of income. Figure 51 showed that most of people with house size less than 21m^2 chose public bank for their mortgage application. Strong positive correlation between Level of Income and Size of House (Table 31) explained the same tendency of preferred banks between both variables. Furthermore, 100% of respondents from house size range 71-100m2 chose private bank for their mortgage application.

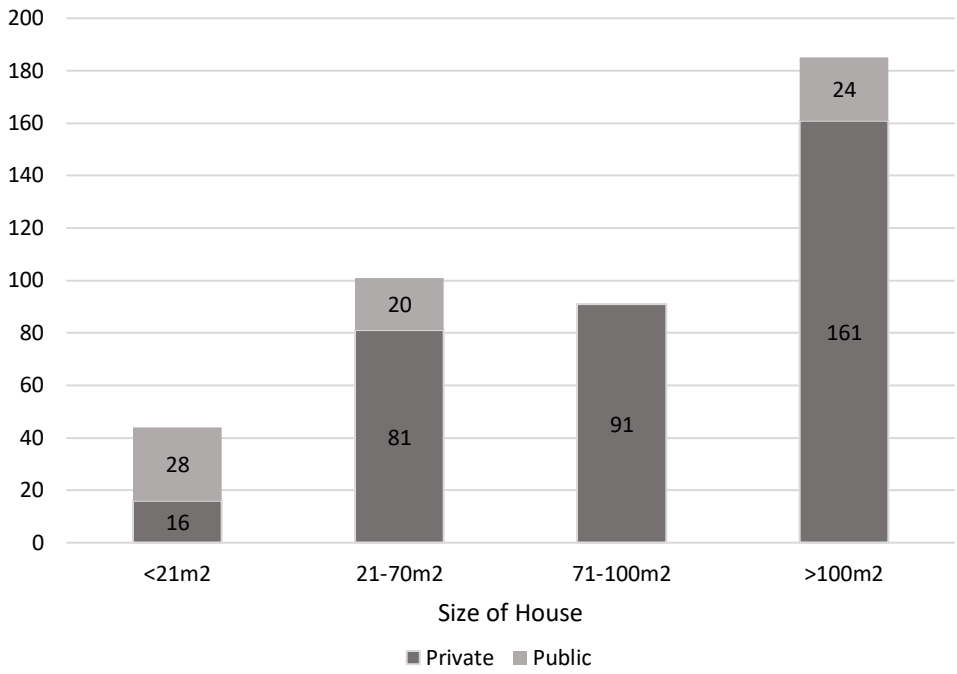


Figure 51: Preferred Bank according to Size of House

6.3 Household Problems in Indonesia

This sub-chapter discussed about problems occurred in Indonesian big cities households. Respondents were handed a list of 12 potential household problems that more likely occur in some developing countries and were asked with two major questions. First question is designed to identify the level of seriousness for every given problem in their daily household and the second question urged to know the willingness of respondent to pay in order to have a solution or improvement for their household regarding the related problems.

Six Points Likert scale is used here for the seriousness of problems and yes/no based question is used to cover the second part of question about the willingness to pay for the related problems. Further discussion about method used for the questionnaire design can be found on the previous chapter.

1. Extremely not serious
2. Very not serious
3. Somewhat not serious
4. Somewhat serious
5. Very serious
6. Extremely serious

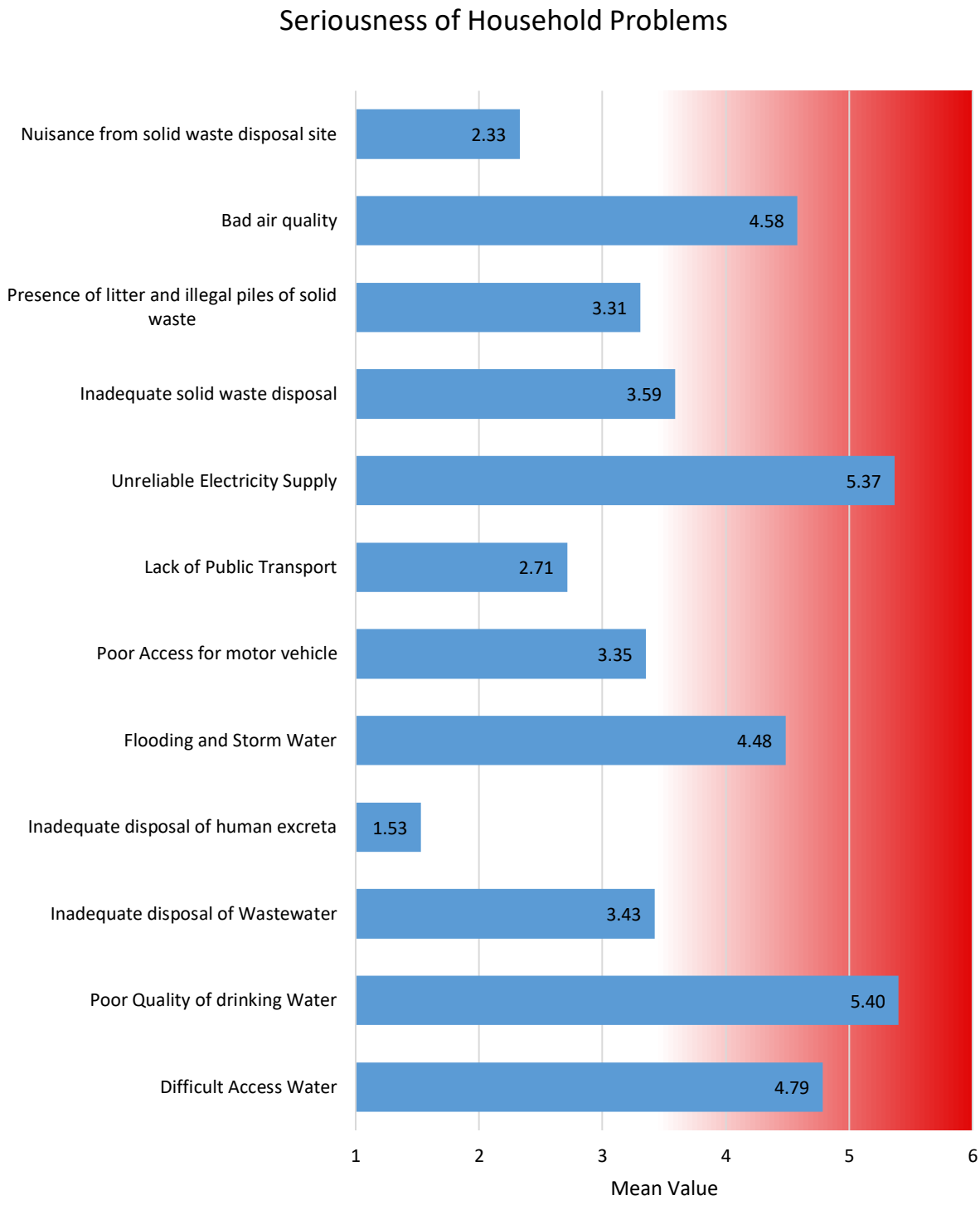


Figure 52: Seriousness of Household Problems

Mean value for each household problem indicates how serious a problem is. The higher the mean value of a problem, the more serious the impact of the related problem is in the household function and also the other way around. Middle value (3.5) is drawn as the shifting point dividing problems into two categories. All household problems with mean value that are higher than the middle value (Middle Value ≤ 3.5) will be categorized as serious problems needed to be further elucidated.

As can be seen on Figure 52, household problems such as Poor Quality of Drinking Water, Unreliable Electricity Supply, Difficult Access Water, Bad Air Quality, Flooding and Strom Water as well as Inadequate Solid Waste Disposal are identified as problems with mean value higher than 3.5 resulting as serious problems in the Indonesian households. Inadequate Disposal of Human Excreta is the only problem with mean value less than two, followed by Nuisance from Solid Waste Disposal Site on the second of the least serious household problems.

Given these points further analysis is important to identify the occurrence of each problem according to each of the observed cities due to the possible difference of respondent perspective as well as their living situation.

Moreover, the analysis of household problem will be as well categorized according to area of living, monthly income of respondents, types of housing and status of ownership. Independent Sample of T-Test and One Way Anova are used as Mean Analysis Method to see difference among mentioned categories before and correlation analysis is used to identify correlation between household problems. Correlation between the seriousness of household problems and the willingness of respondent to pay for the solution of the related problems will be conducted in the next sub chapter.

6.3.1 Household Problems according to Cities

Jakarta and Surabaya as observed cities have shown different mean value of household problems (Table 32). Mean value of total problems in both cities indicated that Jakarta has relatively more serious household problem (total mean value 4.04) compare to Surabaya with its total mean value still lower than the middle value of 3.5.

Previous analysis is mainly done to describe the seriousness of household problems as combination of two cities together. Therefore, Independent T-Test ($\alpha = 5\%$) are conducted here to see if there are significant differences in the seriousness of household problems between cities. Null hypothesis (H_0) as the tested statement specified that there is no significant difference in the seriousness of household problems between Jakarta and Surabaya. The alternative hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis.

H_0: There is no significant difference in the seriousness of each household problem between Jakarta and Surabaya

H_1: There is significant difference in the seriousness of each household problem between Jakarta and Surabaya

If the *p*-value is less than the significance level ($p < 0.05$) then it will be concluded that the observed effect actually reflects the characteristics of the population rather than just sampling error, thus rejecting the null hypothesis.

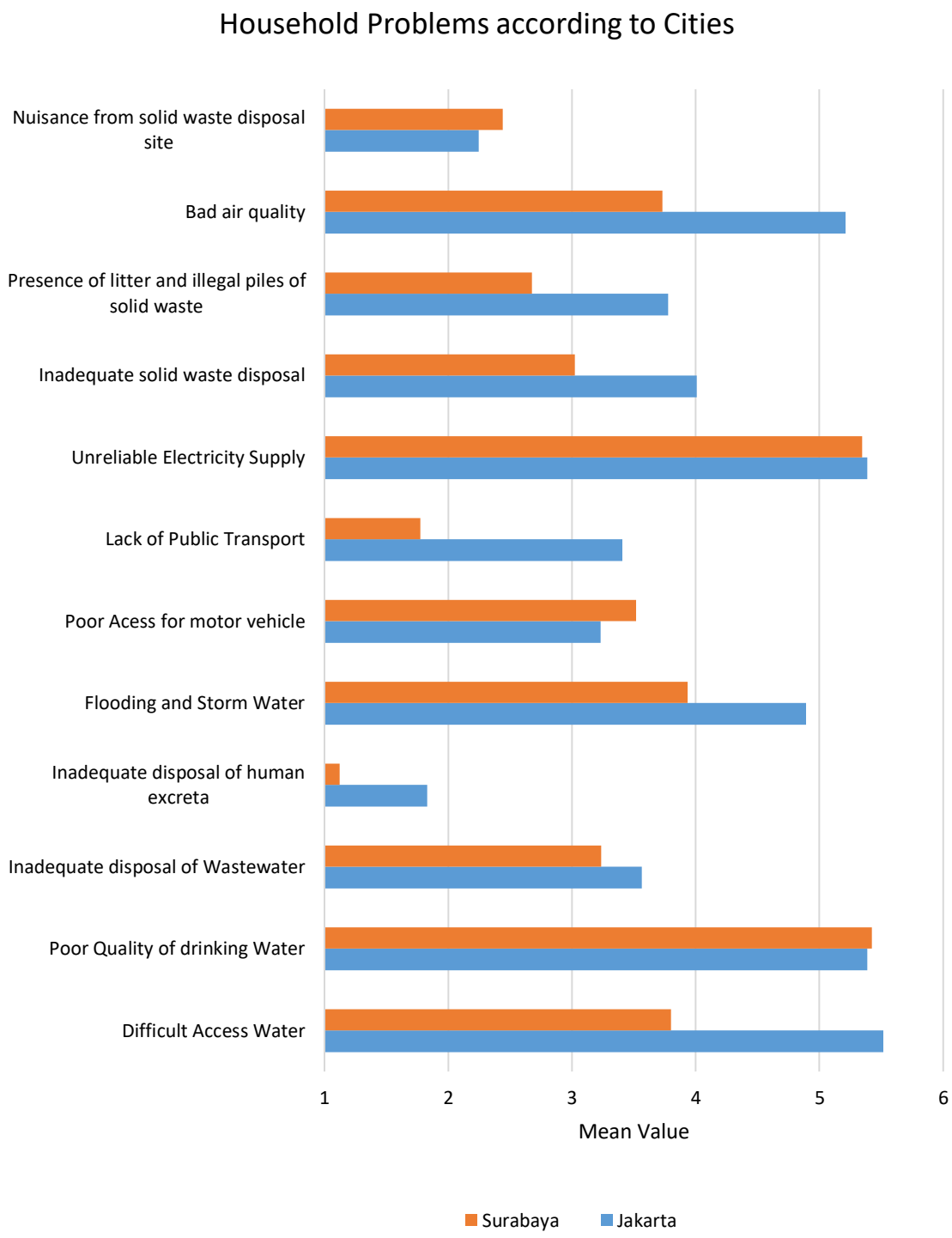


Figure 53: Households Problems according to Cities

Significant value of each problem that is lower than 0.05 resulting in rejection of the Null Hypothesis, meaning there is significant difference between two observed cities. As shown above, there are significant difference between Jakarta and Surabaya in almost all of the listed problems except problems such as Poor Quality of Drinking Water, Unreliable Electricity Supply and Nuisance from Solid Waste Disposal Site. Additionally, it is important to take a careful look

at problems that are significantly different between Jakarta and Surabaya, in order to identify whether some problems are relatively more serious in one city compare to the other.

Table 32: T-Test for Household Problems between Cities

	Mean		Mean	Sig.	Output
	Jakarta	Surabaya	Difference	(2-tailed)	H_0
Difficult Access Water	5,52	3,80	1,72	0,000	Reject
Poor Quality of drinking Water	5,38	5,42	0,04	0,590	Accept
Inadequate disposal of Wastewater	3,57	3,23	0,33	0,006	Reject
Inadequate disposal of human excreta	1,83	1,12	0,71	0,000	Reject
Flooding and Storm Water	4,89	3,93	0,96	0,000	Reject
Poor Access for motor vehicle	3,23	3,52	0,29	0,003	Reject
Lack of Public Transport	3,41	1,78	1,63	0,000	Reject
Unreliable Electricity Supply	5,38	5,35	0,04	0,709	Accept
Inadequate solid waste disposal & Collection Service	4,01	3,02	0,99	0,000	Reject
Presence of litter and illegal piles of solid	3,78	2,68	1,10	0,000	Reject
Bad air quality	5,21	3,73	1,48	0,000	Reject
Nuisance from solid waste disposal site	2,25	2,44	0,19	0,208	Accept
	4,04	3,34			

Jakarta tends to have more serious problems compare to Surabaya, except for problem like Poor Access for Motor Vehicle, where mean value in Surabaya is significantly higher than Jakarta. Difficult Access of Water problem is significantly higher in Jakarta than Surabaya with the difference of mean value about 1.72. As well as problem like Lack of Public Transport where the mean difference of two cities is 1.63, however mean value of each city is still less than middle value indicating the problem is not serious in both cities.

6.3.2 Household Problems according to Area of Living

Figure 54 showed comparison between seriousness of household problems in suburban and urban areas. Generally saying, problems such as Unreliable Electricity Supply, Poor Quality of Drinking Water, Bad Air Quality and Difficult Access Water appeared to be serious in both areas of living. As it has been discussed before, area of living in both Jakarta and Surabaya only consist of Urban and Suburban areas (Ratio 3:1), making independent variable consist of only two variables, urban and suburban variable. Therefore, Independent T-Test is used here instead of One-Way Anova to check whether there is a significant difference between respondents living in suburban and urban areas regarding the seriousness of household problems.

Null hypothesis (H_0) as the tested statement specified that there is no significant difference in the seriousness of household problems between suburban and urban area. The alternative

hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis.

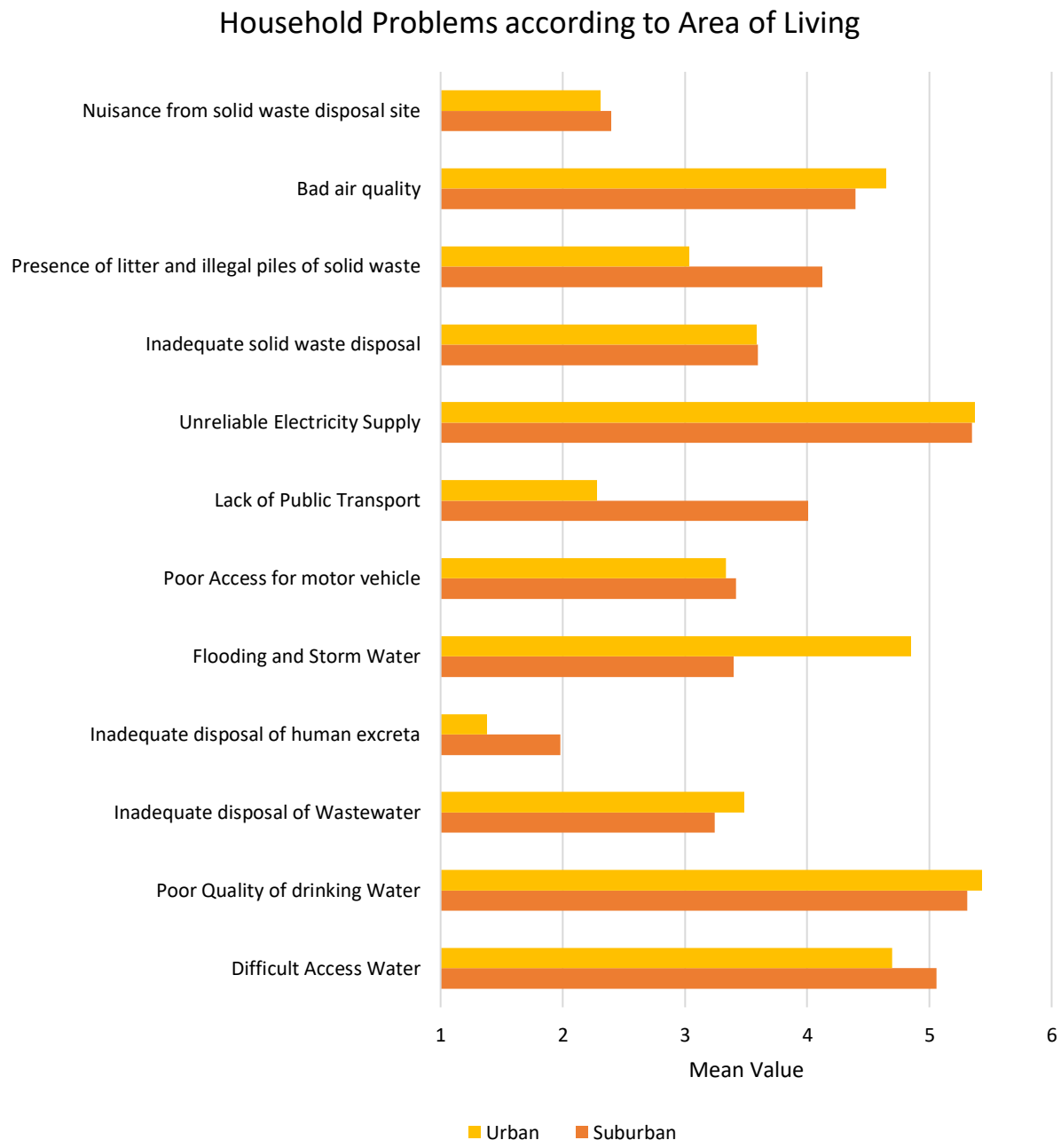


Figure 54: Households Problems according to Area of Living

H_0: There is no significant difference in the seriousness of each household problem between Suburban and Urban Areas

H_1: There is significant difference in the seriousness of each household problem between Suburban and Urban Areas

If the *p*-value is less than the significance level ($p < 0.05$) then it will be concluded that the observed effect actually reflects the characteristics of the population rather than just sampling error, thus rejecting the null hypothesis.

Table 33: T-Test of Household Problems between Areas of Living

	Mean		Mean Difference	Sig. (2-tailed)	Output H_0
	Suburban	Urban			
Difficult Access Water	5,06	4,70	0,36	0,003	Reject
Poor Quality of drinking Water	5,31	5,43	0,12	0,177	Accept
Inadequate disposal of Wastewater	3,25	3,49	0,24	0,063	Accept
Inadequate disposal of human excreta	1,98	1,38	0,60	0,000	Reject
Flooding and Storm Water	3,40	4,85	1,46	0,000	Reject
Poor Access for motor vehicle	3,42	3,33	0,08	0,455	Accept
Lack of Public Transport	4,01	2,28	1,73	0,000	Reject
Unreliable Electricity Supply	5,35	5,38	0,03	0,812	Accept
Inadequate solid waste disposal & Collection Service	3,59	3,59	0,01	0,968	Accept
Presence of litter and illegal piles of solid waste	4,12	3,04	1,09	0,000	Reject
Bad air quality	4,40	4,64	0,25	0,091	Accept
Nuisance from solid waste disposal site	2,40	2,31	0,09	0,556	Accept
	3,86	3,70			

Based on Table 33, Lack of Public Transport is significantly more serious for people residing in suburban area. Presence of Litter and Illegal Piles of Solid Waste problem as well as Difficult Access Water problem are also more serious in suburban area. Meanwhile, Flooding and Strom Water problem is shown to be more serious in the urban area, along with problems like Inadequate Disposal of Wastewater and Bad Air Quality, although differences of the problem between two areas are not significant.

6.3.3 Household Problems according to Level of Income

Level of income is analysed here in order to see household problems that occurred in relation to the social economical class of respondents. Divided into five categories of income level, household problems for people with lowest income level tend to have relatively higher mean value or relatively more serious than household problems facing by people in other income levels (Figure 55).

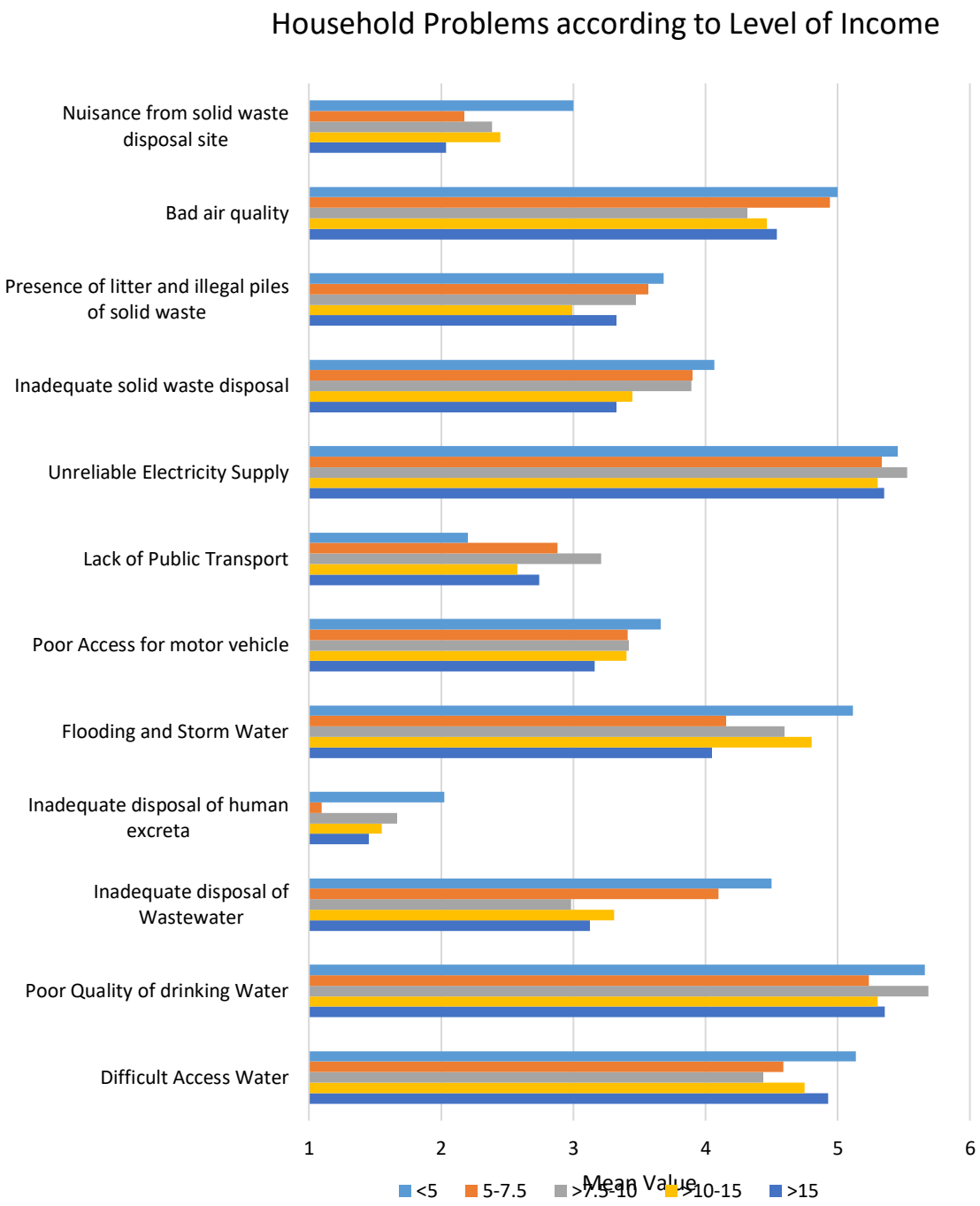


Figure 55: Households Problems according to Level of Income

Problems such as Nuisance from solid waste disposal site, Inadequate Disposal of Human Excreta; Flooding and Storm Water as well as Inadequate Disposal of Wastewater tend to be much more serious for people with lowest level of income.

Furthermore, it is shown on Table 34 that total mean value of all problems for lowest income level (<5 million IDR) is the highest among other income levels. Highest income level on the other hand has shown the least mean value or can also be described as the least in the seriousness of household problems.

Meanwhile, the rest of income level groups showed almost similar number of mean value. Despite the fact that there are differences of mean value between levels of income, it is still necessary to detect whether there are significant difference between each group of income level. Therefore, One-Way Anova test is conducted here for that related purposed.

Level of Income consists of five independent variables making it more accurate to be tested by using Analysis of Variance (One-Way Anova). Dependent variables here are the whole twelve household problems. Anova (α = 5%) is conducted here to see if there are significant differences in the seriousness of household problems among levels of income. Null hypothesis (H_0) as the tested statement specified that there is no significant difference in the seriousness of household problems among level of income. The alternative hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis.

Table 34: One-Way Anova of Household Problem among Level of Income

	Mean					Sig.	Output H_0
	<5	5-7.5	>7.5-10	>10-15	>15		
Difficult Access Water	5,14	4,59	4,44	4,75	4,93	0,022	Reject
Poor Quality of drinking Water	5,66	5,24	5,68	5,30	5,36	0,001	Reject
Inadequate disposal of Wastewater	4,50	4,10	2,98	3,31	3,12	0,000	Reject
Inadequate disposal of human excreta	2,02	1,10	1,67	1,55	1,45	0,000	Reject
Flooding and Storm Water	5,11	4,16	4,60	4,80	4,05	0,000	Reject
Poor Access for motor vehicle	3,66	3,41	3,42	3,40	3,16	0,032	Reject
Lack of Public Transport	2,20	2,88	3,21	2,58	2,74	0,006	Reject
Unreliable Electricity Supply	5,45	5,33	5,53	5,30	5,35	0,618	Accept
Inadequate solid waste disposal & Collection Service	4,07	3,90	3,89	3,45	3,33	0,010	Reject
Presence of litter and illegal piles of solid waste	3,68	3,57	3,47	2,99	3,33	0,043	Reject
Bad air quality	5,00	4,94	4,32	4,46	4,54	0,017	Reject
Nuisance from solid waste disposal site	3,00	2,18	2,39	2,45	2,04	0,002	Reject
	4,13	3,78	3,80	3,70	3,62		

H_0: There is no significant difference in the seriousness of each household problem among levels of income

H_1: There is significant difference in the seriousness of each household problem among levels of income

If the *p*-value is less than the significance level ($p < 0.05$) then it will be concluded that H_0 cannot be accepted. Table 34 is the table that shows the output of the Anova analysis and whether there is statistically significant difference between group (level of income) means. It can be seen on the Significant Value column that all of household problems are statistically significant different in its seriousness according to level of income except for Unreliable Electricity Supply where all groups showed mean value of more than 5, which indicated that this related problem is very serious regardless in which social economic level.

Closely looked, people on the group with the lowest income level tend to have more serious household problems. It can be seen that mean value of this group is always higher than the rest of other income level with the exception of Lack of Public Transport problem where this lowest income level has the least mean value of related problem.

6.3.4 Household Problems according to the Type of Housing

Household problems according to type of housing is shown below to see the level of seriousness of every single household problems according to respondents living in apartment and single home housing. First glance at Figure 56 can be interpreted that the level of seriousness of each household problem is not different between those two types of housing. Nevertheless, it is still necessary to conduct a further analysis to prove that the differences are not statistically significant.

Independent T-Test ($\alpha = 5\%$) is again conducted here to see if there are significant differences in the seriousness of household problems between types of housing. Null hypothesis (H_0) as the tested statement specified that there is no significant different in the seriousness of household problems between apartment and single home. The alternative hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis.

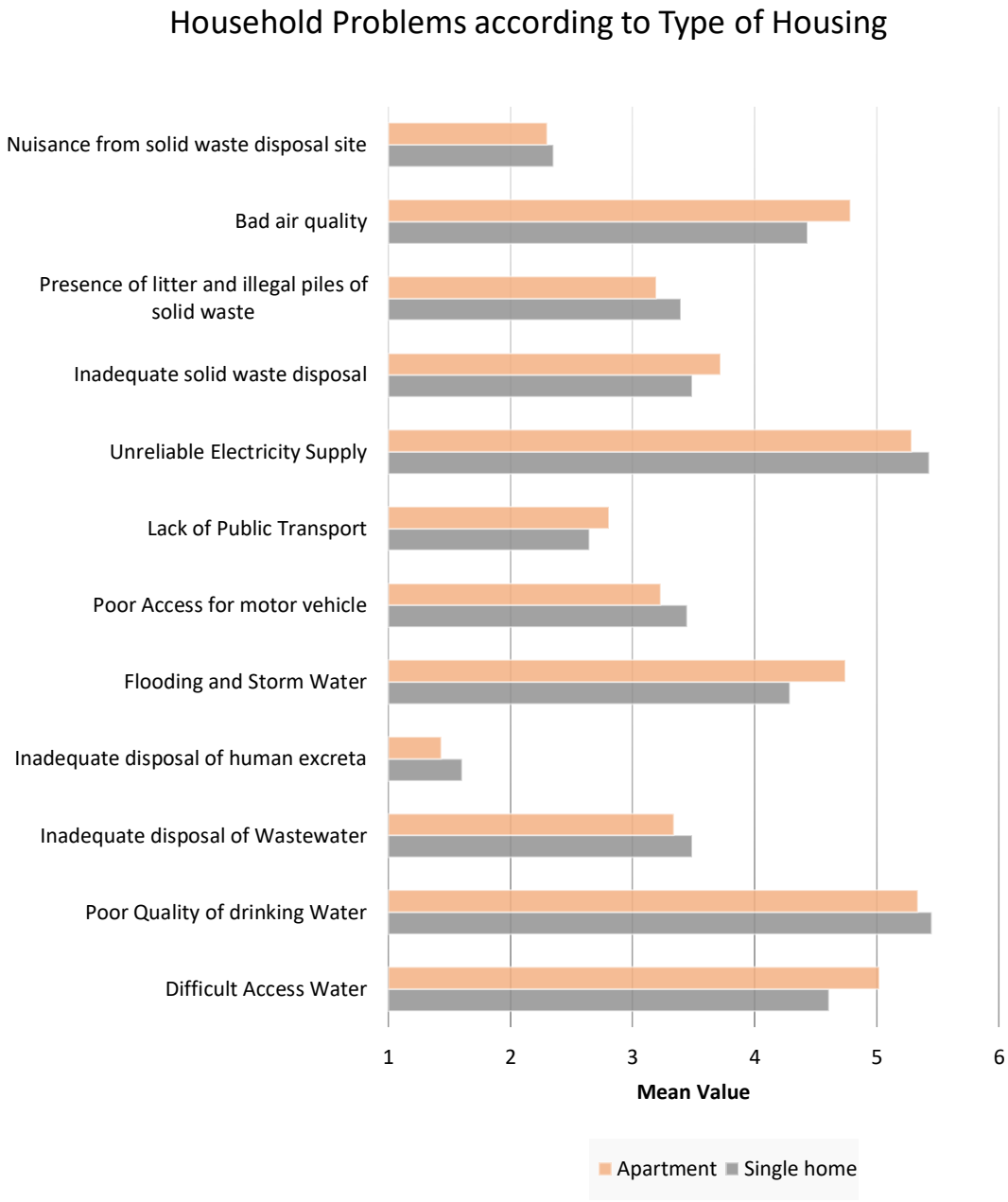


Figure 56: Household Problems according to Type of Housing

H_0: There is no significant difference in the seriousness of each household problem between types of housing

H_1: There is significant difference in the seriousness of each household problem between types of housing

If the *p*-value is less than the significance level ($p < 0.05$) then it will be concluded that the observed effect actually reflects the characteristics of the population rather than just sampling error, thus rejecting the null hypothesis.

Table 35: T-Test of Household Problems between Types of Housing

	Mean		Mean	Sig.	Output
	Single home	Apartment	Difference	(2-tailed)	H_0
Difficult Access Water	4,610	5,022	0,412	0,001	Reject
Poor Quality of drinking Water	5,448	5,339	0,109	0,144	Accept
Inadequate disposal of Wastewater	3,490	3,339	0,151	0,168	Accept
Inadequate disposal of human excreta	1,602	1,433	0,168	0,079	Accept
Flooding and Storm Water	4,290	4,744	0,454	0,003	Reject
Poor Access for motor vehicle	3,448	3,228	0,220	0,021	Reject
Lack of Public Transport	2,647	2,806	0,158	0,254	Accept
Unreliable Electricity Supply	5,432	5,283	0,148	0,115	Accept
Inadequate solid waste disposal & Collection Service	3,490	3,722	0,233	0,134	Accept
Presence of litter and illegal piles of solid waste	3,394	3,194	0,200	0,183	Accept
Bad air quality	4,432	4,783	0,352	0,006	Reject
Nuisance from solid waste disposal site	2,353	2,300	0,053	0,715	Accept
	3,72	3,77			

Total mean value of single home and apartment housing is 3.72 and 3.77 which can be stated that both values are almost equal. However, based on the Independent T-Test displayed on Table 35, it can be seen that there are four problems such as Difficult Access Water, Flooding, Lack of Public Transport and Bad Air Quality with significant values less than 0.05. This means that there is significant difference in the level of seriousness of each mentioned problem between the two independent variables (single home and Apartment).

People living in apartments tend to have more serious problem in difficulty of accessing water, bad air quality in their residential area as well as with flooding problem. Meanwhile, people living in single homes are shown to have more serious problem with access for motor vehicle.

6.3.5 Household Problems according to Status of Ownership

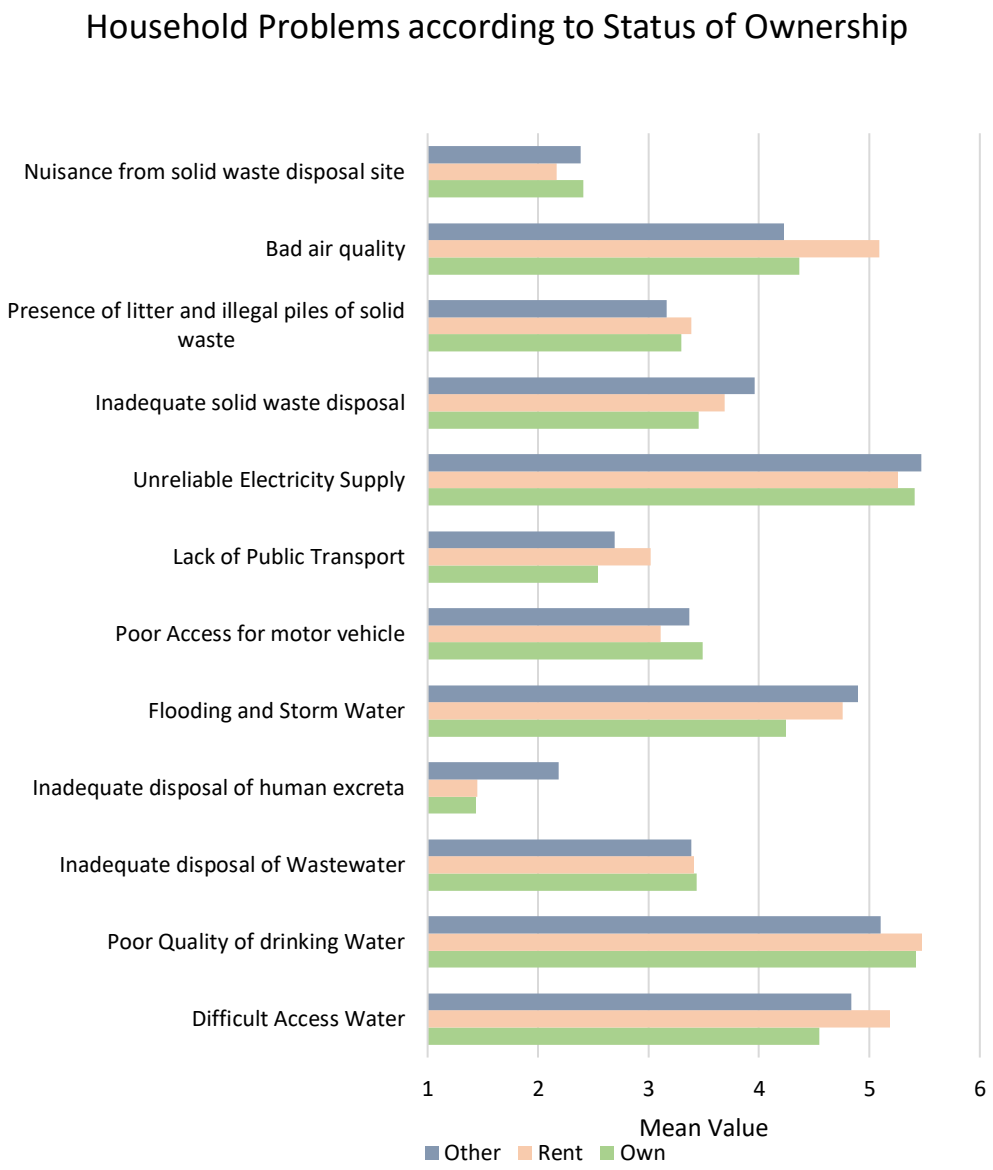


Figure 57: Household Problems according to Status of Ownership

Analysis of Variance (One-Way Anova) is conducted here to see if there are significant differences in the seriousness of household problem among status of ownership. Null hypothesis (H_0) as the tested statement specified that there is no significant difference among status of ownership (α = 5%). The alternative hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis. If the significant value is less than 0.05 (p<0.05) then H_0 will be rejected, which basically is the expected result from this test.

H_0: There is no significant difference in the seriousness of each household problem among status of ownership

H_1: There is significant difference in the seriousness of each household problem among status of ownership

Table 36: One-Way Anova of Household Problems among Status of Ownership

	Mean				Output
	Own	Rent	Other	Sig.	H_0
Difficult Access Water	4,55	5,19	4,84	0,000	Reject
Poor Quality of drinking Water	5,42	5,47	5,10	0,010	Reject
Inadequate disposal of Wastewater	3,44	3,41	3,39	0,953	Accept
Inadequate disposal of human excreta	1,44	1,45	2,18	0,000	Reject
Flooding and Storm Water	4,24	4,76	4,90	0,001	Reject
Poor Access for motor vehicle	3,49	3,11	3,37	0,001	Reject
Lack of Public Transport	2,54	3,02	2,69	0,009	Reject
Unreliable Electricity Supply	5,41	5,26	5,47	0,253	Accept
Inadequate solid waste disposal & Collection Service	3,46	3,69	3,96	0,084	Accept
Presence of litter and illegal piles of solid waste	3,30	3,39	3,16	0,687	Accept
Bad air quality	4,37	5,09	4,22	0,000	Reject
Nuisance from solid waste disposal site	2,41	2,17	2,39	0,303	Accept
	3,67	3,83	3,81		

Table 36 showed that there are significant differences among status of ownership concerning household problems such as Difficult Access Water, Poor Quality of Drinking Water, Inadequate Disposal of Human Excreta, Flooding and Storm Water, Poor Access for motor vehicle, Lack of Public Transport, and Bad Air Quality.

6.3.6 Correlation among Household Problems

Correlations among household problems investigate the relationship pattern between two household problems. Pearson's correlation is used here to measure the strength of the association between the two discussed variables that represent problems faced by households in big cities like Jakarta and Surabaya. The reasoning is to have a bigger picture of how level of seriousness of a problem might influence the seriousness of others.

Pearson's correlation is conducted to analyse quantitative data which show the seriousness of each household problem, in order to see if there are significant correlation in the seriousness of each household problem in their relationship to other existing problems. Null hypothesis (H_0) as the tested statement specified that there is no significant correlation among household problems

(α = 5%). The alternative hypothesis (H_1) stated that there is significant correlation and this statement is expected or hoped to be true instead of the null hypothesis. If the significant value is less than 0.05 (p<0.05) then H_0 will be rejected, which basically is the expected result from this test.

H_0: There is no significant correlation between each of household problem

H_1: There is significant correlation between each of household problem

Pearson number indicates the strength of association between the household problems and the correlation coefficient show the significant difference between problems. When Pearson's number is close to 1,00 this indicates a strong relationship between two of the variables. This can be interpreted as changes in one household problem are strongly correlated with changes in the second problem. Meanwhile, when the Pearson number is close to 0, this indicates that there is a week relationship between two variables (household problems). This as well indicates that changes in one household problem is not correlated with changes in the second or other problem and it can be concluded that two analysed problems are not strongly correlated.

Additionally, when Pearson number is positive (+), it can be interpreted that as one household problem increase in value or its level of seriousness, the second problem also increase in value. In the same way, as one household problem decrease in value or its level of seriousness, the second problem also decrease in in value. Meanwhile, when Pearson number is negative (-), it can be interpreted that as one household problem increase in value, the second problem decrease in value. This correlation is known as negative correlation.

Table 37: Correlations among Household Problems showed significant value and Pearson's number of correlations among household problems in Jakarta and Surabaya as whole. High Pearson's number appeared on the correlation between Flooding and Inadequate disposal of waste water. Positive value of the Pearson's number here can be interpreted that when the mean value (seriousness) of inadequate disposal of waste water increase, the Flooding problem also increase in value. Moreover, problem like difficulty of accessing clean water is correlated to problems such as Inadequate Disposal of Waste Water, Inadequate Disposal of Human Excreta, Flooding, Lack of Public Transport, and Inadequate Solid Waste Disposal, Presence of Illegal Solid Waste as well as Bad Air Quality.

In addition, Lack of Public Transport is strongly correlated with Presence of Litter and Illegal Piles of Solid Waste with the Pearson's number of 0,462, it can be interpreted that when Presence of Litter and Illegal Piles of Solid Waste increase in value or its level of seriousness increase, the value of Lack of Public Transport also increase. Further analysis about the causality of household problems will be discussed on the next chapter.

Table 37: Correlations among Household Problems

		Inadequate disposal of Wastewater	Inadequate disposal of human excreta	Flooding and Storm Water	Poor Access for motor vehicle	Lack of Public Transport	Unreliable Electricity Supply	Inadequate solid waste disposal & Collection Service	Presence of litter and illegal piles of solid waste	Bad air quality
Difficult Access Water	Pearson Correlation	0,149	0,179	0,218		0,373		0,262	0,242	0,370
	Sig. (2-tailed)	0,002	0,000	0,000		0,000		0,000	0,000	0,000
Poor Quality of drinking Water	Pearson Correlation		0,178	0,112						
	Sig. (2-tailed)		0,000	0,021						
Inadequate disposal of Wastewater	Pearson Correlation			0,402			0,117	0,122	0,165	0,257
	Sig. (2-tailed)			0,000			0,016	0,013	0,001	0,000
Inadequate disposal of human excreta	Pearson Correlation					0,298		0,287	0,307	0,121
	Sig. (2-tailed)					0,000		0,000	0,000	0,013
Flooding and Storm Water	Pearson Correlation	0,402						0,149		0,292
	Sig. (2-tailed)	0,000						0,002		0,000
Poor Access for motor vehicle	Pearson Correlation						0,103			
	Sig. (2-tailed)						0,035			
Lack of Public Transport	Pearson Correlation		0,298					0,221	0,462	0,180
	Sig. (2-tailed)		0,000					0,000	0,000	0,000
Unreliable Electricity Supply	Pearson Correlation	0,117			0,103					
	Sig. (2-tailed)	0,016			0,035					
Inadequate solid waste disposal & Collection Service	Pearson Correlation	0,122	0,287	0,149		0,221			0,200	0,133
	Sig. (2-tailed)	0,013	0,000	0,002		0,000			0,000	0,006
Presence of litter and illegal piles of solid	Pearson Correlation	0,165	0,307			0,462		0,200		0,183
	Sig. (2-tailed)	0,001	0,000			0,000		0,000		0,000

6.4 Willingness to Pay for Household Problems

This sub-chapter is aimed to discuss about the willingness of respondents as end user to pay for problems occurred in their household. Yes, No and Not Sure answers are used here to find whether each respondent agrees, disagrees or not sure to pay for solution or improvement in of their household problems.

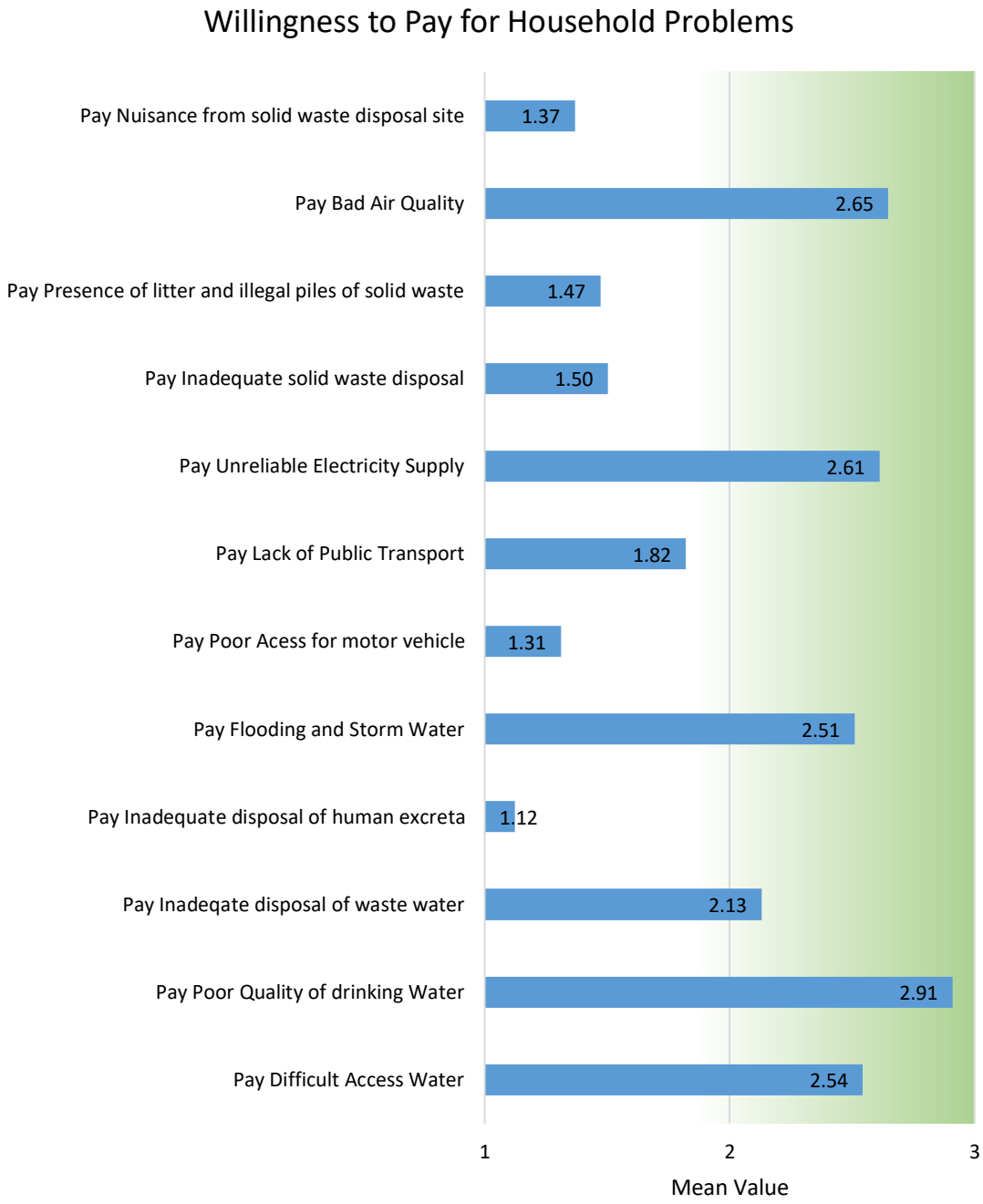


Figure 58: Willingness to Pay for Household Problems

Each answer is weighted with 1, 2 and 3 to transform the qualitative answers into quantitative ones. Answer “Yes” is weighted 3, “Not Sure” is weighted 2 and “No” answer is weighted with 1. Middle value (2) is drawn as the shifting point dividing answers into two zones, every value that is lower than the middle value will be categorized as “Not Willing to Pay” and the other way.

Figure 58 showed total mean of respondent’s answer about their willingness to pay for household problems. Poor Quality of Drinking Water appeared to be the problem that people willing to pay in order to have it improved. Respondent are also willing to pay for problems such as Bad Air Quality, Unreliable Electricity Supply, Difficult Access Water, Flooding as well as Inadequate Disposal of Waste Water. Rest of problems have mean value less than 2 indicating that respondents are not willing to pay for each of them.

Based on this result, it is necessary to conduct an analysis regarding correlation between seriousness of household problem and willingness of respondent to pay for it. This correlation will be conducted on this subchapter. First of all, respondent’s willingness to pay for problems will be categorized according to their cities, area of living, level of income, type of housing and status of ownership.

6.4.1 Willingness to Pay for Household Problems according to Cities

Willingness to pay for household problems is divided here according to two observed cities. The aimed of this discussion is to identify differences between people in Jakarta and Surabaya regarding their willingness to pay in order to solve housing problems. Figure 59 showed that there are some obvious differences between two cities and people in Jakarta tend to be more willing to pay compare to Surabaya as the controlled city.

Jakarta has higher mean value (higher than middle value) in the willingness to pay for problems such as Difficult Access Water, Flooding and Storm Water and Bad Air Quality. It also has higher mean value compare to Surabaya in other problems like Poor Access for Motor Vehicle, Inadequate Solid Waste Disposal, Presence of Litter and Illegal Piles of Solid Waste. However, these problems have mean value less than the middle value.

People in Surabaya have higher mean value (above middle value) compare to Jakarta for some problems like Poor Quality of Drinking Water and Unreliable Electricity Supply. Respondents here are also more willing to pay for Inadequate Disposal of Human Excreta and Nuisance from Solid Waste Disposal Site, even so the mean value for willingness to pay for these two specific problems are still below the middle value.

Next step, Independent T-Test ($\alpha = 5\%$) will be conducted here to see if there are significant differences in the willingness to pay for household problems between cities. Null hypothesis (H_0) as the tested statement specified that there is no significant different in the willingness to pay for household problems between Jakarta and Surabaya. The alternative hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis.

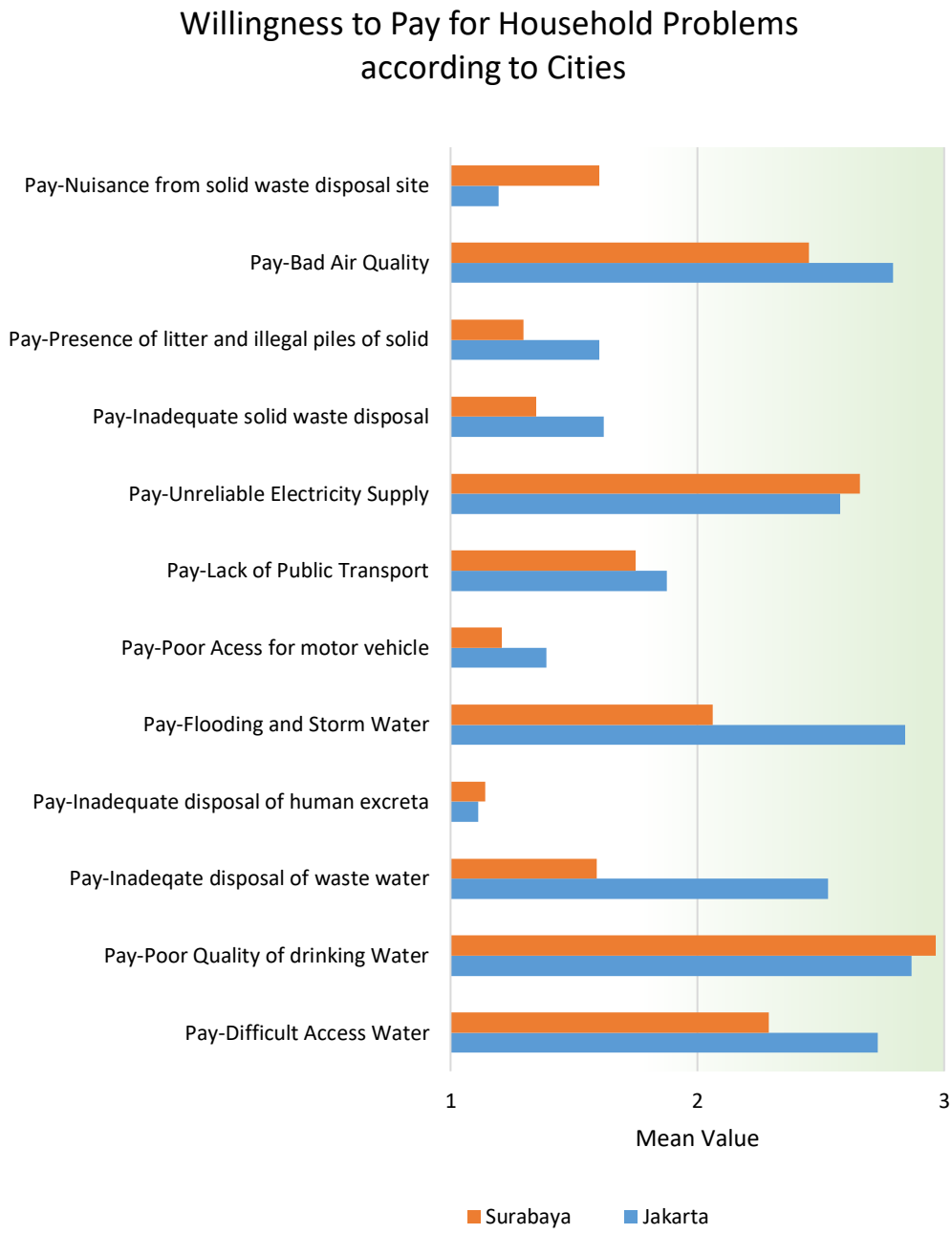


Figure 59: Willingness to Pay for Household Problem According to Cities

H_0: There is no significant difference in the willingness to pay for each household problem between Jakarta and Surabaya

H_1: There is significant difference in the willingness to pay for each household problem between Jakarta and Surabaya

Table 38: T-Test of Willingness to Pay for Household Problems between Cities

	Mean		Sig. (2-tailed)	Output H_0
	Jakarta	Surabaya		
Pay-Difficult Access Water	2,73	2,29	0,000	Reject
Pay-Poor Quality of drinking Water	2,87	2,97	0,001	Reject
Pay-Inadequate disposal of waste water	2,53	1,59	0,000	Reject
Pay-Inadequate disposal of human excreta	1,11	1,14	0,524	Accept
Pay-Flooding and Storm Water	2,84	2,06	0,000	Reject
Pay-Poor Access for motor vehicle	1,39	1,21	0,004	Reject
Pay-Lack of Public Transport	1,88	1,75	0,187	Accept
Pay-Unreliable Electricity Supply	2,58	2,66	0,254	Accept
Pay- Inadequate solid waste disposal & Collection Service	1,62	1,35	0,000	Reject
Pay-Presence of litter and illegal piles of solid waste	1,60	1,30	0,000	Reject
Pay-Bad Air Quality	2,79	2,45	0,000	Reject
Pay-Nuisance from solid waste disposal site	1,19	1,60	0,000	Reject
	2,09	1,86		

If significant value is less than 0.05 (p<0.05), H_0 is rejected

If significant value is more than 0.05 (p>0.05), H_0 is accepted

There are significant differences between Jakarta and Surabaya in the willingness to pay for household problems except for three problems such as Inadequate Disposal of Human Excreta, Lack of Public Transport and Unreliable Electricity Supply. Mean value of all problems in Jakarta is higher than Surabaya. It can be seen on Table 38 that total mean value of Surabaya is below middle value, showing that respondent in Surabaya tend to not willing to pay for household problems.

6.4.2 Willingness to Pay for Household Problems according to Area of Living

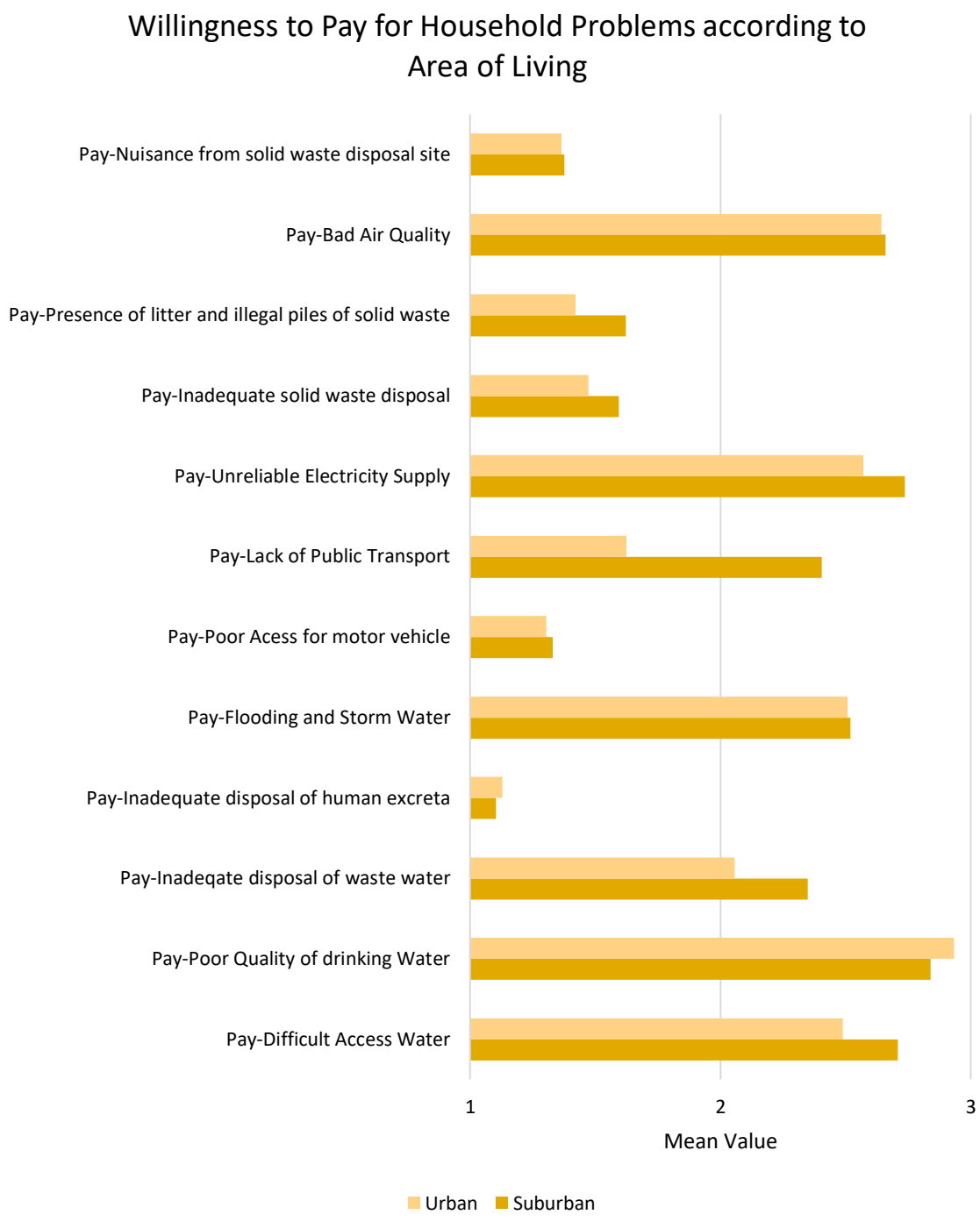


Figure 60: Willingness to Pay for Household Problems according to Area of Living

Roughly said based on Figure 60 that people living in the suburban area are more willing to pay for household's problems compare to those living in the urban area, unless for two specific problems, Poor Quality of Drinking Water and Inadequate Disposal of Human Excreta.

Willingness to pay to solve the lack of public transport is also higher from the suburban side, the mean value is higher than 2 (middle value). Meanwhile from the urban side, people are not so willing to pay for that exact problem (mean value < 2).

Independent T-Test is used to check whether there is a significant difference between respondents living in suburban and urban areas regarding the seriousness of household problems. Null hypothesis (H_0) as the tested statement specified that there is no significant difference in the seriousness of household problems between suburban and urban area. The alternative hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis.

H_0: There is no significant difference in the willingness to pay for each household problem between Suburban and Urban areas

H_1: There is significant difference in the willingness to pay for each household problem between Suburban and Urban areas

Table 39: T-Test of Willingness to Pay for Household Problems Criteria between Areas of Living

	Mean		Sig.	Output
	Suburban	Urban	(2-tailed)	H_0
Pay-Difficult Access Water	2,708	2,489	0,022	Reject
Pay-Poor Quality of drinking Water	2,84	2,933	0,145	Accept
Pay-Inadequate disposal of waste water	2,349	2,057	0,003	Reject
Pay-Inadequate disposal of human excreta	1,104	1,13	0,599	Accept
Pay-Flooding and Storm Water	2,519	2,508	0,905	Accept
Pay-Poor Access for motor vehicle	1,33	1,305	0,738	Accept
Pay-Lack of Public Transport	2,406	1,625	0,000	Reject
Pay-Unreliable Electricity Supply	2,736	2,571	0,403	Accept
Pay- Inadequate solid waste disposal & Collection Service	1,594	1,473	0,179	Accept
Pay-Presence of litter and illegal piles of solid waste	1,623	1,422	0,036	Reject
Pay-Bad Air Quality	2,66	2,644	0,035	Reject
Pay-Nuisance from solid waste disposal site	1,377	1,365	0,879	Accept
	2,10	1,96		

Special case appears on the willingness to pay for Poor Quality of Drinking Water, people in urban area have higher value or more willing to pay for this related problem, however, the mean value difference between two groups is not significant.

6.4.3 Willingness to Pay for Household Problems according to the Level of Income

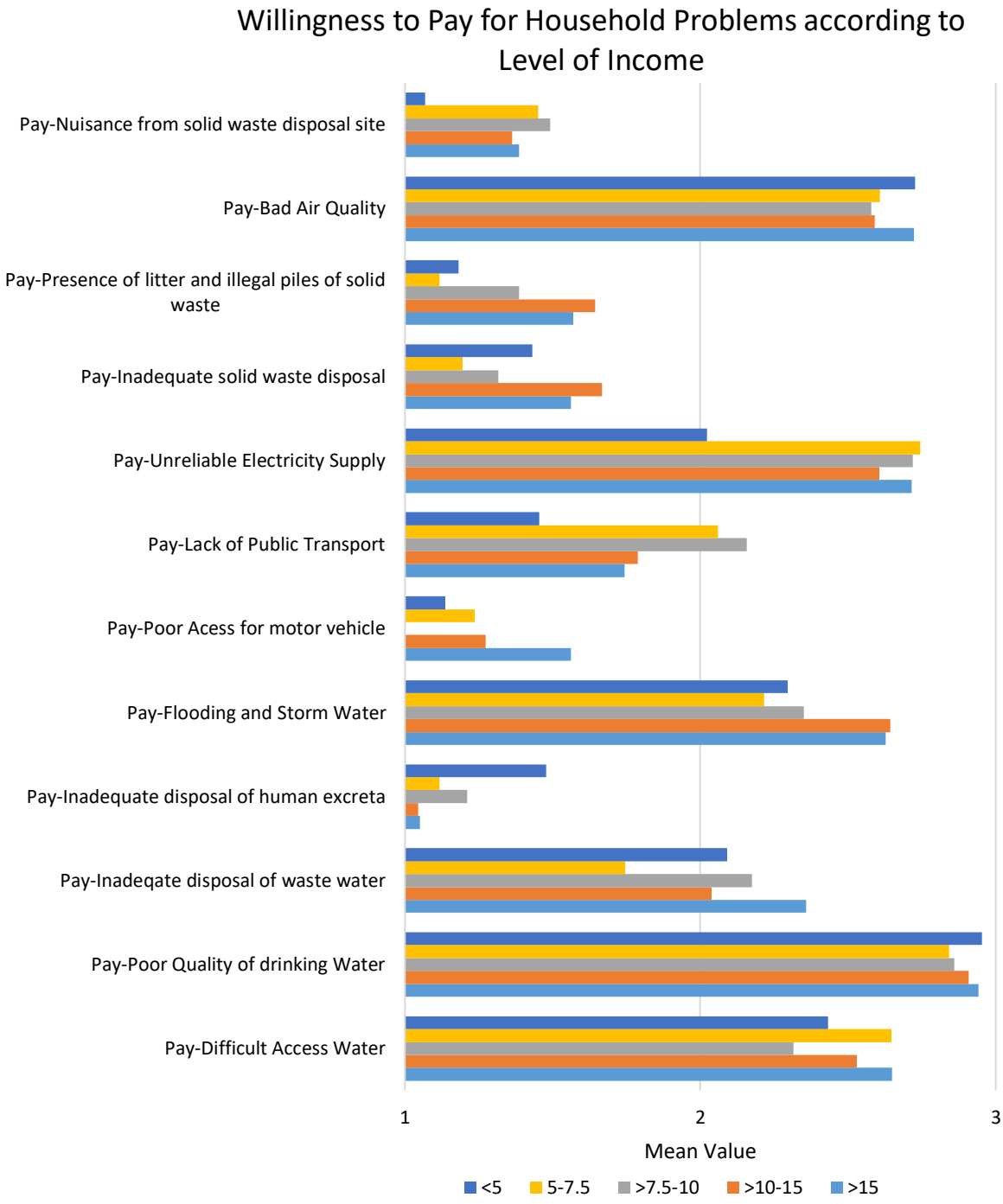


Figure 61: Willingness to Pay for Household Problems according to Level of Income

Analysis of Variance is conducted here to detect differences among different income levels of respondents regarding their willingness to pay for household problems. It is necessary to detect whether there are significant differences between each group of income level. Level of Income consists of five independent variables making it more accurate to be tested by using Analysis of

Variance (One-Way Anova). Dependent variables here are the whole twelve household problems. Anova (α = 5%) is conducted here to see if there are significant differences in the seriousness of household problems among levels of income.

Null hypothesis (H_0) as the tested statement specified that there is no significant difference in the seriousness of household problems among level of income. The alternative hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis. If the significant value is less than 0.05 (p<0.05) then H_0 will be rejected, which basically is the expected result from this test.

H_0: There is no significant difference in the willingness to pay for each household problem among levels of income

H_1: There is significant difference in the willingness to pay for each household problem among levels of income

Table 40: One-Way Anova for Willingness to Pay for Household Problems among Levels of Income

	Mean					Sig.	Output H_0
	<5	5-7.5	>7.5-10	>10-15	>15		
Pay-Difficult Access Water	2,43	2,65	2,32	2,53	2,65	0,019	Reject
Pay-Poor Quality of drinking Water	2,95	2,84	2,86	2,91	2,94	0,208	Accept
Pay-Inadequate disposal of waste water	2,09	1,75	2,18	2,04	2,36	0,001	Reject
Pay-Inadequate disposal of human excreta	1,48	1,12	1,21	1,05	1,05	0,000	Reject
Pay-Flooding and Storm Water	2,3	2,22	2,35	2,64	2,63	0,001	Reject
Pay-Poor Access for motor vehicle	1,14	1,24	1,00	1,27	1,56	0,000	Reject
Pay-Lack of Public Transport	1,45	2,06	2,16	1,79	1,74	0,002	Reject
Pay-Unreliable Electricity Supply	2,02	2,75	2,72	2,61	2,72	0,00	Reject
Pay- Inadequate solid waste disposal & Collection Service	1,43	1,2	1,32	1,67	1,56	0,002	Reject
Pay-Presence of litter and illegal piles of solid waste	1,18	1,12	1,39	1,64	1,57	0,00	Reject
Pay-Bad Air Quality	2,73	2,61	2,58	2,59	2,72	0,263	Accept
Pay-Nuisance from solid waste disposal site	1,07	1,45	1,49	1,36	1,39	0,037	Accept
	1,86	1,92	1,97	2,01	2,07		

Lowest income level respondents are willing to pay the most for solution of poor quality of water and bad air quality. This group at the same time is not willing to pay for poor access for motor vehicle problem. The second group or respondents with the second lowest income level tend to be willing to pay for quality of water and electricity supply. Respondents in the income level >7.5-10 and >10-15 million IDR showed almost the same tendency with the previous group. People with the highest income level appeared to have the highest mean value for willingness

to pay for household problems. On Table 40 can be seen that the willingness to pay is increasing alongside the increase of income level. There are statistically significant differences in almost all willingness to pay factors, except willingness to pay for Poor Quality of Drinking Water, Bad Air Quality and Nuisance from Solid Waste Disposal Site. As a result, it can be generally concluded that respondent's level of income has influence toward their willingness to pay.

6.4.4 Willingness to Pay for Household Problems according to Type of Housing

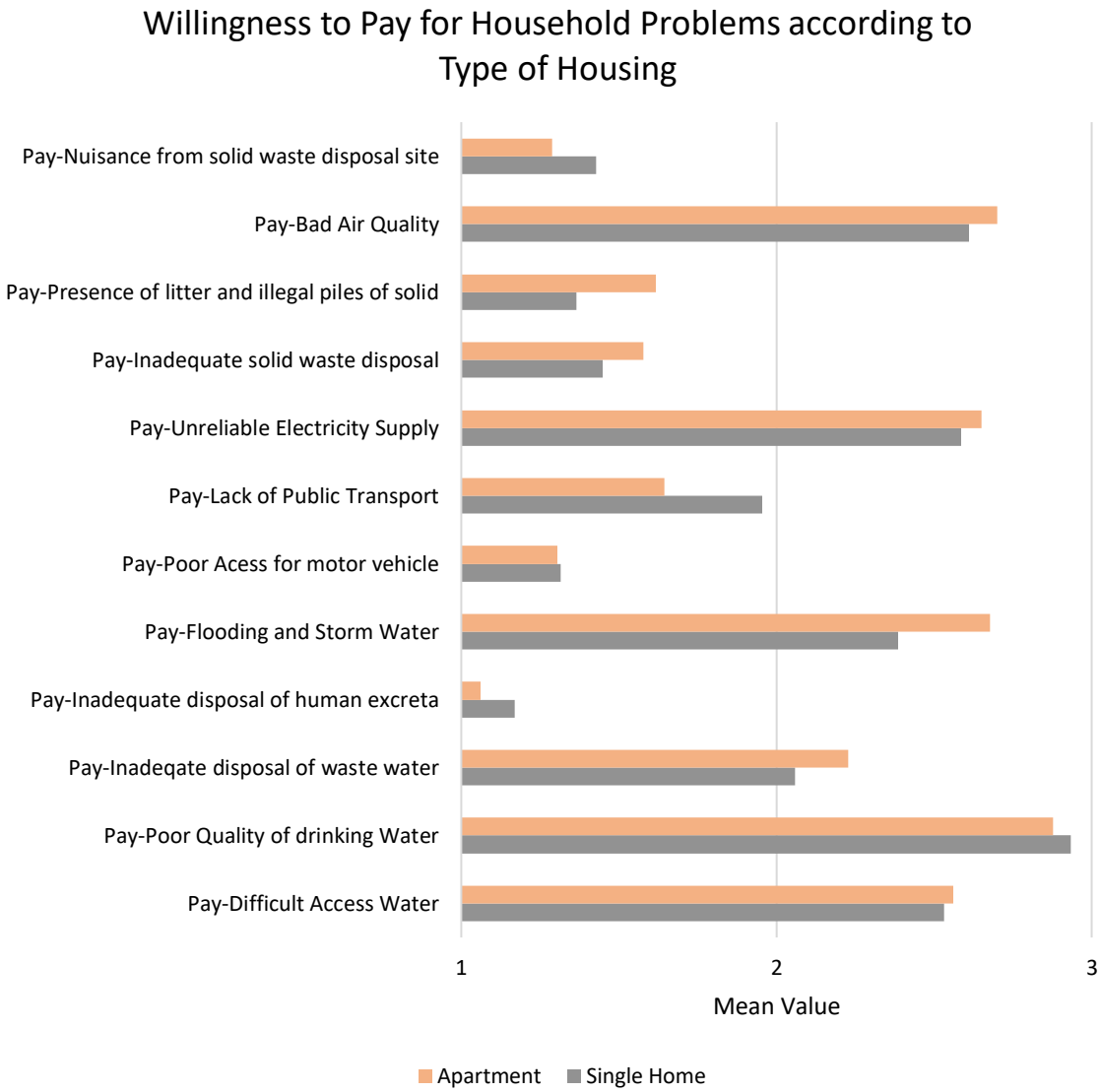


Figure 62: Willingness to Pay for Household Problems according to Type of Housing

Figure 62 showed respondent's willingness to pay for the solution of their household problem according to type of housing they are living in. For problem such as Bad Air Quality, Flooding and Unreliable Electricity Soppy, people living in apartment type of housing tend to have more

willingness to pay compare to those living in single home. Table 41 showed a more detailed comparison between both housing types.

Independent T-Test (α = 5%) is again conducted here to see if there are significant differences in the seriousness of household problems between types of housing. Null hypothesis (H_0) as the tested statement specified that there is no significant different in the seriousness of household problems between apartment and single home. The alternative hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis.

H_0: There is no significant difference in the willingness to pay for each household problem between types of housing

H_1: There is significant difference in the willingness to pay for each household problem between types of housing

If the *p*-value is less than the significance level ($p < 0.05$) then it will be concluded that the observed effect actually reflects the characteristics of the population rather than just sampling error, thus rejecting the null hypothesis.

Table 41: T-Test of Willingness to Pay for Household Problems between Types of Housing

	Mean		Sig.	Output
	Single Home	Apartment	(2-tailed)	H_0
Pay-Difficult Access Water	2,53	2,56	0,659	Accept
Pay-Poor Quality of drinking Water	2,93	2,88	0,09	Accept
Pay-Inadequate disposal of waste water	2,06	2,23	0,058	Accept
Pay-Inadequate disposal of human excreta	1,17	1,06	0,009	Reject
Pay-Flooding and Storm Water	2,39	2,68	0,000	Reject
Pay-Poor Access for motor vehicle	1,32	1,31	0,883	Accept
Pay-Lack of Public Transport	1,95	1,64	0,001	Reject
Pay-Unreliable Electricity Supply	2,59	2,65	0,358	Accept
Pay- Inadequate solid waste disposal & Collection Service	1,45	1,58	0,106	Accept
Pay-Presence of litter and illegal piles of solid	1,37	1,62	0,002	Reject
Pay-Bad Air Quality	2,61	2,70	0,113	Accept
Pay-Nuisance from solid waste disposal site	1,43	1,29	0,045	Reject
	1,98	2,02		

Table 41 listed total mean values of both single home and apartment types of housing regarding the willingness to pay. People residing in housing type of apartments have slightly higher total mean value (above middle value). Moreover, there are significant differences between the willingness to pay of these two types of housing for problems such as Iinadequate disposal of

waste water, Flooding and Storm Water, Lack of Public Transport and Presence of litter and illegal piles of solid.

6.4.5 Willingness to Pay for Household Problems according to Status of Ownership

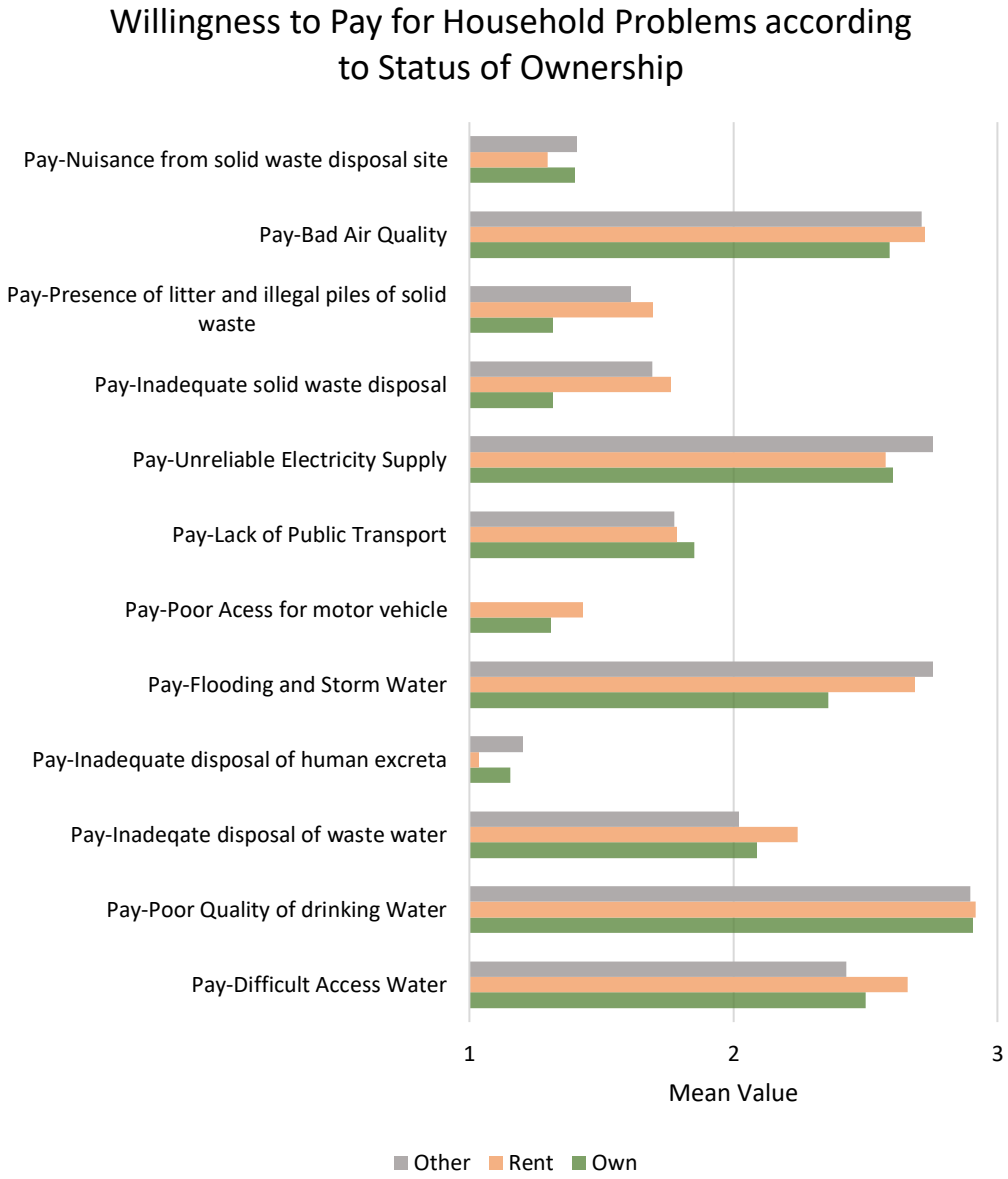


Figure 63: Willingness to Pay for Household Problems among Status of Ownership

This part of discussion is aimed to see whether respondent's status of ownership will influence their willingness to pay for problems occurred in their household. Analysis of Variance (One-Way Anova) is conducted here to see if there are significant differences in the willingness to pay for each household problem among levels of income. Null hypothesis (H_0) as the tested statement specified that there is no significant difference among levels of income ($\alpha = 5\%$). The

alternative hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis. If the significant value is less than 0.05 (p<0.05) then H_0 will be rejected, which basically is the expected result from this test.

H_0: There is no significant difference in the willingness to pay for each household problem among status of ownership

H_1: There is significant difference in the willingness to pay for each household problem among status of ownership

Table 42: One-Way Anova of Willingness to Pay for Household Problems among Status of Ownership

	Mean				Output
	Own	Rent	Other	Sig.	H_0
Pay-Difficult Access Water	2,502	2,659	2,429	0,051	Accept
Pay-Poor Quality of drinking Water	2,907	2,919	2,898	0,912	Accept
Pay-Inadequate disposal of waste water	2,089	2,244	2,020	0,189	Accept
Pay-Inadequate disposal of human excreta	1,156	1,037	1,204	0,019	Reject
Pay-Flooding and Storm Water	2,359	2,689	2,755	0,000	Reject
Pay-Poor Access for motor vehicle	1,308	1,430	1,000	0,001	Reject
Pay-Lack of Public Transport	1,852	1,785	1,776	0,770	Accept
Pay-Unreliable Electricity Supply	2,603	2,578	2,755	0,318	Accept
Pay- Inadequate solid waste disposal & Collection Service	1,316	1,763	1,694	0,000	Reject
Pay-Presence of litter and illegal piles of solid waste	1,316	1,696	1,612	0,000	Reject
Pay-Bad Air Quality	2,591	2,726	2,714	0,073	Accept
Pay-Nuisance from solid waste disposal site	1,401	1,296	1,408	0,369	Accept
	1,95	2,07	2,02		

There are significant differences among respondents categorized based on their status of ownership regarding their willingness to pay for problems such as Inadequate Disposal of Human Excreta, Flooding, and Poor Access for Motor Vehicle, Inadequate Solid Waste Disposal as well as Presence of Litter and Illegal Piles of Solid Waste. Respondents with the status ownership of own have the lowest willingness to pay for total problems compare to those of two others ownership status.

6.4.6 Relationship between the Seriousness of Household Problems and the Willingness to Pay

Table 43: Correlation Between Seriousness of Household Problem and the Willingness to pay

		Willingness to pay
Difficult Access Water	Pearson Correlation	,567**
	Sig. (2-tailed)	,000
Poor Quality of drinking Water	Pearson Correlation	,249**
	Sig. (2-tailed)	,000
Inadequate disposal of Wastewater	Pearson Correlation	,147**
	Sig. (2-tailed)	,003
Inadequate disposal of human excreta	Pearson Correlation	,249**
	Sig. (2-tailed)	,000
Flooding and Storm Water	Pearson Correlation	,306**
	Sig. (2-tailed)	,000
Poor Access for motor vehicle	Pearson Correlation	-,081
	Sig. (2-tailed)	,098
Lack of Public Transport	Pearson Correlation	,363**
	Sig. (2-tailed)	,000
Unreliable Electricity Supply	Pearson Correlation	,320**
	Sig. (2-tailed)	,000
Inadequate solid waste disposal & Collection Service	Pearson Correlation	-,030
	Sig. (2-tailed)	,541
Presence of litter and illegal piles of solid	Pearson Correlation	,046
	Sig. (2-tailed)	,346
Bad air quality	Pearson Correlation	,550**
	Sig. (2-tailed)	,000
Nuisance from solid waste disposal site	Pearson Correlation	,161**
	Sig. (2-tailed)	,001

Correlations between the seriousness of household problems and the willingness of people to pay for them explore the question whether people are willing to pay for problems that are serious for them in performing their daily household activities. Pearson's correlation is used here to measure the strength of the association between the two discussed variables. The reasoning is to have a bigger picture of how level of seriousness of a problem might influence the willingness of people to pay for the solution or improvement.

H_0: There is no significant correlation between each of household problems and the willingness to pay

H_1: There is significant correlation between each of household problems and the willingness to pay

Null hypothesis (H_0) as the tested statement specified that there is no significant correlation between household problems and willingness to pay ($\alpha = 5\%$). The alternative hypothesis (H_1) stated that there is significant correlation and this statement is expected or hoped to be true instead of the null hypothesis. If the significant value is less than 0.05 ($p<0.05$) then H_0 will be rejected, which basically is the expected result from this test.

Pearson number indicates the strength of association between seriousness of household problems and willingness to pay, while the correlation coefficient shows the significant difference between those two variables. When Pearson's number is close to 1,00 this indicates a strong relationship between two of the variables. This can be interpreted as change in the seriousness of one household problem is strongly correlated with changes in the willingness to pay. Meanwhile, when the Pearson number is close to 0, this indicates that there is a weak relationship between two variables. This as well indicates that change in the seriousness of one household problem is not correlated with changes in the second variable or willingness of people to pay for it. This can be concluded that two analysed problems are not strongly correlated.

Additionally, when Pearson number is positive (+), it can be interpreted that as the seriousness of one household problem increase in value, the willingness of people to way for it also increase in value. In the same way, as the seriousness of one household problem decrease in value, the willingness of people to way for it also decrease in value. Meanwhile, when Pearson number is negative (-), it can be interpreted that as the seriousness of one household problem increase in value, the willingness of people to way for it decrease in value. This correlation is known as negative correlation

Table 43: Correlation Between Seriousness of Household Problem and the Willingness to pay displayed the correlation between seriousness of each household problem and the willingness of people to pay for it. Problems like Difficult Access to Clean Water and Bad Air Quality have strong correlation to the willingness to pay for each of them. Rest of problems such as Poor Quality of Drinking Water, Inadequate Disposal of Waste Water, Inadequate Disposal of Human Excreta, Flooding and Storm Water, Lack of Public Transport, Unreliable Electricity Supply as well as Nuisance from Solid Waste Disposal Site are significantly correlated to willingness of people to pay for each of them but with slightly lower Pearson's numbers. Meanwhile, problems such as Poor Access for Motor Vehicle, Inadequate Solid Waste Disposal and Presence of Litter and Illegal Piles of Solid Waste showed no correlation between their level of seriousness with the willingness of people to pay for them.

6.5 Sustainable Housing in Jakarta and Surabaya

6.5.1 Awareness and Understanding of Sustainable Building Concept

Concept of Sustainable/Green Building has been introduced since 1980's to the home building industry with the main idea of a better energy efficiency. On this part, respondents were asked about sustainable building concept. First of all, they were asked about their awareness of the concept and whether they understand it. Figure 64 presented the percentage of total respondents according to their awareness of sustainable building concept or more often known

as green building concept. Almost 80% of respondents stated that they are aware with the green building concept. However, when they are asked whether they understand the basic concept of it, only 31% of respondents stated that they understand.

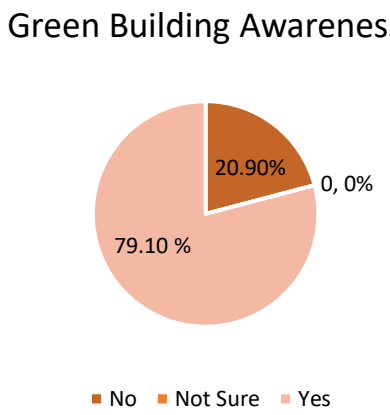


Figure 64: Awareness of Green Building

Meanwhile, around 35% of respondent are not sure whether they really understand the concept of sustainable building and the rest 33% stated that they do not understand it (Figure 65).

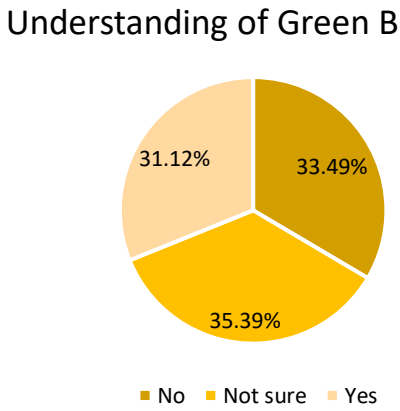


Figure 65: Understanding of Green Building

6.5.2 Willingness to Invest in Green Building

Figure 66 showed respondent's answer about their willingness to invest in green building after being explained about its basic concept. More than 96% respondents stated that they are willing to invest in such investment for their housing purposed, and the rest 3% stated that they are not sure about investing in green building.

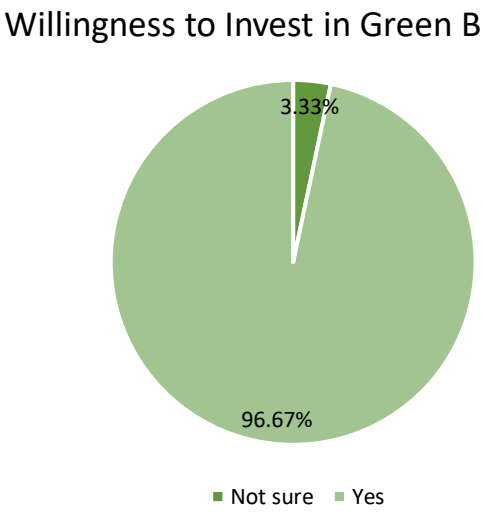


Figure 66: Willingness to Invest in Green Building

Further analysis is conducted to identify 3.33% of respondent who are not sure about the idea of investing in green building.

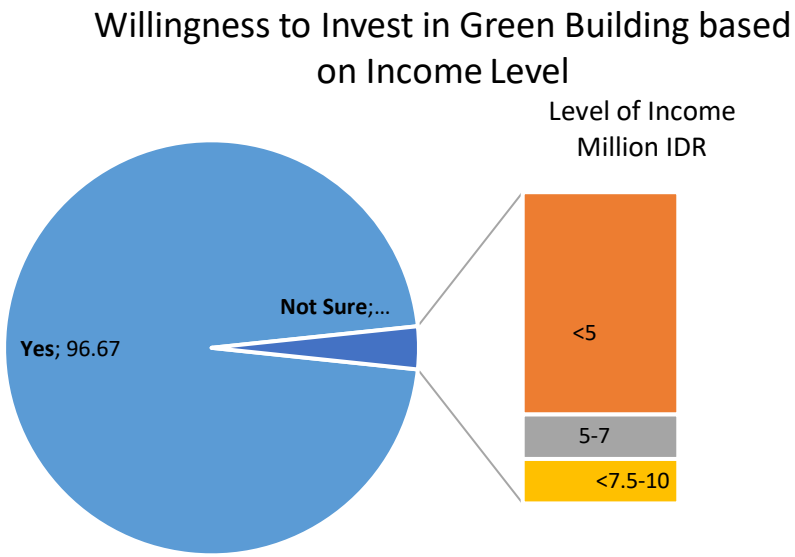


Figure 67: Willingness to Invest in Green Building based on Income Level

Cross tabulation analysis on Table 44 presents distribution of respondents answer based on their monthly income levels. It can be seen that respondents who stated that they are not sure about investing in green building come the most from the lowest income level (Figure 67).

Table 44: Cross tabulation between Monthly Income and Willingness to Invest in Green Building

	Willingness to Invest in GB		
Monthly Income	Not sure	Yes	Total
<5	10	34	44
5-7.5	2	49	51
<7.5-10	2	55	57
<10-15	0	132	132
>=15	0	137	137
Total	14	407	421

6.5.3 Factor Hampering Green Building Investment

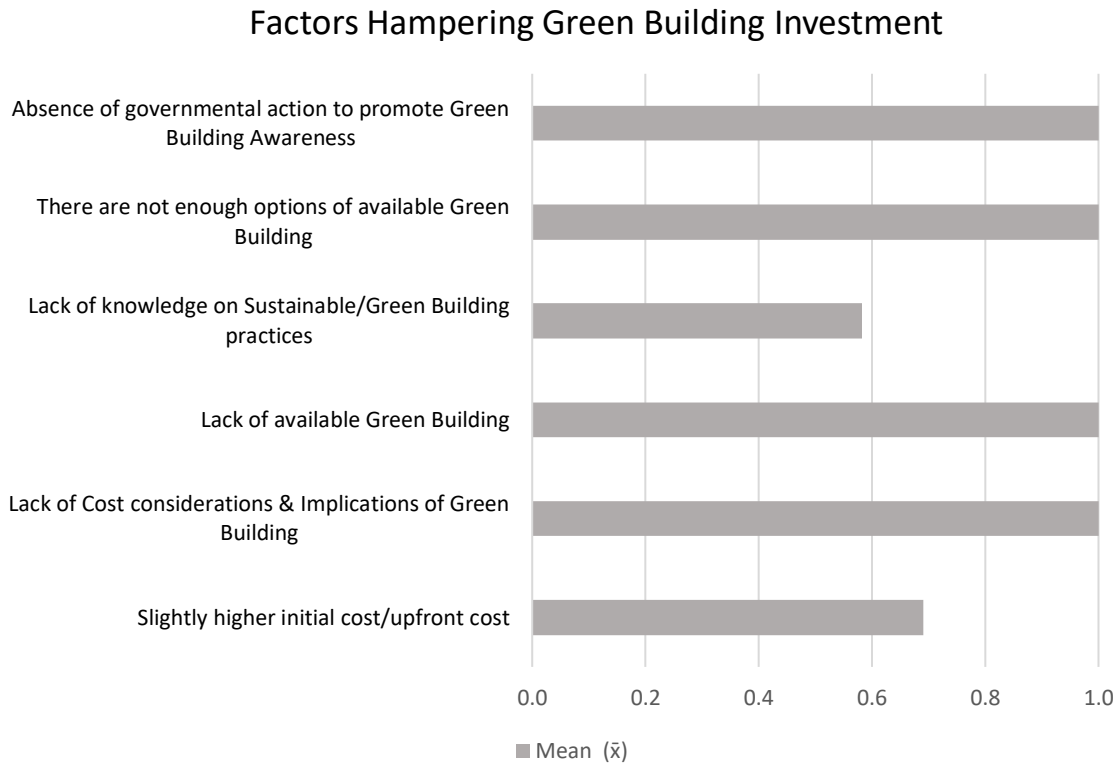


Figure 68: Factors Hampering Green Building Investment

Respondents here are asked to choose among several factors that might hamper them from investing in green building. Respondents are allowed to choose more than one factor, therefore each factor should be weighted with value ‘1’ when it is chosen and ‘0’ when it is not chosen. The close each criterion’s mean to 1, the more likely the criterion to become the factor that hampers investment in green building.

Figure 68 showed that 100% respondents agreed that lack of availability, option, cost consideration and implication of green building as well as absence of governmental action to promote it are factors that might hamper them from investing in green building.

Table 45: Factors Hampering Green Building Investment

	Mean (x̃)		
City of Residence	**Jakarta**	**Surabaya**	**Total**
Slightly higher initial cost/upfront cost	0,67	0,72	0,69
Lack of Cost considerations & Implications of Green Building	1,00	1,00	1,00
Lack of available Green Building	1,00	1,00	1,00
Lack of knowledge on Sustainable/Green Building practices	0,60	0,56	0,58
There are not enough options of available Green Building	1,00	1,00	1,00
Absence of governmental action to promote Green Building Awareness	1,00	1,00	1,00

Moreover, only 70% respondent agreed with higher initial cost and 58% respondent agreed with lack of knowledge about green building practice could be hampered factor of green building investment. It can be seen that respondents in Jakarta and Surabaya tend to have similar perspective about factors hampering green building investment. Both cities agreed 100% for four hampered factors, and the rest of two factors like higher cost and lack of knowledge have relatively lower values Table 45.

6.6 Green Building Criteria

Total of 18 green building criteria from existing certification system in Indonesia are chosen here in order to ask respondents as end users about their opinion regarding the importance of each criterion in their own household. Respondents here are asked for two different questions. First question is aimed to know the importance level of green building criteria in order to improve the quality of household. The second question is aimed to know whether the respondents are willing to pay more to have each related criterion for their household.

Six Points Likert scale is used here for the seriousness of problems and yes/no based question is used to cover the second part of question about the willingness to pay for the related problems. Further discussion about method used for the questionnaire design can be found on the previous chapter. The second part of question will be discussed in the next sub-chapter.

Table 46: Six Points Likert Scale

Six Points Likert Scale					
1	**2**	**3**	**4**	**5**	**6**
Extremely Unimportant	Very Unimportant	Somewhat Unimportant	Somewhat Important	Very Important	Extremely Important

In the influential or importance of green building criteria, respondents are asked to choose from one to six scale, with one represents extremely unimportant/uninfluential until six represents that a criterion is extremely important (Table 46).

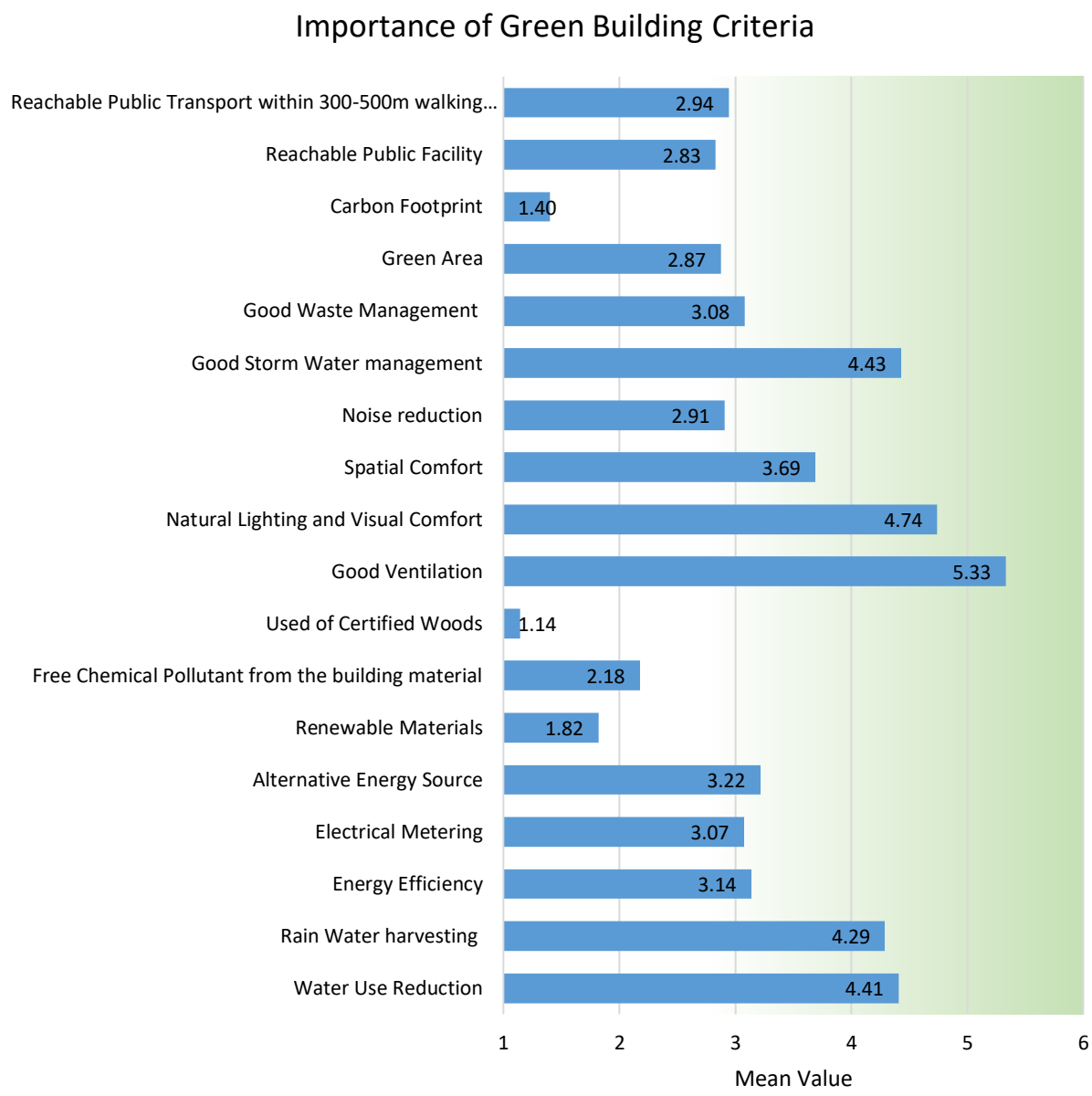


Figure 69: Green Building Criteria

Mean value for each criterion of green building indicates how influential a criterion is. The higher the mean value of a criterion, the more influential the related criterion is in the household function and also the other way around. Middle value (3.5) is drawn as the shifting point dividing criteria into two categories. All criteria with mean value that are higher than the middle value (Middle Value ≤ 3.5) will be categorized as considered important or influential to have in the improvement of household quality.

Importance of green building criteria is shown on Figure 69. The mean value of each criterion is a cumulative of both cities, Jakarta and Surabaya. There are only six criteria have total mean

value above 3.5, they are Good Ventilation criterion with has the highest mean value (5.33), followed by Natural Lighting and Visual Comfort criteria(4.74), Good Storm Water Management(4.43), Rain Water Harvesting (4.29) as well as Spatial Comfort (3.69).

The rest of green building criteria have mean values less than the middle value, which can be concluded that their existences are not considered important for the quality of household. However, it is still necessary to break down each the value of criterion based on respondent's cities of origin, area of living, level of income, type of housing they currently live in and their status of ownership.

6.6.1 Importance of Green Building Criteria according to Cities

Previous analysis is principally done to define the importance of green building criteria in household. Independent T-Test (α = 5%) is conducted here to each criterion of green building in order to see whether there is significant difference in the importance of each tested criteria between respondents in Jakarta and Surabaya.

Null hypothesis (H_0) as the tested statement specified that there is no significant difference in the seriousness of household problems between Jakarta and Surabaya. The alternative hypothesis (H_1) stated that there is significant difference and this hypothesis is expected or hoped to be true instead of the null one.

H_0: There is no significant difference in the importance of each green building criterion between Jakarta and Surabaya

H_1: There is significant difference in the importance of each green building criterion between Jakarta and Surabaya

If the *p*-value is less than the significance level ($p < 0.05$) then it will be concluded that H_0 cannot be accepted. From Table 14, it can be seen that there are significant difference for the importance of green building criteria between Jakarta and Surabaya except for Energy Efficiency, Electrical Metering, Noise Reduction, Good Storm Water Management, Carbon Footprint and Reachable Public Transport criteria.

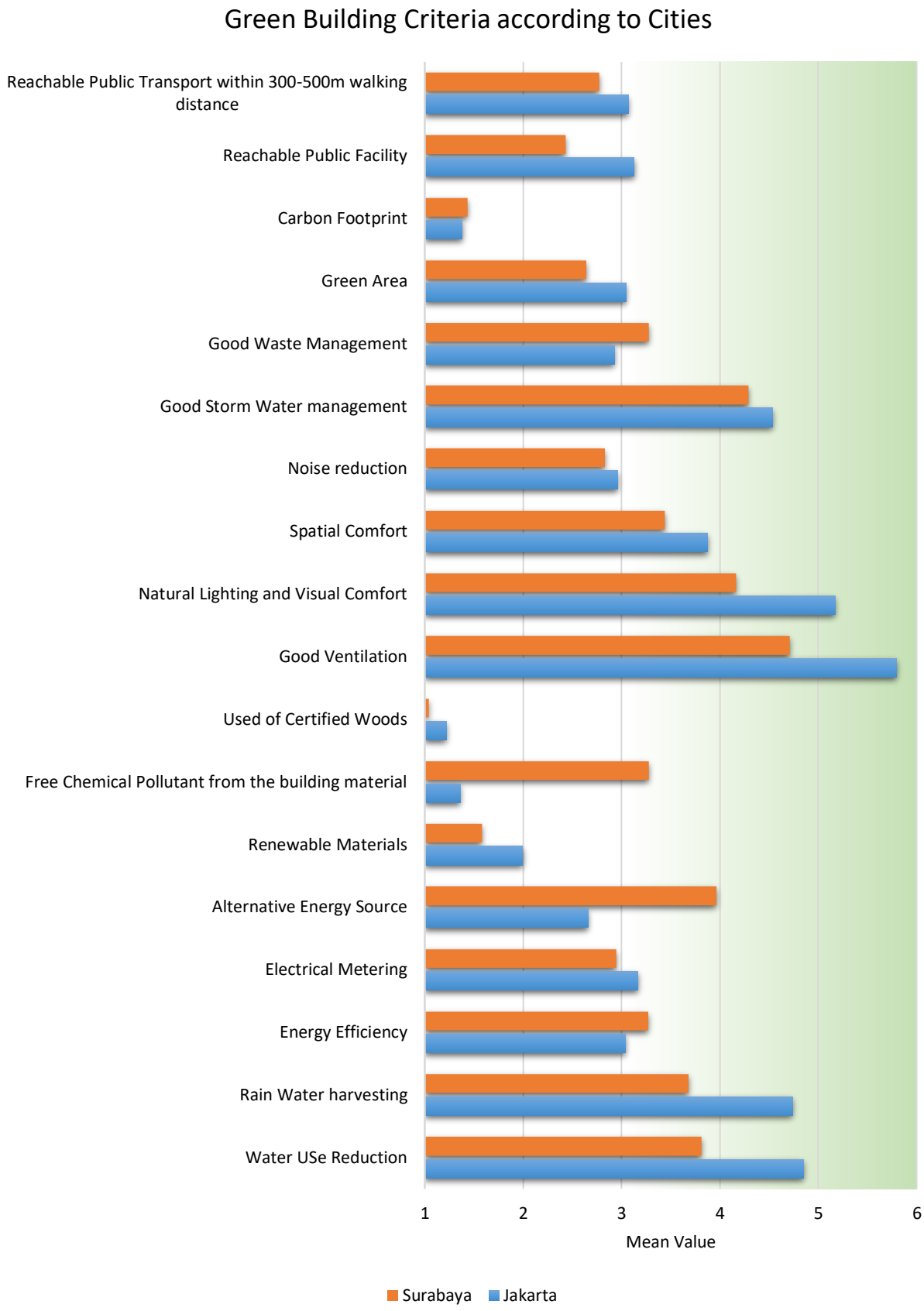


Figure 70: Green Building Criteria according to Cities

There are significant differences about the importance of green building criteria between people living in Jakarta and Surabaya. Importance of good ventilation appears to be the most important

green building criterion in Jakarta, following by criterion for Natural Light and Visual Comfort criterion. Meanwhile importance of green building criteria is relatively lower in Surabaya compare to Jakarta. Furthermore, Good Ventilation criterion appears to be the most important criterion for respondent living in Surabaya following by Good Storm Water management and Natural Lighting and Visual Comfort.

Table 47: T-Test of Green Building Criteria between Cities

	Mean		Sig. (2-tailed)	Output H0
	Jakarta	Surabaya		
Water Use Reduction	4,85	3,81	0,000	Reject
Rain Water harvesting	4,74	3,68	0,000	Reject
Energy Efficiency	3,04	3,27	0,210	Accept
Electrical Metering	3,17	2,94	0,206	Accept
Alternative Energy Source	2,66	3,97	0,000	Reject
Renewable Materials	2,00	1,58	0,001	Reject
Free Chemical Pollutant from the building material	1,36	3,28	0,000	Reject
Used of Certified Woods	1,22	1,04	0,000	Reject
Good Ventilation	5,79	4,71	0,000	Reject
Natural Lighting and Visual Comfort	5,17	4,16	0,000	Reject
Spatial Comfort	3,87	3,44	0,002	Reject
Noise reduction	2,96	2,83	0,476	Accept
Good Storm Water management	4,53	4,29	0,108	Accept
Good Waste Management	2,93	3,28	0,033	Reject
Green Area	3,05	2,64	0,003	Reject
Carbon Footprint	1,38	1,44	0,508	Accept
Reachable Public Facility	3,13	2,43	0,000	Reject
Reachable Public Transport within 300-500m walking distance	3,07	2,77	0,060	Accept

In addition, there are several green building criteria with level of importance lower than the middle value (<2,5) such as Carbon Foot Print, Renewable Material and Used of Certified Wood for both Jakarta and Surabaya, while Free Chemical Pollutant from the Building Material criterion appeared to be not important for people living in Jakarta only.

6.6.2 Importance of Green Building Criteria according to Area of Living

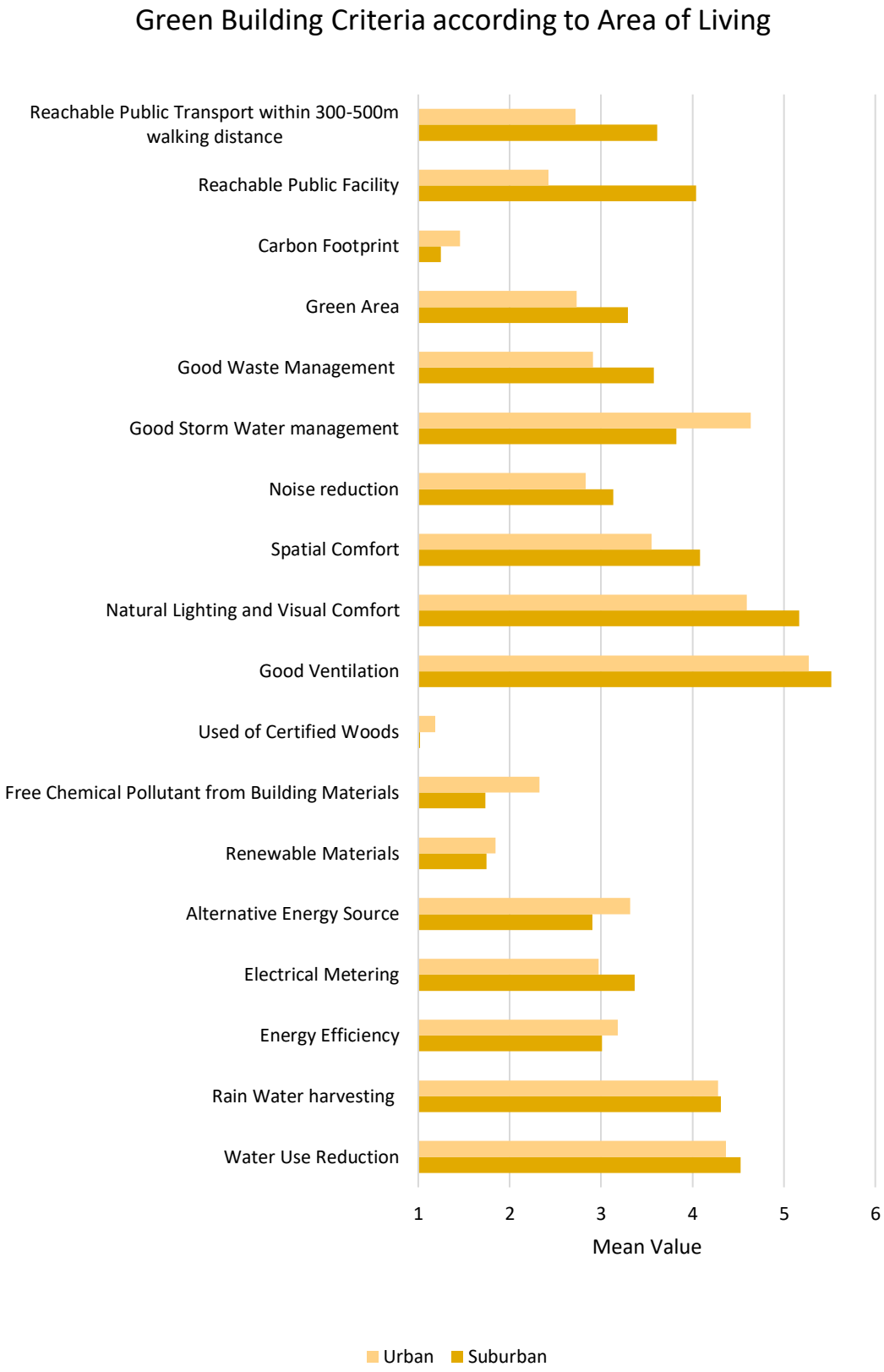


Figure 71: Green Building Criteria according to Area of Living

Importance of green building criteria can as well be analysed based on respondent's living area. People living in suburban tend to consider criteria like Reachable Public Transport, Reachable

Public Facility, Spatial Comfort, Natural Lighting and Visual Comfort, Good Ventilation, Rain Water Harvesting as well as Water Use Reduction to be more important than those living in urban area. In contrast, people living in urban area consider Good Water Storm Management as an important criterion more than those in suburban area.

Independent T-Test is used here to further analyses the importance level of green building criteria according to respondents living area. The test is aimed to identify significant difference for each criterion between those living in suburban and urban areas. Null hypothesis assumed that there is no significant difference between the two areas of living. The alternative hypothesis (H_1) assumed that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis. If the significant value is less than 0.05 (p<0.05) then H_0 will be rejected, which principally is the expected result from this test.

H_0: There is no significant difference in the importance of each green building criterion between Suburban and Urban Area

H_1: There is significant difference in the importance of each green building criterion between Suburban and Urban Area

Table 48: T-Test of Green Building Criteria between Areas of Living

	Mean		Mean	Sig.	Output
	Suburban	Urban	Difference	(2-tailed)	H_0
Water Use Reduction	4,53	4,37	0,16	0,152	Accept
Rain Water harvesting	4,31	4,28	0,03	0,798	Accept
Energy Efficiency	3,01	3,18	0,17	0,355	Accept
Electrical Metering	3,37	2,98	0,39	0,061	Accept
Alternative Energy Source	2,91	3,32	0,42	0,021	Reject
Renewable Materials	1,75	1,84	0,10	0,494	Accept
Free Chemical Pollutant from Building Materials	1,74	2,32	0,59	0,001	Reject
Used of Certified Woods	1,02	1,18	0,17	0,000	Reject
Good Ventilation	5,52	5,27	0,25	0,016	Reject
Natural Lighting and Visual Comfort	5,17	4,60	0,57	0,000	Reject
Spatial Comfort	4,09	3,56	0,53	0,000	Reject
Noise reduction	3,13	2,83	0,30	0,172	Accept
Good Storm Water management	3,82	4,64	0,81	0,000	Reject
Good Waste Management	3,58	2,91	0,66	0,001	Reject
Green Area	3,29	2,73	0,56	0,001	Reject
Carbon Footprint	1,25	1,46	0,21	0,016	Reject
Reachable Public Facility	4,04	2,43	1,61	0,000	Reject
Reachable Public Transport within 300-500m walking distance	3,61	2,72	0,90	0,000	Reject

Based on significant values of green building criteria listed on Table 48, the importance of criteria such as Water Use Reduction, Rain Water Harvesting, Energy Efficiency, Electrical Metering, Renewable Material as well as Noise Reduction are not significantly different for those living in suburban and urban areas. Criterion with the biggest mean difference is Reachable

Public Facility, where people in suburban considered this specific criterion as important (above middle value), while those in urban area don't, followed by Reachable Public Transport criterion with the same tendency, however with a relatively smaller difference of the mean value. Significant difference is also discovered between those living in suburban and urban areas regarding Good Storm Water Management. People in urban area consider this criterion to be more important than those living in suburban.

6.6.3 Importance of Green Building Criteria according to Level of Income

The next analysis is aimed to explore differences among level of income regarding importance of green building criteria. It is known from the previous sub chapter that there are relationship between respondent's income level and the seriousness of their household problems. Therefore, it is crucial to know whether income level of respondents might as well have influence to their opinion concerning the importance of green building criteria.

Level of income consists of five independent variables making Analysis of Variance (One-Way Anova) as the most appropriate test to identify any significant difference among groups. Analysis of Variance or Anova ($\alpha = 5\%$) is conducted here to see if there are significant differences in the importance of green building criteria among levels of income. Null hypothesis (H_0) as the tested statement specified that there is no significant difference among level of income. The alternative hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis.

H_0: There is no significant difference in the importance of each green building criterion among level of income

H_1: There is significant difference in the importance of each green building criterion among level of income

There are significant differences ($p < 0.05$) among level of income for almost all of listed criteria with the exception of criteria such as Water Use Reduction, Rain Water Harvesting, Free Chemical Pollutant and Green Area. Moreover, respondents with the higher income level tend to give higher value for criteria such as Good Ventilation, Natural Lighting and Visual Comfort as well as Spatial Comfort, which basically created significant differences from those with lower income level in relation to the importance level of mentioned criteria (Table 49).

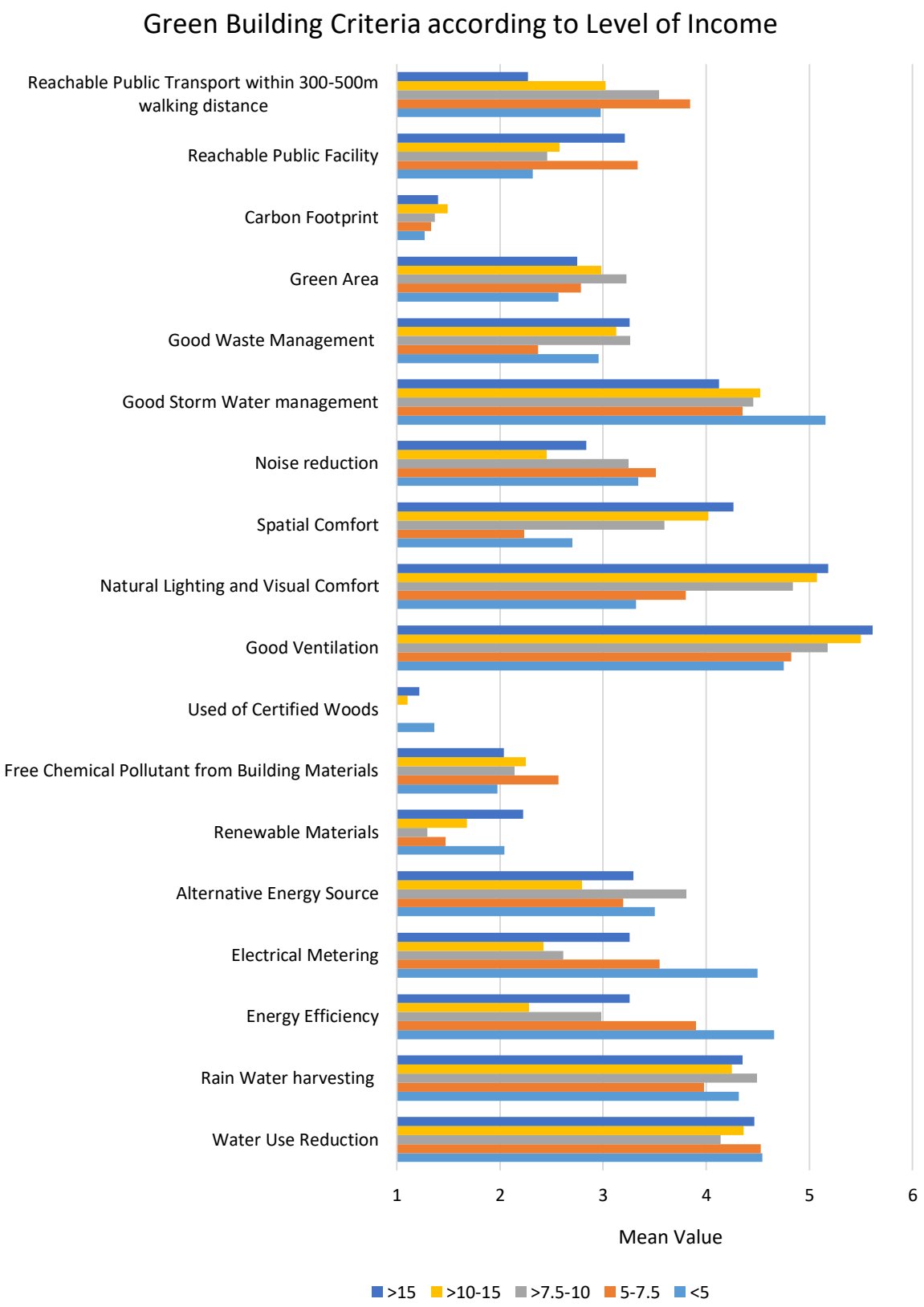


Figure 72: Green Building Criteria according to Level of Income

People categorized as the lowest income level tend to give more value for energy related criteria like Energy Efficiency and Electrical Metering compare to other levels of income.

Table 49: One-Way Anova for Green Building Criteria among Levels of Income

	Mean					Sig.	Output H_0
	<5	5-7.5	>7.5-10	>10-15	>15		
Water Use Reduction	4,55	4,53	4,14	4,36	4,47	0,250	Accept
Rain Water harvesting	4,32	3,98	4,49	4,25	4,35	0,163	Accept
Energy Efficiency	4,66	3,90	2,98	2,28	3,26	0,000	Reject
Electrical Metering	4,50	3,55	2,61	2,42	3,26	0,000	Reject
Alternative Energy Source	3,50	3,20	3,81	2,80	3,29	0,002	Reject
Renewable Materials	2,05	1,47	1,30	1,68	2,23	0,000	Reject
Free Chemical Pollutant from Building Materials	1,98	2,57	2,14	2,25	2,04	0,379	Accept
Used of Certified Woods	1,36	1,00	1,00	1,11	1,22	0,000	Reject
Good Ventilation	4,75	4,82	5,18	5,50	5,61	0,000	Reject
Natural Lighting and Visual Comfort	3,32	3,80	4,84	5,08	5,18	0,000	Reject
Spatial Comfort	2,70	2,24	3,60	4,02	4,26	0,000	Reject
Noise reduction	3,34	3,51	3,25	2,45	2,84	0,001	Reject
Good Storm Water management	5,16	4,35	4,46	4,52	4,12	0,003	Reject
Good Waste Management	2,95	2,37	3,26	3,13	3,26	0,013	Reject
Green Area	2,57	2,78	3,23	2,98	2,75	0,080	Accept
Carbon Footprint	1,27	1,33	1,37	1,49	1,40	0,571	Accept
Reachable Public Facility	2,32	3,33	2,46	2,58	3,21	0,000	Reject
Reachable Public Transport within 300-500m walking distance	2,98	3,84	3,54	3,02	2,27	0,000	Reject

6.6.4 Importance of Green Building Criteria according to Type of Housing

Housing types like single home and apartment have their own advantages and disadvantages. This part of study aimed to see respondent's opinion about the importance of green building criteria based on their type of housing. Independent T-Test is used here to additionally analyse the importance level of green building criteria according to respondents housing type.

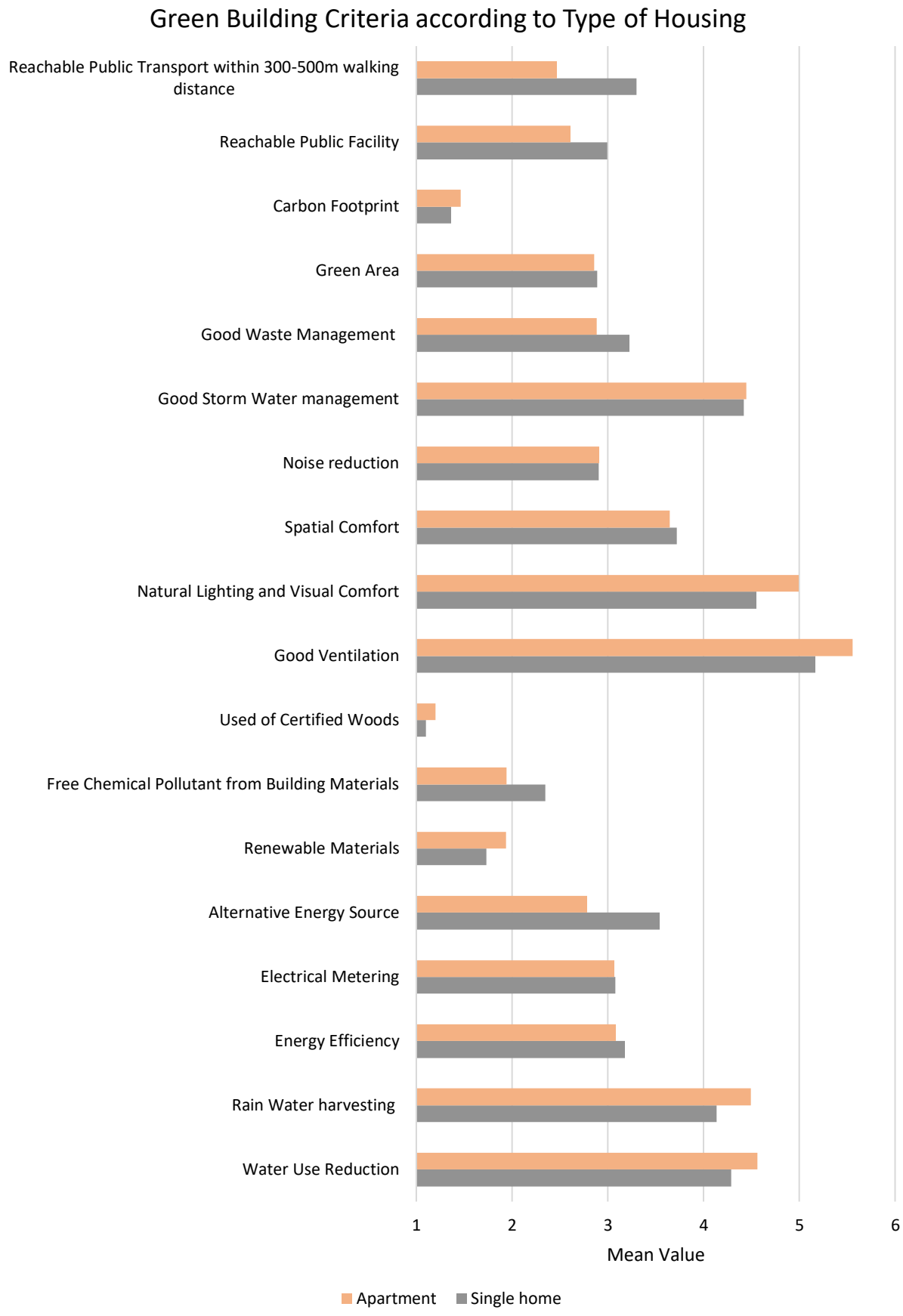


Figure 73: Green Building Criteria according to Type of Housing

The test is aimed to identify significant difference for each criterion between those residing in single home and apartment. Null hypothesis assumed that there is no significant difference between the two housing types. The alternative hypothesis (H_1) assumed that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis. If the significant value is less than 0.05 (p<0.05) then H_0 will be rejected, which principally is the expected result from this test.

H_0: There is no significant difference in the importance of each green building criterion between types of housing

H_1: There is significant difference in the importance of each green building criterion between types of housing

Significant difference be found between respondents with single home and apartment type of housing in criteria such as Water Use Reduction, Rain Water Harvesting, Good Ventilation, as well as Natural Lighting and Visual Comfort where people residing in apartment type of housing tend to value these criteria more than those in single home. Furthermore, criteria such as Alternative Energy Source, Free Chemical Pollutant, Reachable Public Facility and Reachable Public Transport are criteria that have been valued higher from those residing in single home type of housing.

Table 50: T-Test for Green Building Criteria between Types of Housing

	Mean		Sig. (2-tailed)	Output H_0
	Single home	Apartment		
Water Use Reduction	4,290	4,561	0,012	Reject
Rain Water harvesting	4,137	4,494	0,001	Reject
Energy Efficiency	3,178	3,083	0,576	Accept
Electrical Metering	3,079	3,067	0,944	Accept
Alternative Energy Source	3,539	2,783	0,000	Reject
Renewable Materials	1,730	1,939	0,101	Accept
Free Chemical Pollutant from Building Materials	2,349	1,944	0,015	Reject
Used of Certified Woods	1,100	1,200	0,069	Accept
Good Ventilation	5,166	5,556	0,000	Reject
Natural Lighting and Visual Comfort	4,552	4,994	0,000	Reject
Spatial Comfort	3,722	3,644	0,576	Accept
Noise reduction	2,905	2,911	0,971	Accept
Good Storm Water management	4,419	4,444	0,869	Accept
Good Waste Management	3,224	2,883	0,027	Reject
Green Area	2,888	2,856	0,809	Accept
Carbon Footprint	1,361	1,461	0,232	Accept
Reachable Public Facility	2,996	2,611	0,011	Reject
Reachable Public Transport within 300-500m walking distance	3,299	2,467	0,000	Reject

6.6.5 Importance of Green Building Criteria according to Status of Ownership

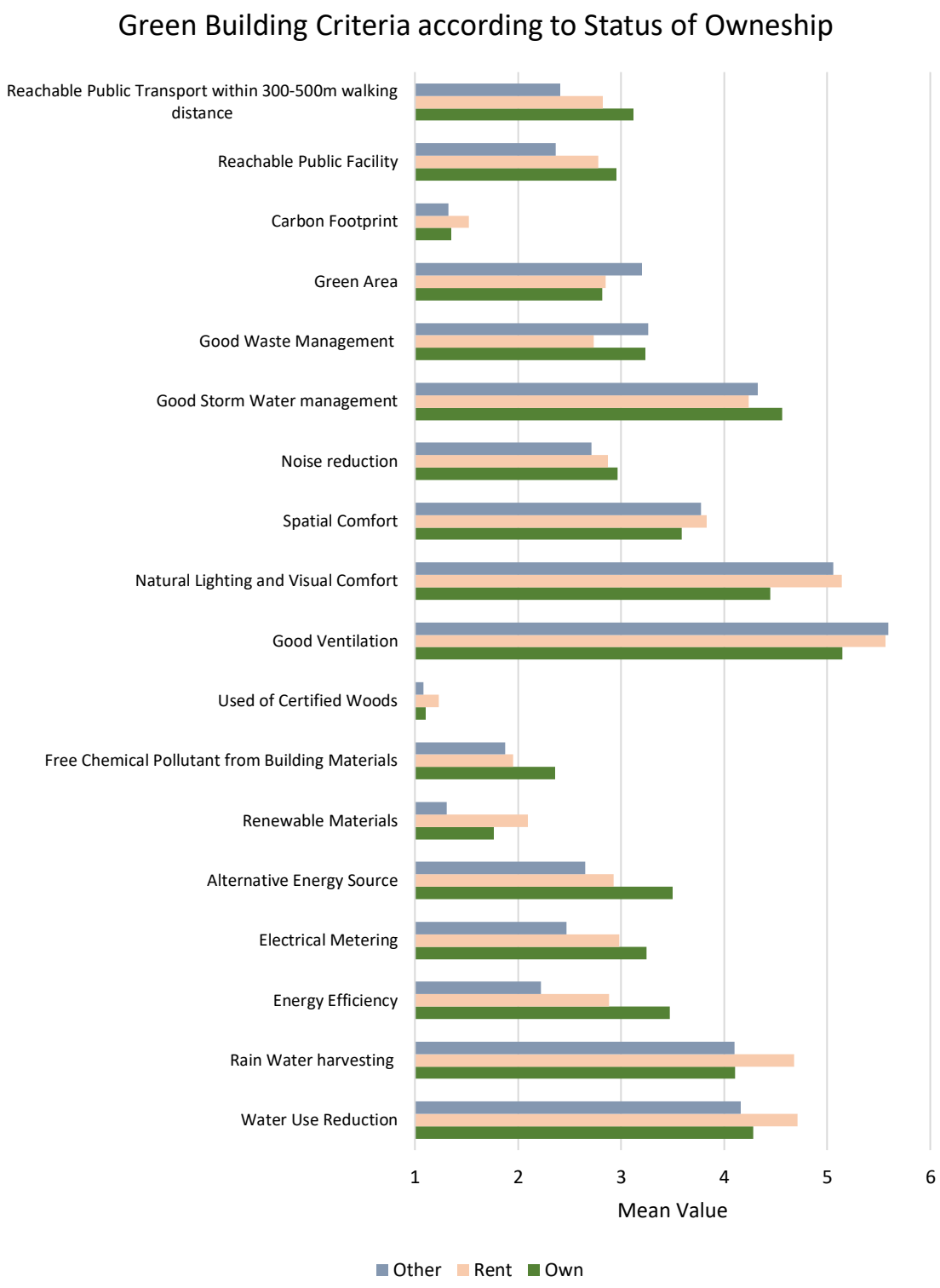


Figure 74: Green Building Criteria according to Status of Ownership

Analysis of Variance (One-Way Anova) is conducted here to see if there are significant differences in the importance of green building criteria among status of ownership. Null

hypothesis (H_0) as the tested statement specified that there is no significant difference among status of ownership ($\alpha = 5\%$).

The alternative hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis. If the significant value is less than 0.05 ($p<0.05$) then H_0 will be rejected, which basically is the expected result from this test.

H_0: There is no significant difference in the importance of each green building criterion among status of ownership

H_1: There is significant difference in the importance of each green building criterion among status of ownership

Table 51: One-Way Anova for Green Building Criteria among Status of Ownership

	Mean				Output
	Own	Rent	Other	Sig.	H_0
Water Use Reduction	4,283	4,711	4,163	0,000	Reject
Rain Water harvesting	4,105	4,681	4,102	0,000	Reject
Energy Efficiency	3,473	2,881	2,224	0,000	Reject
Electrical Metering	3,249	2,985	2,469	0,015	Reject
Alternative Energy Source	3,498	2,926	2,653	0,000	Reject
Renewable Materials	1,768	2,096	1,306	0,001	Reject
Free Chemical Pollutant from Building Materials	2,363	1,956	1,878	0,045	Reject
Used of Certified Woods	1,105	1,230	1,082	0,058	Accept
Good Ventilation	5,148	5,563	5,592	0,000	Reject
Natural Lighting and Visual Comfort	4,447	5,141	5,061	0,000	Reject
Spatial Comfort	3,591	3,830	3,776	0,260	Accept
Noise reduction	2,966	2,874	2,714	0,667	Accept
Good Storm Water management	4,561	4,237	4,327	0,136	Accept
Good Waste Management	3,236	2,733	3,265	0,010	Reject
Green Area	2,819	2,852	3,204	0,191	Accept
Carbon Footprint	1,350	1,526	1,327	0,126	Accept
Reachable Public Facility	2,958	2,778	2,367	0,045	Reject
Reachable Public Transport within 300-500m walking distance	3,122	2,822	2,408	0,011	Reject

6.7 Willingness to Pay for Green Building Criteria

This sub-chapter is aimed to discuss about the willingness of respondents as end user to pay for green building criteria concerning their household improvement. Yes, No and Not Sure

answers are used here to find whether each respondent agrees, disagrees or not sure to pay for each green building criterion.

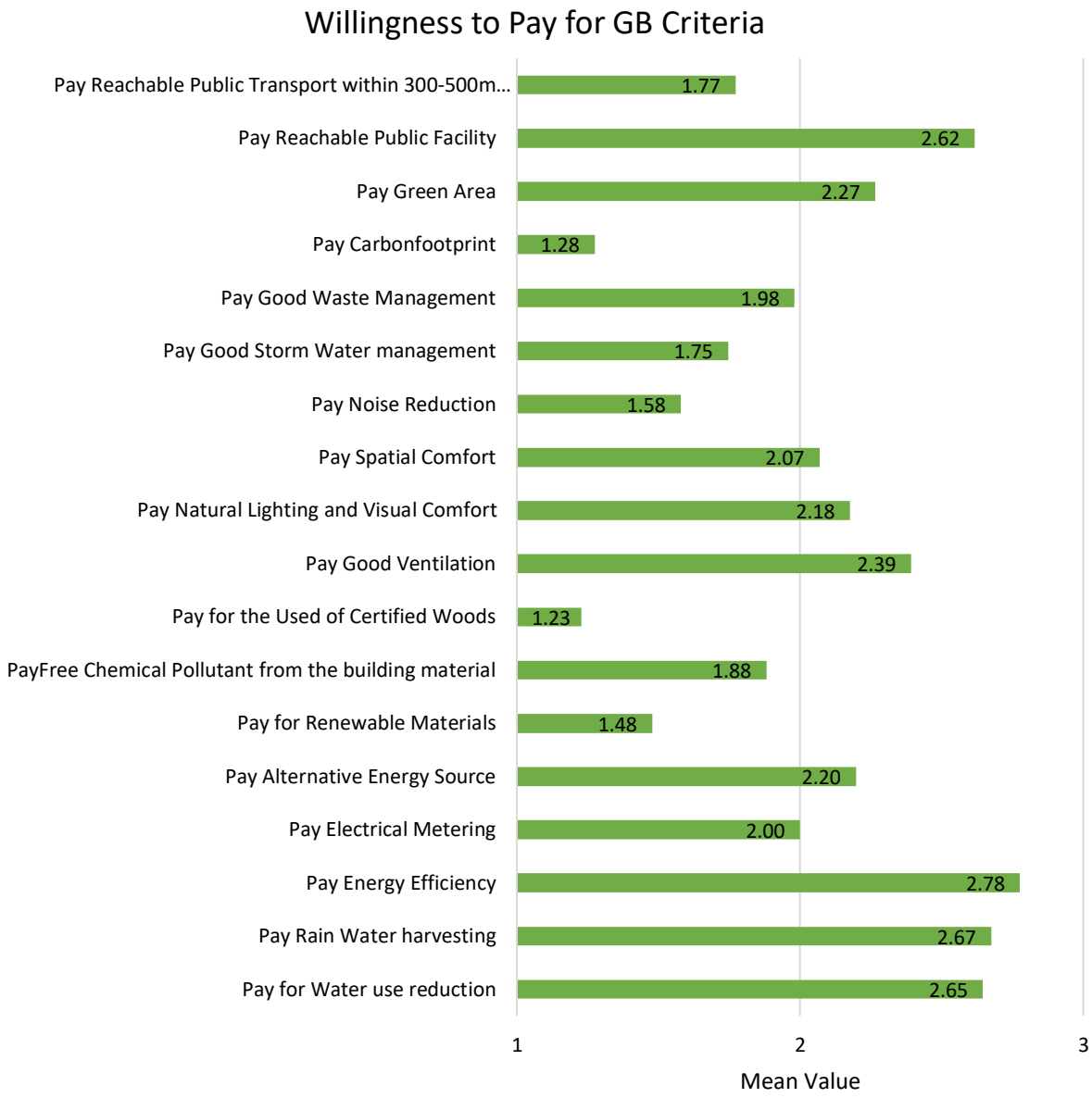


Figure 75: Willingness to Pay for Green Building Criteria

Each answer is weighted with 1, 2 and 3 to transform the qualitative answers into quantitative ones. Answer “Yes” is weighted 3, “Not Sure” is weighted 2 and “No” answer is weighted with 1. Middle value (2) is drawn as the shifting point dividing answers into two zones, every value that is higher than the middle value will be categorized as “Willing to Pay” and the other way around.

Respondents are willing to pay for green building criteria (criteria with mean value > 2) such as Energy Efficiency, Rain Water Harvesting, Water Use Reduction, Reachable Public Facility, Good Ventilation, Green Area, Alternative Energy Source, Natural Lighting and Visual Comfort as well as Spatial Comfort (Figure 75). Further analysis will be conducted divide value of

criterion based on respondent's cities of origin, area of living, level of income, type of housing they currently live in and their status of ownership.

6.7.1 Willingness to Pay for Green Building Criteria according to Cities

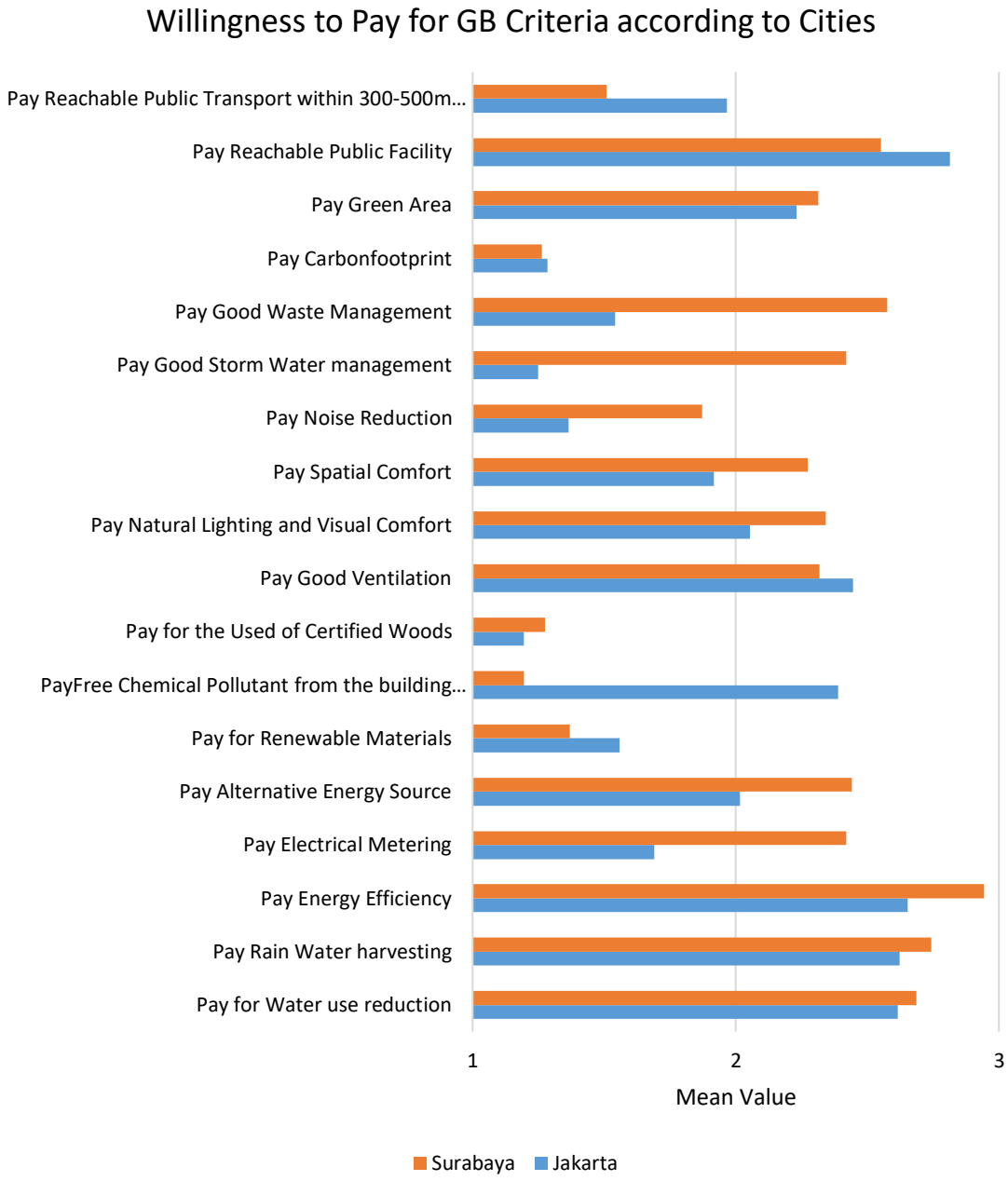


Figure 76: Willingness to Pay for GB Criteria according to Cities

Independent T-Test (α = 5%) is conducted to see if there are significant differences in the willingness to pay for green building criteria between cities. Null hypothesis (H_0) as the tested statement specified that there is no significant different in the willingness to between respondents in Jakarta and Surabaya. The alternative hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis.

H_0: There is no significant difference in the willingness to pay for each green building criterion between Jakarta and Surabaya

H_1: There is significant difference in the willingness to pay for each green building criterion between Jakarta and Surabaya

If the *p*-value is less than the significance level ($p < 0.05$) then it will be concluded that the observed effect actually reflects the characteristics of the population rather than just sampling error, thus rejecting the null hypothesis.

Table 52: T-Test of Willingness to Pay for Green Building Criteria between Cities

	Mean		Sig.	Output
	Jakarta	Surabaya	(2-tailed)	H_0
Pay for Water use reduction	2,616	2,687	0,272	Accept
Pay Rain Water harvesting	2,624	2,743	0,065	Accept
Pay Energy Efficiency	2,653	2,944	0,000	Reject
Pay Electrical Metering	1,69	2,419	0,000	Reject
Pay Alternative Energy Source	2,017	2,441	0,000	Reject
Pay for Renewable Materials	1,558	1,369	0,014	Reject
Pay Free Chemical Pollutant from the building material	2,388	1,196	0,000	Reject
Pay for the Used of Certified Woods	1,194	1,274	0,133	Accept
Pay Good Ventilation	2,446	2,318	0,129	Accept
Pay Natural Lighting and Visual Comfort	2,054	2,341	0,000	Reject
Pay Spatial Comfort	1,917	2,274	0,000	Reject
Pay Noise Reduction	1,364	1,872	0,000	Reject
Pay Good Storm Water management	1,248	2,419	0,000	Reject
Pay Good Waste Management	1,541	2,575	0,000	Reject
Pay Carbon footprint	1,285	1,263	0,730	Accept
Pay Green Area	2,231	2,313	0,311	Accept
Pay Reachable Public Facility	2,665	2,553	0,000	Reject
Pay Reachable Public Transport within 300-500m walking distance	1,967	1,508	0,000	Reject
	1,970	2,139		

Total mean value of the willingness to pay for green building criteria is higher from respondents in Surabaya compare to Jakarta. Moreover, Independent T-Test (Table 52) presented that respondent in Surabaya are significantly more willing to pay for green building criteria such as Energy Efficiency, Electrical Metering, Alternative Energy Source, Natural Lighting and Visual Comfort, Spatial Comfort, Noise Reduction, Good Storm Water management, Good Waste Management, as well as Reachable Public Transport. Respondents in Jakarta are however significantly more willing to pay for green building criteria such as Renewable Material, Free Chemical Pollutant from the building material, and Reachable Public Facility.

6.7.2 Willingness to Pay for Green Building Criteria according to Area of Living

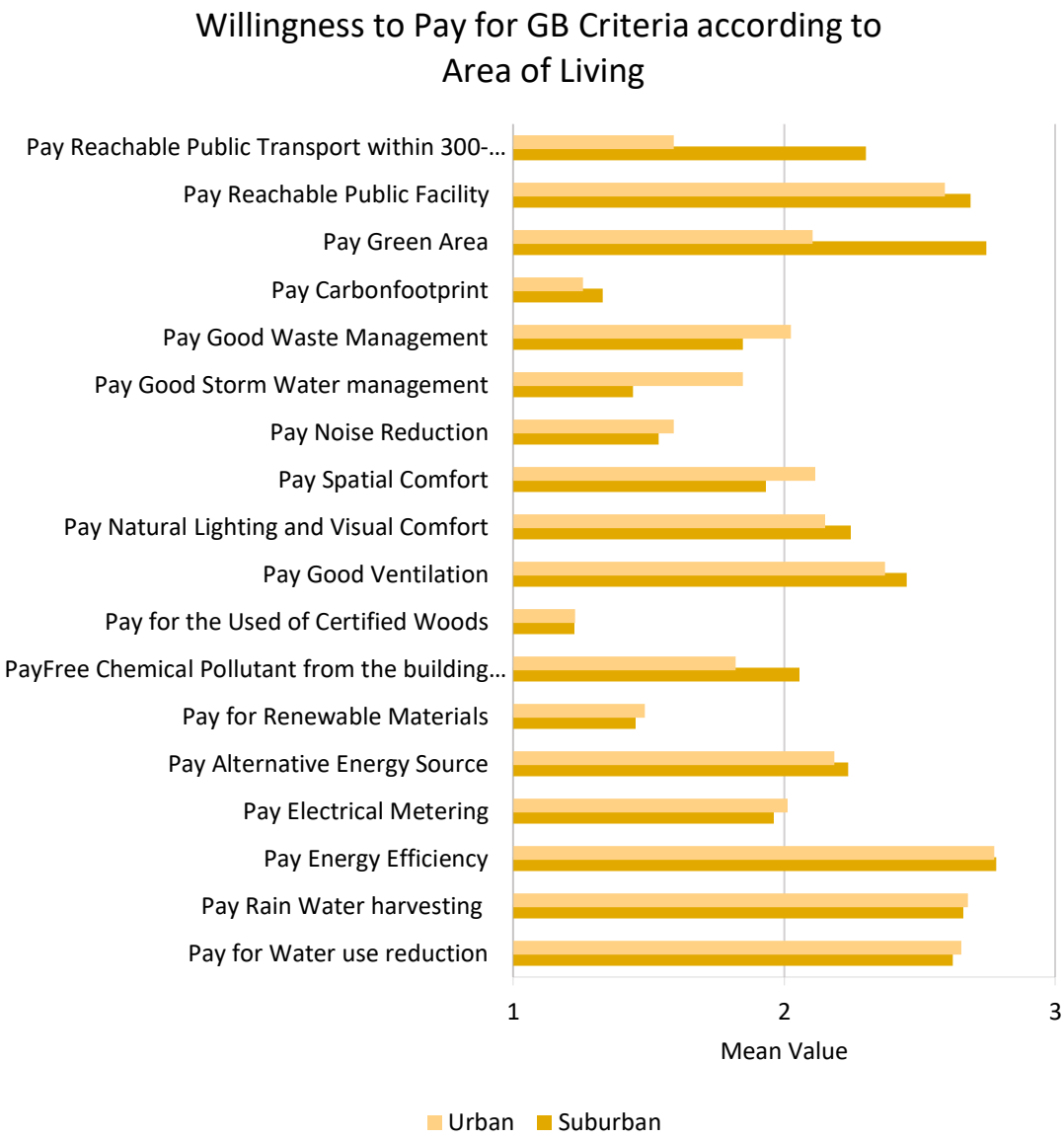


Figure 77: Willingness to Pay for GB Criteria according to Area of Living

T-Test (α = 5%) is conducted to see if there are significant differences in the willingness to pay for green building criteria between area of living. Null hypothesis (H_0) as the tested statement specified that there is no significant different in the willingness to between respondent living in suburban and urban area. The alternative hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis.

H_0: There is no significant difference in the willingness to pay for each green building criterion between Suburban and Urban Areas

H_1: There is significant difference in the willingness to pay for each green building criterion between Suburban and Urban Areas

Table 53: T-Test of Willingness to Pay for Green Building Criteria between Areas of Living

	Mean		Sig.	Output
	Suburban	Urban	(2-tailed)	H_0
Pay for Water use reduction	2,62	2,65	0,672	Accept
Pay Rain Water harvesting	2,66	2,68	0,801	Accept
Pay Energy Efficiency	2,78	2,77	0,901	Accept
Pay Electrical Metering	1,96	2,01	0,636	Accept
Pay Alternative Energy Source	2,24	2,18	0,508	Accept
Pay for Renewable Materials	1,45	1,49	0,710	Accept
Pay Free Chemical Pollutant from the building material	2,06	1,82	0,027	Reject
Pay for the Used of Certified Woods	1,23	1,23	0,971	Accept
Pay Good Ventilation	2,45	2,37	0,386	Accept
Pay Natural Lighting and Visual Comfort	2,25	2,15	0,291	Accept
Pay Spatial Comfort	1,93	2,11	0,086	Accept
Pay Noise Reduction	1,54	1,59	0,578	Accept
Pay Good Storm Water management	1,44	1,85	0,000	Reject
Pay Good Waste Management	1,85	2,03	0,103	Accept
Pay Carbon footprint	1,33	1,26	0,326	Accept
Pay Green Area	2,75	2,10	0,000	Reject
Pay Reachable Public Facility	2,69	2,59	0,192	Accept
Pay Reachable Public Transport within 300-500m walking distance	2,30	1,59	0,000	Reject

Result of the T-Test analysis on Table 53 showed that people in both suburban and urban area are mostly willing to pay for Energy Efficiency following by willingness to pay for Rain Water Harvesting on the second place and Water Use Reduction on the third place. There are significant differences for people living in suburban and urban areas regarding their willingness to pay for green building criteria such as Free Chemical Pollutant from Building Materials, Good Storm Water Management, Green Area and Reachable Public Transport within 300-500m walking distance. People living in suburban area are more willing to pay for green building criteria in order to have improvement such as availability of green area, free from chemical pollutant and reachable public transport within 300-500m walking distance. While people living in urban area are significantly more willing to pay for a better storm water management.

6.7.3 Willingness to Pay for Green Building Criteria according to Level of Income

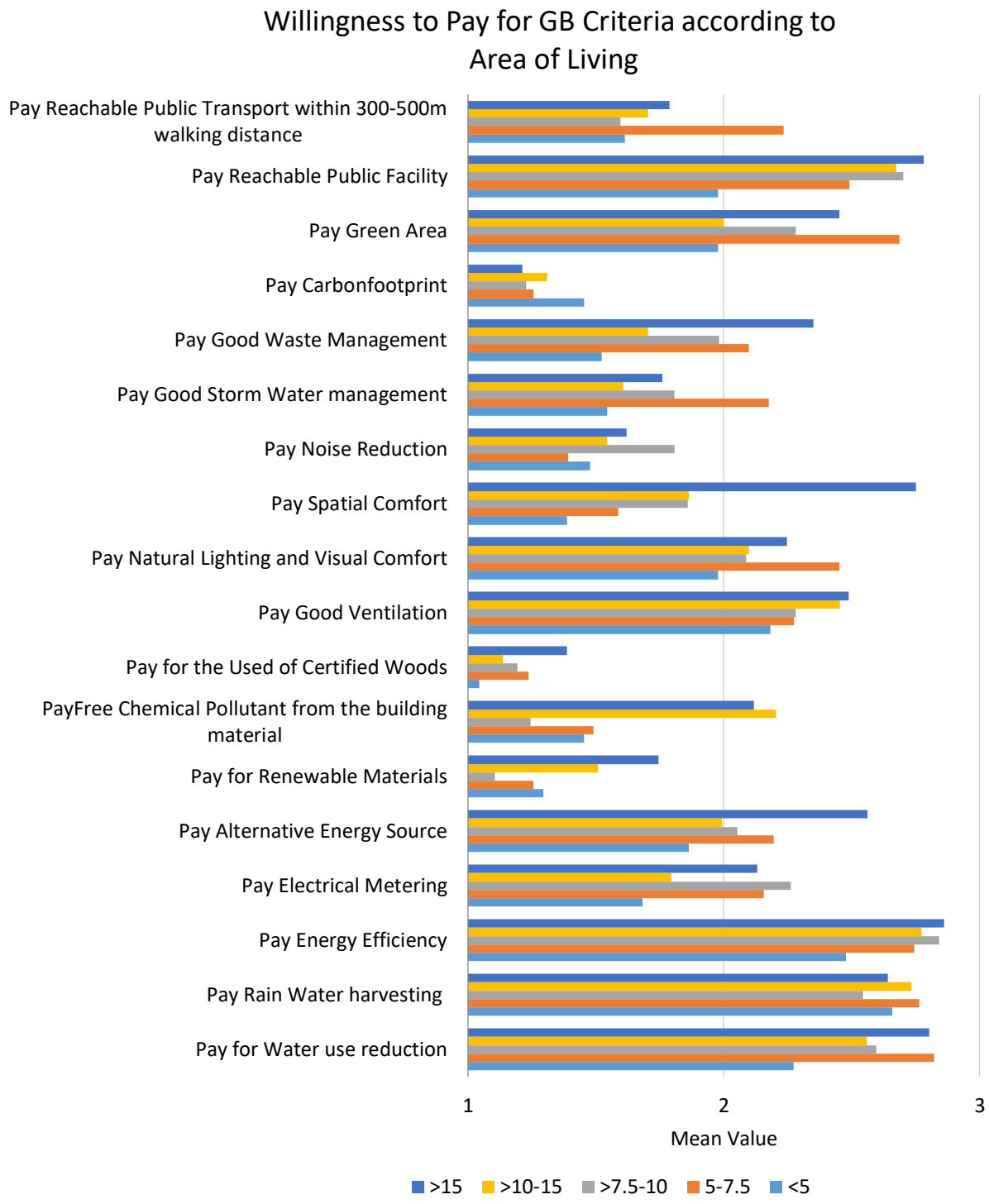


Figure 78: Willingness to Pay for Green Building Criteria according to Level of Income

Analysis of Variance is conducted here to detect differences among different income levels of respondents regarding their willingness to pay for green building criteria. It is necessary to detect whether there are significant differences between each group of income level. Level of Income consists of five independent variables making it more accurate to be tested by using

Analysis of Variance (One-Way Anova). Dependent variables here are the whole green building criteria. Anova (α = 5%) is conducted here to see if there are significant differences in willingness to pay for green building criteria among levels of income.

Null hypothesis (H_0) as the tested statement specified that there is no significant difference in the seriousness of household problems among level of income. The alternative hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis. If the significant value is less than 0.05 (p<0.05) then H_0 will be rejected, which basically is the expected result from this test.

H_0: There is no significant difference in the willingness to pay for each green building criterion among different levels of income

H_1: There is significant difference in the willingness to pay for each green building criterion among different levels of income

Table 54: One-Way Anova of Willingness to Pay for Green Building Criteria among Levels of Income

	Mean						Output
	<5	5-7.5	>7.5-10	>10-15	>15	Sig.	H_0
Pay for Water use reduction	2,27	2,82	2,60	2,56	2,80	0,000	Reject
Pay Rain Water harvesting	2,66	2,76	2,54	2,73	2,64	0,343	Accept
Pay Energy Efficiency	2,48	2,75	2,84	2,77	2,86	0,006	Reject
Pay Electrical Metering	1,68	2,16	2,26	1,80	2,13	0,001	Reject
Pay Alternative Energy Source	1,86	2,20	2,05	1,99	2,56	0,000	Reject
Pay for Renewable Materials	1,30	1,25	1,11	1,51	1,74	0,000	Reject
Pay Free Chemical Pollutant from the building material	1,45	1,49	1,25	2,20	2,12	0,000	Reject
Pay for the Used of Certified Woods	1,05	1,24	1,19	1,14	1,39	0,000	Reject
Pay Good Ventilation	2,18	2,27	2,28	2,45	2,49	0,115	Accept
Pay Natural Lighting and Visual Comfort	1,98	2,45	2,09	2,10	2,25	0,014	Reject
Pay Spatial Comfort	1,39	1,59	1,86	1,86	2,75	0,000	Reject
Pay Noise Reduction	1,48	1,39	1,81	1,55	1,62	0,135	Accept
Pay Good Storm Water management	1,55	2,18	1,81	1,61	1,76	0,001	Reject
Pay Good Waste Management	1,52	2,10	1,98	1,70	2,35	0,000	Reject
Pay Carbon footprint	1,45	1,25	1,23	1,31	1,21	0,267	Accept
Pay Green Area	1,98	2,69	2,28	2,00	2,45	0,000	Reject
Pay Reachable Public Facility	1,98	2,49	2,70	2,67	2,78	0,000	Reject
Pay Reachable Public Transport within 300-500m walking distance	1,61	2,24	1,60	1,70	1,79	0,002	Reject

6.7.4 Willingness to Pay for Green Building Criteria according to Type of Housing

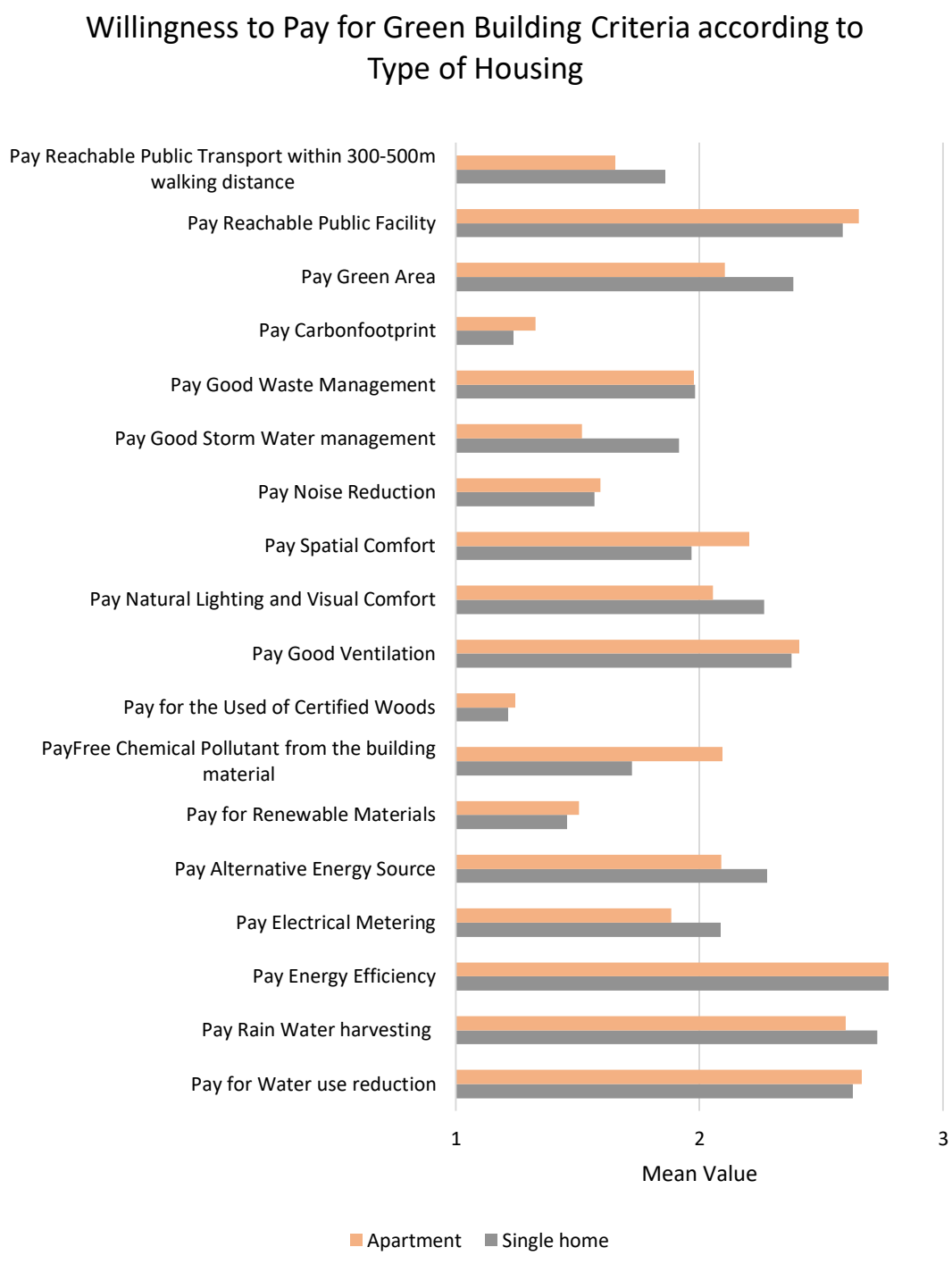


Figure 79: Willingness to Pay for GB Criteria according to Type of Housing

Independent T-Test (α = 5%) is again conducted here to see if there are significant differences in the willingness to pay for each green building criterion between types of housing. Null hypothesis (H_0) as the tested statement specified that there is no significant different in the willingness to pay for each green building criterion between apartment and single home. The

alternative hypothesis (H_1) stated that there is significant difference and this statement is expected or hoped to be true instead of the null hypothesis.

H_0: There is no significant difference in the willingness to pay for each green building criterion between types of housing

H_1: There is significant difference in the willingness to pay for each green building criterion between types of housing

If the *p*-value is less than the significance level ($p < 0.05$) then it will be concluded that the observed effect actually reflects the characteristics of the population rather than just sampling error, thus rejecting the null hypothesis.

Table 55: T-Test of Willingness to Pay for Green Building Criteria between Types of Housing

	Mean		Sig.	Output
	Single home	Apartment	(2-tailed)	H_0
Pay for Water use reduction	2,631	2,667	0,580	Accept
Pay Rain Water harvesting	2,730	2,600	0,055	Accept
Pay Energy Efficiency	2,776	2,778	0,975	Accept
Pay Electrical Metering	2,087	1,883	0,030	Reject
Pay Alternative Energy Source	2,278	2,089	0,014	Reject
Pay for Renewable Materials	1,456	1,506	0,526	Accept
Pay Free Chemical Pollutant from the building material	1,722	2,094	0,000	Reject
Pay for the Used of Certified Woods	1,216	1,244	0,577	Accept
Pay Good Ventilation	2,378	2,411	0,684	Accept
Pay Natural Lighting and Visual Comfort	2,266	2,056	0,006	Reject
Pay Spatial Comfort	1,967	2,206	0,009	Reject
Pay Noise Reduction	1,568	1,594	0,768	Accept
Pay Good Storm Water management	1,917	1,517	0,000	Reject
Pay Good Waste Management	1,983	1,978	0,953	Accept
Pay Carbon footprint	1,237	1,328	0,171	Accept
Pay Green Area	2,386	2,106	0,001	Reject
Pay Reachable Public Facility	2,589	2,656	0,325	Accept
Pay Reachable Public Transport within 300-500m walking distance	1,859	1,656	0,024	Reject

6.7.5 Willingness to Pay for Green Building Criteria according to Status of Ownership

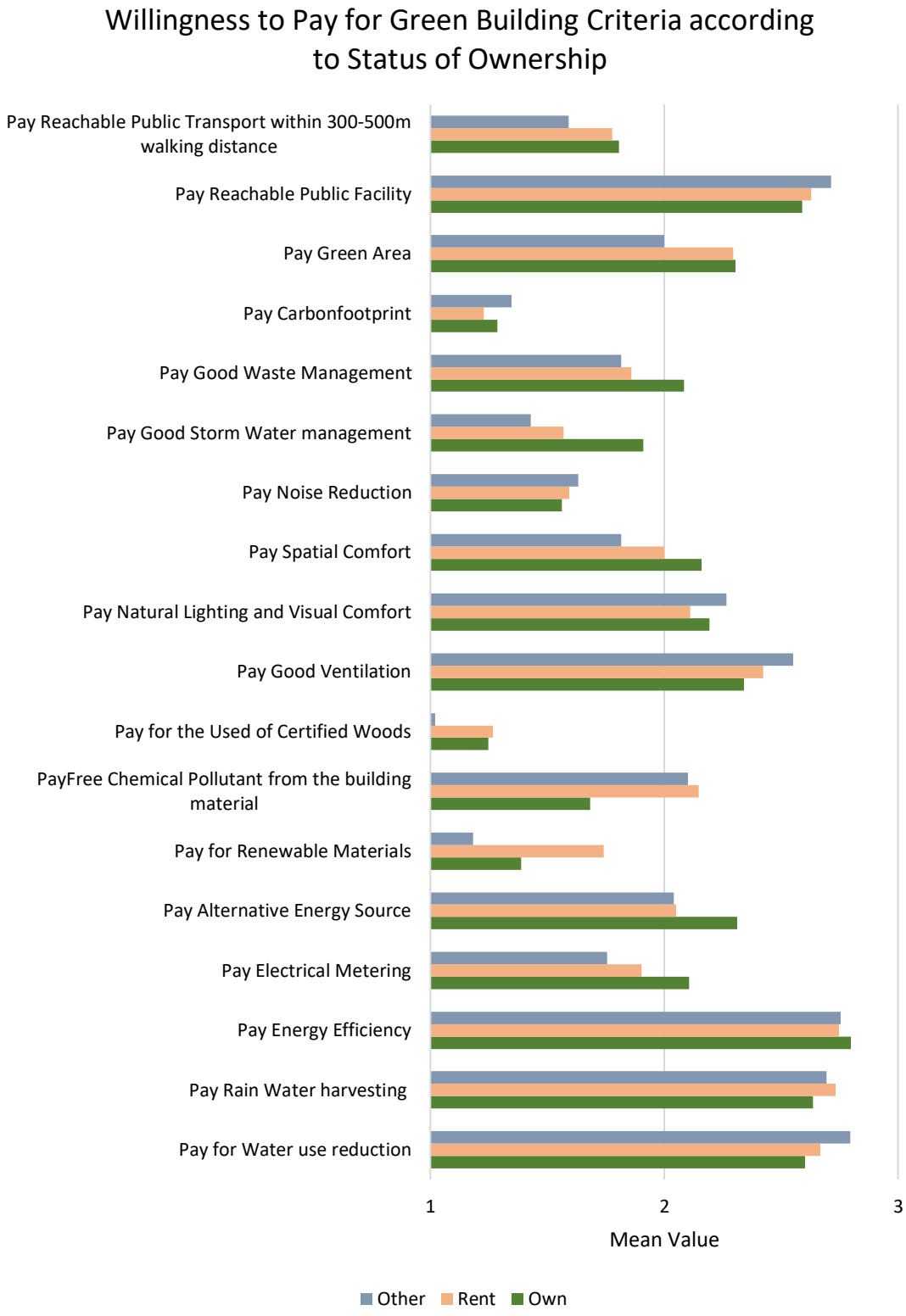


Figure 80: Willingness to Pay for GB Criteria according to Status of Ownership

H_0: There is no significant difference in the willingness to pay for each green building criterion among status of ownership

H_1: There is significant difference in the willingness to pay for each green building criterion among status of ownership

Table 56: One-Way Anova of Willingness to Pay for Green Building Criteria among Status of Ownership

	Mean			Sig.	Output H_0
	Own	Rent	Other		
Pay for Water use reduction	2,603	2,667	2,796	0,160	Accept
Pay Rain Water harvesting	2,637	2,733	2,694	0,403	Accept
Pay Energy Efficiency	2,797	2,748	2,755	0,725	Accept
Pay Electrical Metering	2,105	1,904	1,755	0,022	Reject
Pay Alternative Energy Source	2,312	2,052	2,041	0,002	Reject
Pay for Renewable Materials	1,388	1,741	1,184	0,000	Reject
Pay Free Chemical Pollutant from the building material	1,684	2,148	2,102	0,000	Reject
Pay for the Used of Certified Woods	1,249	1,267	1,020	0,011	Reject
Pay Good Ventilation	2,342	2,422	2,551	0,245	Accept
Pay Natural Lighting and Visual Comfort	2,194	2,111	2,265	0,430	Accept
Pay Spatial Comfort	2,160	2,000	1,816	0,037	Reject
Pay Noise Reduction	1,561	1,593	1,633	0,860	Accept
Pay Good Storm Water management	1,911	1,570	1,429	0,000	Reject
Pay Good Waste Management	2,084	1,859	1,816	0,042	Reject
Pay Carbon footprint	1,287	1,230	1,347	0,526	Accept
Pay Green Area	2,304	2,296	2,000	0,064	Accept
Pay Reachable Public Facility	2,591	2,630	2,714	0,509	Accept
Pay Reachable Public Transport within 300-500m walking distance	1,806	1,778	1,592	0,339	Accept

6.7.6 Correlation between Green Building Criteria and Willingness of Respondents to Pay

Correlations between green building criteria and respondent's willingness to pay for them is aimed to identify whether importance of green building criteria have influence to the willingness of people to pay. Pearson's correlation is used here to measure the strength of the association between these two discussed variables.

Table 57: Correlation between Green Building Criteria and Willingness to Pay

		Willingness to Pay
Water Use Reduction	Pearson Correlation	-0,028
	Sig. (2-tailed)	0,565
Rain Water harvesting	Pearson Correlation	-0,007
	Sig. (2-tailed)	0,879
Energy Efficiency	Pearson Correlation	-0,005
	Sig. (2-tailed)	0,926
Electrical Metering	Pearson Correlation	-0,029
	Sig. (2-tailed)	0,553
Alternative Energy Source	Pearson Correlation	,281**
	Sig. (2-tailed)	0,000
Renewable Materials	Pearson Correlation	,128**
	Sig. (2-tailed)	0,009
Free Chemical Pollutant from the building material	Pearson Correlation	-0,028
	Sig. (2-tailed)	0,565
Used of Certified Woods	Pearson Correlation	,141**
	Sig. (2-tailed)	0,004
Good Ventilation	Pearson Correlation	0,013
	Sig. (2-tailed)	0,795
Natural Lighting and Visual Comfort	Pearson Correlation	0,090
	Sig. (2-tailed)	0,066
Spatial Comfort	Pearson Correlation	-0,045
	Sig. (2-tailed)	0,352
Noise reduction	Pearson Correlation	-0,022
	Sig. (2-tailed)	0,647
Good Storm Water management	Pearson Correlation	-0,027
	Sig. (2-tailed)	0,576
Good Waste Management	Pearson Correlation	-0,016
	Sig. (2-tailed)	0,746
Green Area	Pearson Correlation	-0,056
	Sig. (2-tailed)	0,249
Carbon Footprint	Pearson Correlation	-0,084
	Sig. (2-tailed)	0,085
Reachable Public Facility	Pearson Correlation	0,067
	Sig. (2-tailed)	0,173
Reachable Public Transport within 300-500m walking distance	Pearson Correlation	,484**
	Sig. (2-tailed)	0,000

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

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

H_0: There is no significant correlation between importance of green building criteria and the willingness to pay

H_1: There is significant correlation between importance of green building criteria and the willingness to pay

Null hypothesis (H_0) as the tested statement specified that there is no significant correlation between variables (α = 5%). The alternative hypothesis (H_1) stated that there is significant correlation and this statement is expected or hoped to be true instead of the null hypothesis. If the significant value is less than 0.05 (p<0.05) then H_0 will be rejected, which basically is the expected result from this test.

Pearson number indicates the strength of association green building criteria and respondent's willingness to pay for them, while the correlation coefficient shows the significant difference between those two variables. When Pearson's number is close to 1,00 this indicates a strong relationship between two of the variables. This can be interpreted as change in the importance of green building criterion is strongly correlated with change in the willingness to pay. Meanwhile, when the Pearson number is close to 0, this indicates that there is a weak relationship between two variables. This as well indicates that change in the importance of green building criterion is not correlated with changes in the second. This can be concluded that two analysed problems are not strongly correlated.

Additionally, when Pearson number is positive (+), it can be interpreted that as the importance of green building criterion increase in value, the willingness of people to pay for it also increase in value. In the same way, as the importance of green building criterion decrease in value, the willingness of people to pay for it also decrease in value. Meanwhile, when Pearson number is negative (-), it can be interpreted that as the importance of green building criterion increase in value, the willingness of people to pay for it decrease in value. This correlation is known as negative correlation.

Table 57 presents result of correlation analysis between green building criteria and the willingness of people to pay for each of them. There are only four criteria out of eighteen that have correlation between their importance and willingness of people to pay for them. Reachable Public Transport within 300-500 meters Walking Distance criterion has the strongest correlation among three other criteria, in other words there is a strong correlation between the importance of Reachable Public Transport within 300-500 meters Walking Distance criterion with the willingness of people to pay for it. Three other criteria mentioned before are Alternative Energy Source, Renewable Materials and Used of Certified Woods. However, Person's numbers of these three criteria are relatively low.

6.8 Relationship between Household Problem and Green Building Criteria

Green building criteria were developed to improve the environmental performance of buildings in general and the quality of living in specific. Therefore, it is necessary for the set of green building criteria to meet the actual requirements of people living in the observed area. In other words, green building criteria have to solve current or existing problems facing by society and furthermore have to enhance the quality standard of living in general.

Relationships between importance of green building criteria and seriousness of household problems are analysed through correlation analysis.

6.8.1 Correlation between Household Problem and Green Building Criteria

Correlations between the seriousness of household problems and the importance of green building criteria explore whether seriousness of household problems have influence to the necessity or importance of green building criteria and vise versa. Pearson's correlation is used here to measure the strength of the association between these two discussed variables.

Table 58: Correlation between Household Problems and Green Building Criteria

		Water Use Reduction	Rain Water harvesting	Alternative Energy Source	Good Ventilation	Good Storm Water management	Good Waste Management	Reachable Public Transport within 300-500m walking distance
Difficult Access Water	Pearson Correlation	,645**	,621**	-,298**	,270**	,063	-,040	,109*
	Sig. (2-tailed)	,000	,000	,000	,000	,195	,417	,025
Flooding and Storm Water	Pearson Correlation	,149**	,226**	-,053	,165**	,503**	-,209**	-,084
	Sig. (2-tailed)	,002	,000	,277	,001	,000	,000	,087
Lack of Public Transport	Pearson Correlation	,249**	,242**	-,218**	,232**	-,161**	,061	,389**
	Sig. (2-tailed)	,000	,000	,000	,000	,001	,213	,000
Unreliable Electricity Supply	Pearson Correlation	-,009	,023	,182**	-,017	,021	-,042	,006
	Sig. (2-tailed)	,853	,640	,000	,728	,660	,389	,904
Presence of litter and illegal piles of solid	Pearson Correlation	,246**	,190**	-,159**	,105*	-,042	,356**	,260**
	Sig. (2-tailed)	,000	,000	,001	,032	,393	,000	,000
Bad air quality	Pearson Correlation	,335**	,291**	-,248**	,279**	,114*	-,123*	-,054
	Sig. (2-tailed)	,000	,000	,000	,000	,019	,011	,268

H_0: There is no significant correlation between seriousness of household problem and importance of green building criterion

H_1: There is significant correlation between seriousness of household problem and importance of green building criterion

Null hypothesis (H_0) as the tested statement specified that there is no significant correlation between household problems and green building criteria (α = 5%). The alternative hypothesis (H_1) stated that there is significant correlation and this statement is expected or hoped to be true instead of the null hypothesis. If the significant value is less than 0.05 (p<0.05) then H_0 will be rejected, which basically is the expected result from this test.

Pearson number indicates the strength of association between seriousness of household problems and importance of green building criteria, while the correlation coefficient shows the significant difference between those two variables. When Pearson's number is close to 1,00 this indicates a strong relationship between two of the variables. This can be interpreted as change in the seriousness of one household problem is strongly correlated with changes in the importance of green building criteria. Meanwhile, when the Pearson number is close to 0, this indicates that there is a weak relationship between two variables. This as well indicates that change in the seriousness of one household problem is not correlated with changes in the second variable or importance of green building criteria. This can be concluded that two analysed problems are not strongly correlated.

Additionally, when Pearson number is positive (+), it can be interpreted that as the seriousness of household problems increase in value, the importance of green building criteria also increase in value. In the same way, as the seriousness of one household problem decrease in value, importance of green building criteria also decreases in value. Meanwhile, when Pearson number is negative (-), it can be interpreted that as the seriousness of one household problem increase in value, the importance of green building criteria decreases in value. This correlation is known as negative correlation.

Table 58 shows relationship between importance of household problems and green building criteria. It can be seen that difficulty in accessing clean water is strongly correlated to green building criteria like Water Use Reduction and Rain Water Harvesting. This fact showed that people experiencing difficulty in accessing clean water for their household think that improvements from green building to reduce the use of clean water and to harvest rain water are as well important.

According to Table 58, Flooding and Storm Water problem showed a significant correlation to green building criterion of Good Storm Water Management. This particular result can be interpreted that as the seriousness of flooding and storm water problem increases, the importance of good storm water management criterion also increases.

Moreover, next correlations are in between Lack of Public Transport and Reachable Public Transport, Presence of Litter & Illegal Pile of Solid and Good Waste Management as well as the correlation between Bad Air Quality and Good Ventilation. However, correlation between these problems and criteria are relatively not so strong, considering the Pearson's number is lower than 0.5.

6.9 Concluding Remark

Household problems in Indonesia are dominated by four major problems. Water related problem like difficulty in accessing clean water and quality of the water itself, unreliable electricity supply, flooding as well as bad air quality. These problems influence life quality of people residing in big cities in Indonesia like Jakarta and Surabaya. The seriousness of these problems are as well

high regardless the area of living, level of income and status of ownership, except bad air quality and flooding, where these two particular problem effect people living in urban area more than in suburban area.

Notably, seriousness of household problems influence people's willingness to pay for them except for problems such as poor access for motor vehicle, inadequate solid waste disposal and presence of little and illegal piles of solid waste. As a result, these exceptional problems need to be put into serious consideration by the local authority.

Green building criteria are considered important just for specific criteria such as good ventilation, natural lighting, and good storm water management as well as water related criteria like water use reduction and rain water harvesting. Conversely, results showed that respondent are not willing to pay for these criteria regardless their importance. However, there are some exceptions in this very cases, where there is significant correlation between the importance of green building criteria and willingness of people to pay for them. These criteria are such as Alternative Energy Sources, Renewable Materials, Used of Certified Woods and Reachable Public Transport, in spite of their relatively low Pearson's numbers indicating the strength of the correlation is indeed not excessively strong.

Another key point, good awareness is shown by people who considered criteria such as Alternative Energy Sources, Renewable Materials, Used of Certified Woods and Reachable Public Transport to be important tend to be as well willing to pay for these specific criteria. This result could give a positive sign regarding the self-awareness of Indonesian toward sustainable development through real estate industry.

With this in mind, further analysis showed that there are no significant correlations between actual household problems and green building criteria in Indonesia. To put it differently, seriousness of household problems facing by people living in Jakarta and Surabaya have no effect on the importance of green building criteria that were originally set to improve performances of household specifically and society in general.

Existing green building criteria cannot overcome household problems nor furthermore improve the quality of Indonesian household especially in big cities like Jakarta and Surabaya. Lack of correlation between existing housing problems and green building criteria in Indonesia showed that it is important for further investigation regarding criteria that can improve the housing performance in big cities like Jakarta and Surabaya which fundamentally as well as both directly and indirectly solve the existing and potential problems in the industry.

7 The Rationale Behind Proposed Green Building Criteria in Indonesian Housing Industry

7.1 Introduction

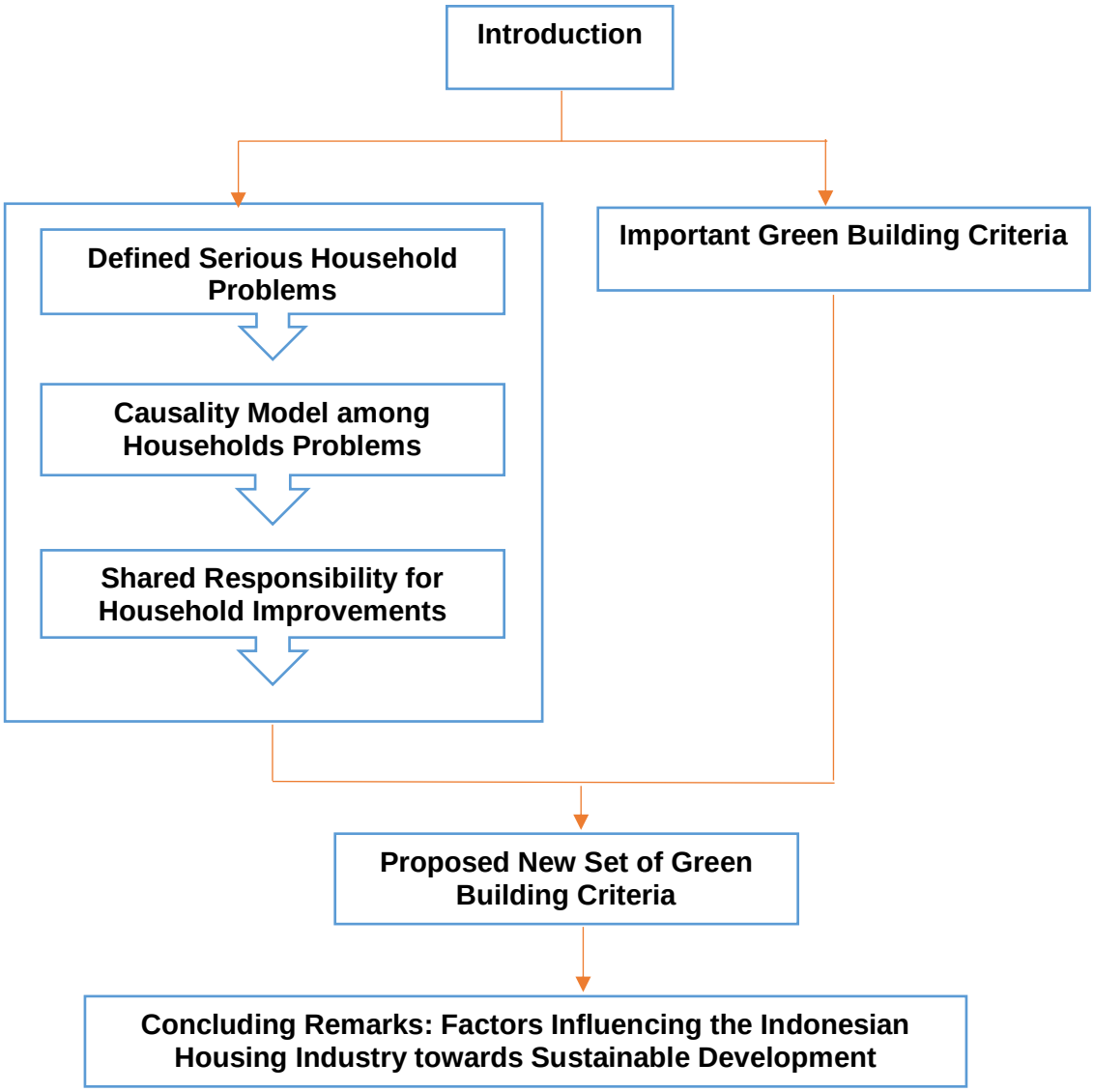


Figure 81: Rationale behind the Proposed Green Building Criteria

The real estate industry is one of the main important sectors that hold key role in the economic development of any country. It is known as the indicator of the economic performance as well as the stability of a country's monetary condition. Implementation of an Environmental Building Assessment Method in the real estate industry is influenced by factors that mostly are defined as challenges and barriers that are needed to be undertaken. Lack of social awareness towards the importance of environmental protection is likely to be one of the main obstacles faced by

governments as well as designers in order to effectively improve and transform the performance of building industry in general. Furthermore, the uncertainty that occurs in every newly investment has disinclined investors to invest in such projects. Hence, there is a need to develop a new approach to effectively implement an Environmental Building Assessment Method without jeopardising the need of investors in achieving their return of investment.

This chapter discusses the importance of developing a new approach to effectively improve the performance of building industry in Indonesia towards sustainable development. Starting from identifying the main existing problem in the Indonesian housing industry and by reviewing the existing building certification system, this chapter will provide a new model of building certification system consisting of perspective from the end user who directly face the problems on the daily basis as well as having to pay either to repair or/and to improve their quality of living. Moving forward, housing is the mandatory and basic need of every single person making real estate industry as an important sector to improve in order to provide a good quality of living.

Besides, this chapter will examine two segments which are the serious household problems and the important green building criteria as well as relationship of each factor related to both segments. Finally, factors influencing the housing industry in Indonesia toward sustainable development will be defined based on the empirical study.

7.2 Household Problems and Green Building Criteria

This sub chapter discuss about defined serious household problems and important green building criteria in big cities in Indonesia. It principally aims to show the main causality of problems which is believed to be an important starting point of the problem solving scheme.

7.2.1 Defined Serious Household Problems

Based on the data analysis of the previous chapter, several problems are defined as serious problems by end users regardless their city of origin, area of living and their level of income. These problems are causing the most serious problems that influence the comfortability and the living quality of end users in big cities in Indonesia.

Some figures will be presented on the next sub-subchapter to show the relationship among household problems based on the correlation results from the previous chapter. Each sub-subchapter represents every defined serious household problem in Jakarta and Surabaya. The solid lines show the direct causality between the centre problem and rest of serious problems, while the dotted lines show the relationship in causality manner among rest of problems.

7.2.1.1 Difficulty in Accessing Clean Water

Difficulty in accessing clean water in big cities have become one of common environmental issues facing by high population density area, hence the necessity to save the quantity of water consumed cannot be the main concern when the ability of the society to access clean water is not yet fulfilled. To have it in a more certain way, this particular problem is believed to generate other environmentally related problems due to its natural impact to the environmental in general.

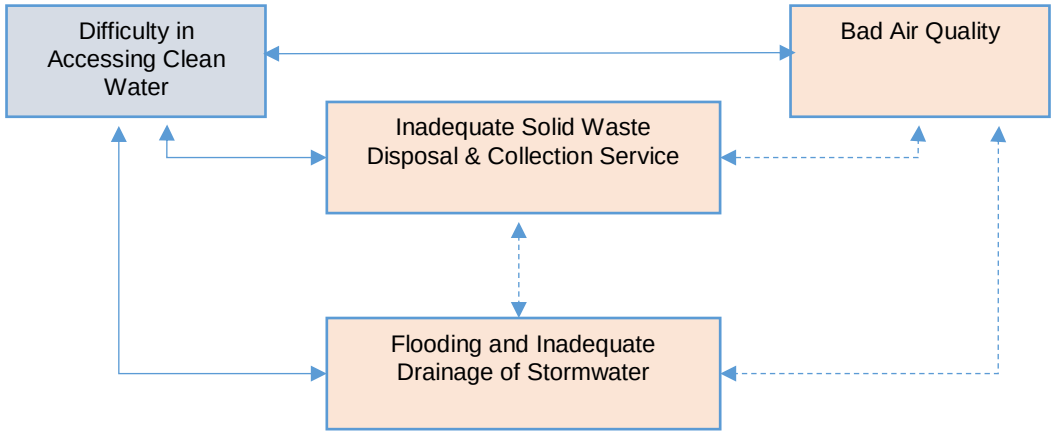


Figure 82: Causality of Difficulty in Accessing Clean Water

Figure 82 shows a causality relationship among defined serious problems with Difficulty in Accessing Clean Water problem as the centre of the causality diagram. It can be seen that difficulty in accessing water has causality relationship with three different problems.

In Jakarta, this particular problem turned out to be more severe compare to Surabaya even though it is not so significantly different, this finding supports previous existing researches where clean water is known to be contaminated in Jakarta due to the excessive use groundwater which way bigger compare to the time needed for groundwater basin to regain and to refill itself causing saltwater to fill these empty spaces especially in the north side of Jakarta. Another reason is the relatively expensive initial instalment of water pipe providing by the local authority associate with the irregular water flow to some area of the city where water only flows during several hours a day. This of course is intricate enough when the water flow time is in the middle of the night to store water for their daily household needs. Lastly, it is widely known that rivers in Jakarta and Surabaya are highly contaminated and far away from reaching the minimum standard of clean water that can be consumed for households.

Likewise, difficulty in accessing water appears to be a serious problem facing by people in big cities regardless their living area, level of income and their type of housing. However, the main question remains whether end users are willing to pay in order to improve this particular problem in their current or future households. Since there is a significant positive correlation between the seriousness of difficulty in accessing clean water and people's willingness to pay for it, it can be said that people are well aware about this certain problem and are willing to spend more money in order to find either solution or an improvement for their household irrespectively from their level of income. A conclusion could be drawn that level of income has no influence to people willingness to pay for having a better clean water access, meaning that every level of income group in Jakarta and Surabaya as the two representative big cities in Indonesia agrees to improve their ability to accessing clean water for the shake of their household.

Moreover, table above shows the rational behinds the causality of household problems related to the difficulty in accessing clean water. It can be seen that even though each problem explained in the table has significant correlation with the main problem, but the causality between them is believed to be indirectly. In other words, there is another factor that influence the causality directly.

In this case, the contaminated water or bad quality of available water is the main trigger of the decreasing accessibility of clean water. The column causality on every reasoning table shows the connection among problems. Where directly means that change in one problem will directly influence another problem and/or the other way around. Meanwhile indirectly causality means that there is one other causality in between two correlated problems.

Table 59: Reasoning behind the Causality of Difficulty in Accessing Clean Water

	Difficulty in Accessing Clean Water
Flooding and Inadequate Drainage of Storm water	Flooding and inadequate drainage of storm have direct influence to the accessibility of clean water in general especially in high populous cities where the distance between clean water source and urban area is relatively short. Occurrence of flooding will bring together rain water, river water and wastes such as waste water as well as solid waste. This of course will create a contamination to the purity of clean water source.
Inadequate Solid Waste Disposal & Collection Service	Inadequate solid waste disposal and collection service contributes to the difficulty in accessing water in Indonesia. The pile of solid waste has covered most of rivers in big cities where automatically reducing the clean water availability for the city itself.
Bad Air Quality	As it has been discussed before, bad air quality is resulted from several causes including burning of fossils fuel, agricultural activities, exhaust from factory and industry, mining operation as well as indoor air pollution. When the air is being polluted, the chance for its to influence the water is really high through condensation process and vice versa. That means, when the air quality is bad, the water quality is most likely to be compromised which partially lead to the decreasing amount of the clean water.

7.2.1.2 Poor Quality of Drinking Water

Poor quality of drinking water in big cities in Indonesia like Jakarta and Surabaya is known as common household problem. It can be proved with the high number of commercial drinking water companies that have been growing in Indonesia due to the high demand of healthy and good quality of drinking water among the society. Hence explaining the similarities of its seriousness between Jakarta and Surabaya.

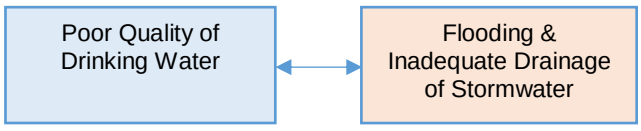


Figure 83: Causality of Poor Quality of Drinking Water

Moreover, groundwater that mostly used for drinking water has been contaminated by salt water in the northern part of Jakarta, this problem occurred as result of over extracting of groundwater in Jakarta that not only for consumption purpose but also for the commercial/industrial purposes

as well as the relatively low ground surface in that area, causing salt water from the sea to infiltrate the empty void of groundwater as it has been explained on the previous discussion. Meanwhile, poor quality of drinking water problem showed the same level of seriousness in both urban and suburban area indicating that the population density doesn't make any difference in the quality of drinking water.

Figure 83 shows household problem that is significantly correlated with the poor quality of drinking water. Compare to the previous problem which is Difficulty in Accessing Clean Water, it could be seen that there is only one problem that is correlated to the poor quality of drinking water. However, it is known that difficulty in accessing clean water has something to do with lack of the clean water availability. Hence, poor quality of drinking water can roughly be interpreted as the trigger behinds the difficulty in accessing clean water. Besides the statistical analysis showing that only one problem is significantly correlated with this particular problem, the fact that the reasoning explained in the previous sub-sub chapter (7.2.1.1) where difficulty in accessing clean water occurs due to the damage causing by other problems leading to worsen quality and performance of water sources, it is highly important to take these other problems which indirectly related to the difficulty in accessing clean water into considerations when it comes to the reasoning of the causality for poor quality of drinking water problem.

Table 60: Reasoning behind the Causality of Poor Quality of Drinking Water

	Poor Quality of Drinking Water
Flooding & Inadequate Drainage of Storm water	Flooding always causes damage for the surrounding environmental due to the mixture of objects being brought by the water which most of the time are mixture of garbage and others polluted surface. This of course will influence the quality of the drinking water when the flood reached and is mixed with the water source.

Lack of consideration for quality improvement of the drinking water is therefore necessary and must be included in green building assessment system. When it comes to different level of incomes, it can be seen that people with different income level tend to value this problem differently, where people with the lowest income level have the most serious problem concerning poor quality of their drinking water in comparison to other groups. Interestingly, every level of income group is willing to pay more money in order to have a better quality of drinking water. The tremendous growth drinking water bottle industry in Indonesia indicates that people are willing and have already invested in this particular way to be able to consume a good quality of drinking water.

7.2.1.3 Flooding and Storm Water

Flooding and storm water problem is the most common environmental problem in Jakarta especially during rainy season which last for six months long in Indonesia. The inadequate disposal of waste water has worsened the situation as well. Hard surface had taken green spaces where water can be naturally absorbed to the ground. People in Jakarta have more

serious problem concerning disposal of waste water, this can be seen through flooding that occurs every year in the past decade.

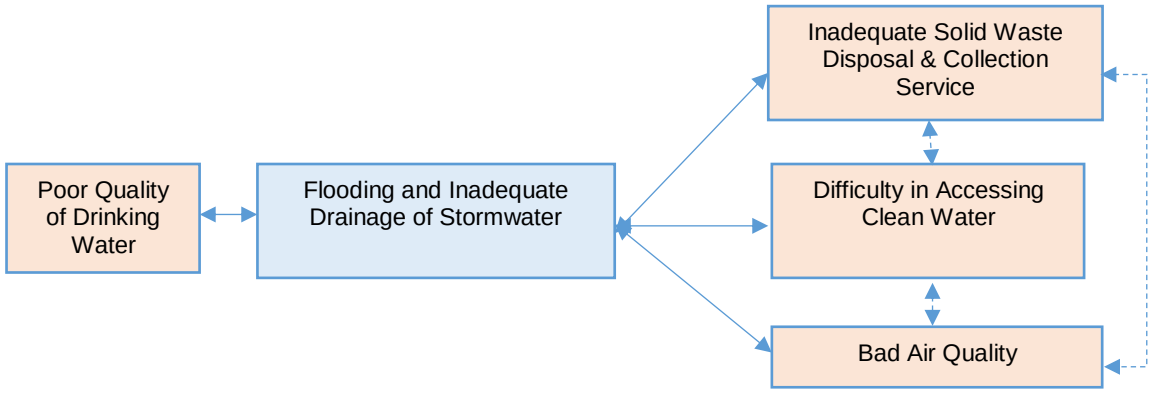


Figure 84: Causality of Flooding and Inadequate Drainage of Stormwater

Table 61 shows three indirect causalities and one direct causality for flooding problem. As it can be perceived, flooding will cause a direct problem for poor quality of drinking water as well as bad air quality. Conversely, decreasing in quality of clean water will automatically increase the difficulty in accessing the water itself since the availability is compromised.

Table 61: Reasoning behind the Causality of Flooding and Inadequate Drainage of Storm Water

	Flooding and Inadequate Drainage of Storm water
Poor Quality of Drinking Water	Flooding always causes damage for the surrounding environmental due to the mixture of objects being brought by the water which most of the time are mixture of garbage and others polluted surface. This of course will influence the quality of the drinking water when the flood reached and is mixed with the water source.
Inadequate Solid Waste Disposal& Collection Service	Inadequate solid waste disposal will increase the probability of flooding occurrence.
Difficulty in Accessing Clean Water	Flooding and inadequate drainage of storm have direct influence to the accessibility of clean water in general especially in high populous cities where the distance between clean water source and urban area is relatively short. Occurrence of flooding will bring together rain water, river water and wastes such as waste water as well as solid waste. This of course will create a contamination to the purity of clean water source.
Bad Air Quality	Polluted water from flooding might presents a health hazard. Hazard materials included in the flooding water will later be released into air leading to bad air quality.

7.2.1.4 Unreliable Electricity Supply

It is relatively common not only in small cities but also big cities like Jakarta and Surabaya that the residents have to suffer from the unreliable electricity supply. This can be seen by the increasing number of electricity generators installed by private industries and households in order to support or to replace their main electricity needs and dependency from the public electric source.

Jakarta as the capital city of Indonesia has shown a better improvement for its electricity supply over the past five years. However, the same improvement is not found in Surabaya where regardless its smaller area compares to Jakarta which on this case can be interpreted as also smaller or lower electricity demand, Surabaya still suffers from both unreliable electricity source as well as relatively high electricity price. Based on the empirical study conducting in both Jakarta and Surabaya, respondents in both cities stated that electricity supply is still becoming one of their common household problems. This particular problem is as well stated the same way regardless the living area, level of income, type of housing of observed respondents.

Moreover, unreliable electricity supply shows no significant correlation with others defined serious problems. However, this fact should not be understood that this individual problem is less important than others. With that in mind, as it has been discussed on the fifth chapter about the potential household problems in Indonesia, where Indonesian Electricity Company or also known as PLN has been considered for having internal financial flows. It is believed that the government-regulated tariffs are way too low to cover the basic operational cost nor the subsidy could provide such a significant contribution. In addition, it has been identified that there are high number of the electricity consumer who either not willing, nor able to pay their electricity bills causing big trouble from the overdue debts, which on this case, the growth of the company and its productivity will surely be compromised.

7.2.1.5 Inadequate solid waste disposal & Collection Service

Inadequate solid waste disposal and collection service as one of defined serious problem in big cities' household is no longer a new challenge for people living in urban area. However, this doesn't mean that there is no growing concern toward this precise problem. The lack of an adequate solid waste management practice has worsened the environmental condition, leading to bad contamination of both surface and ground water. Based on the empirical study, respondent in Jakarta showed more concern about inadequate solid waste disposal, meanwhile there is no significant difference between people living in urban and suburban area when it comes to solid waste problem.

The existing solid waste management practice clearly needs to be improved or changed in order to produce a more efficient waste management. All of the three steps in waste management from collecting, processing and disposing have to be handled as efficient and as effective as possible. When it is observed further ahead, it can be seen that from the empirical result, inadequate solid waste disposal is significantly correlated with two specific problems regardless their level of seriousness in household activities, these two problems including lack of public transport and presence of illegal solid waste.

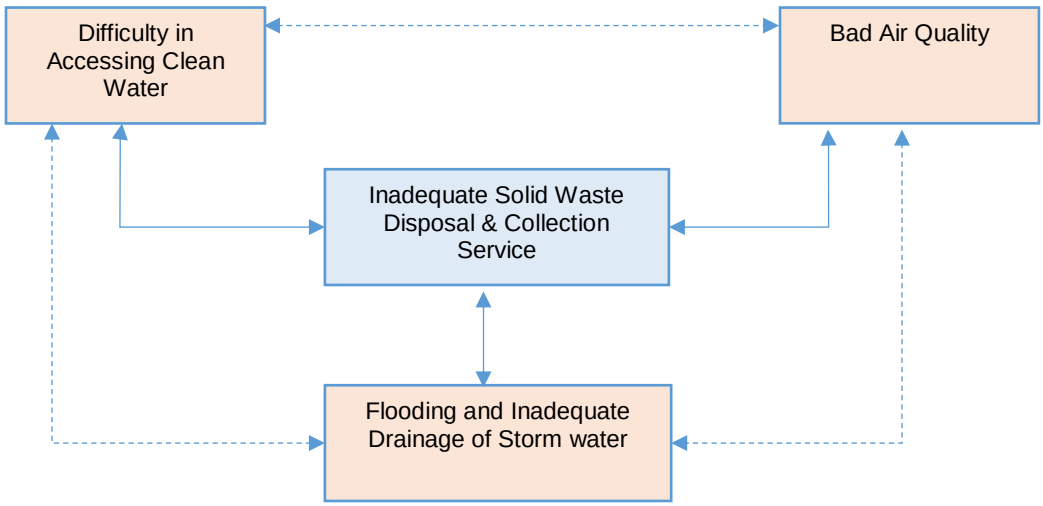


Figure 85: Inadequate Solid Waste Disposal

Pursuing a better waste management practice should including a better collecting-transport of solid waste, where good traffic condition is always needed in order to lower the exposure of waste in the open air of urban area. In the worse scenario, it is commonly found that the solid waste is failed to be collected, leaving the exposed area prone to further degradation like spread of disease, bad odour and flooding. Therefore, a more detailed research concerning further influence of waste management needs to be conducted.

Table 62: Reasoning behind the Causality of Inadequate Solid Waste Disposal & Collection Service

	Inadequate Solid Waste Disposal
Flooding and Inadequate Drainage of Storm water	Inadequate solid waste disposal will increase the probability of flooding occurrence.
Bad Air Quality	Decomposition of solid waste produces certain bad odour when it isn't treated properly especially when it is being exposed to high humidity. Hence, inadequate disposal of solid waste disposal will destroy the air quality of the surrounding area. Furthermore, bad waste collection service could lead to abandon waste which its decomposition process might release certain amount of air pollution.
Difficulty in Accessing Clean Water	Inadequate solid waste disposal contributes to the difficulty in accessing water in Indonesia. The pile of solid waste has covered most of rivers in big cities where automatically reducing the clean water availability for the city itself.

7.2.1.6 Bad air quality

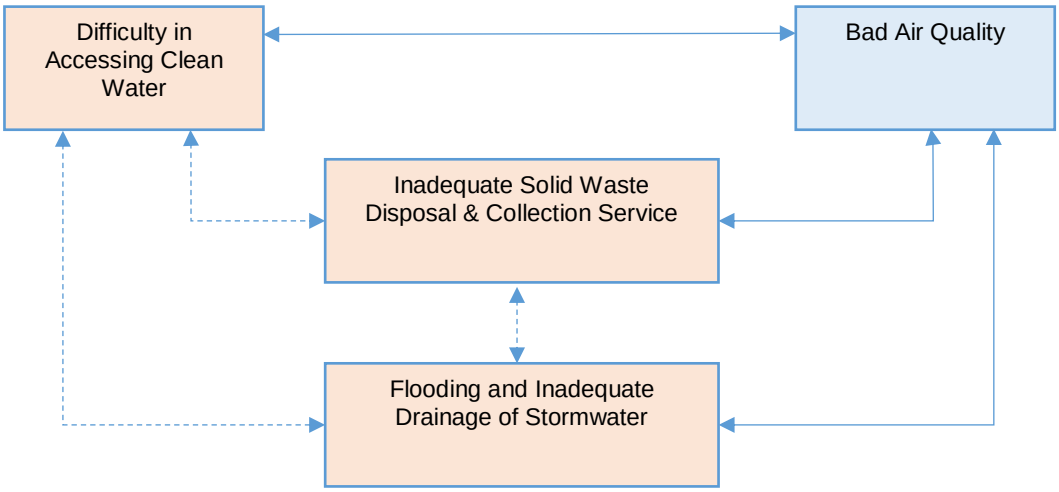


Figure 86: Causality of Bad Air Quality

Jakarta as the largest and the most populated city in Indonesia has suffered from bad air quality that mostly caused by industrial activity and bad traffic jam. This problem is as well faced by people living in Surabaya although the problem is not as severe as in Jakarta, in fact there is a significant different between the severity of bad air quality in these two cities. Also, people who live in apartments tend to rate this particular problem as more serious than people living in single unit home. This finding can be explained with the fact that apartments (especially in Jakarta) tend to be located in the middle of the city where most traffic occur.

Table 63: Reasoning behind Causality of Bad Air Quality

	Bad Air Quality
Flooding and Inadequate Drainage of Storm water	Polluted water from flooding might presents a health hazard. Hazard materials included in the flooding water will later be released into air leading to bad air quality.
Difficulty in Accessing Clean Water	As it has been discussed before, bad air quality is resulted from several causes including burning of fossils fuel, agricultural activities, exhaust from factory and industry, mining operation as well as indoor air pollution. When the air is being polluted, the chance for its to influence the water is really high through condensation process and vice versa. That means, when the air quality is bad, the water quality is most likely to be compromised which partially lead to the decreasing amount of the clean water.
Inadequate Solid Waste Disposal & Collection Service	Decomposition of solid waste produces certain bad odour when it isn't treated properly especially when it is being exposed to high humidity. Hence, inadequate disposal of solid waste disposal will destroy the air quality of the surrounding area.

As it can be seen on the Causality of Bad Air Quality Figure, bad air quality has significant correlations with three other serious problems such as difficulty in accessing clean water, inadequate solid waste disposal as well as flooding and inadequate drainage of storm water. Table 63 shows the explanation of these three correlations.

7.2.2 Reasoning behinds Causality Model among Household Problems

Household problems in Indonesia especially in big cities like Jakarta and Surabaya have tendency to influence or to be influenced by each other. As it has been discussed in this chapter, there are total of six defined serious problems facing by most households in big cities. Each of these problems is known to have its impact to the living quality of people in the defined area. Based on reasoning behind every problem, it is important to have a bigger picture where the flow of problems can be seen in order to identify the initial point of the whole problems occurring in big cities.

In Jakarta and Surabaya, three out of six defined serious problems have something to do with water. Difficulty in accessing clean water, poor quality of drinking water and flooding dominate fifty percent of the defined serious problems. Hence, it can be seen that water management, including clean and waste water management need to be taken more seriously in Indonesia in order to improve the current household condition as well as to avoid further degradation.

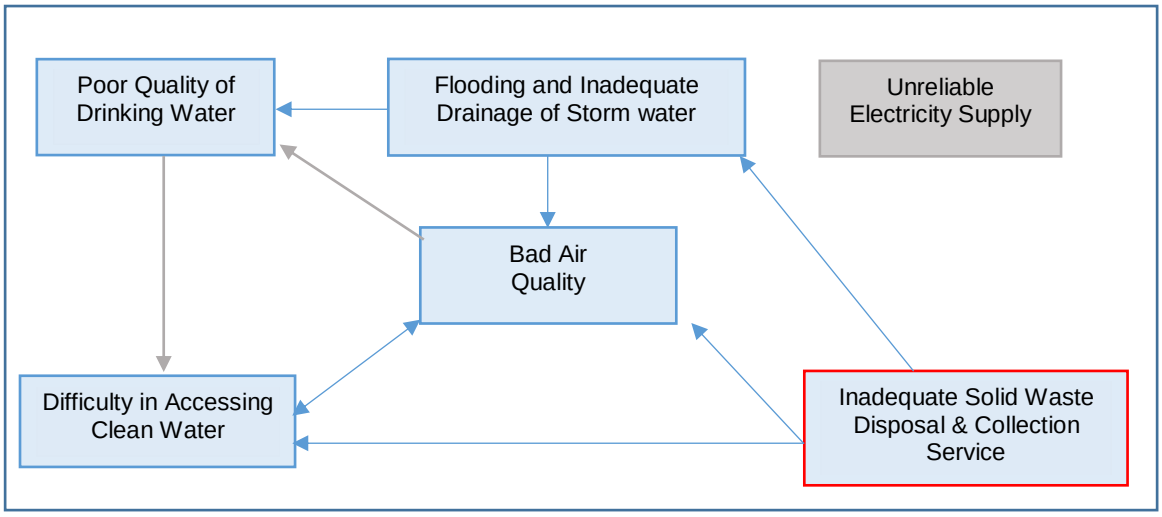


Figure 87: Reasoning behinds Causality Model Among Defined Serious Household Problems

The section of causality among household problems is described on Figure 87. This figure explains the reasoning of causality among problems based on both statistical result from the previous chapter as well as its causal environmental relationship with each other. Each box and arrow including their colour will represent specific role inside the causality model.

Unreliable electricity supply is drawn with grey colour box which shows that it doesn't have a correlation to other existing defined serious problems. Moreover, left right arrows represents two ways relationship, which means one problem influences and is influenced by another one. This

relationship can be seen between Bad Air Quality problem and Difficulty in Accessing Clean Water, where bad air quality is resulted from several causes including burning of fossils fuel, agricultural activities, exhaust from factory and industry, mining operation as well as indoor air pollution. When the air is being polluted, the chance for its to influence the water is really high through condensation process and vice versa. That means, when the air quality is bad, the water quality is most likely to be compromised which partially lead to the decreasing amount of the clean water. Moreover, a left or a right single arrow represents the relationship where one problem influences but isn't influenced by the second problem. Causality relationship for this matter can be found between the rest of the problems. Meanwhile, grey single arrow shows that there is a relationship between two problems, where one problem influences but isn't influenced by the other one based on the environmental understanding from the literature review regardless their statistical result from the empirical study.

Flooding and inadequate drainage of storm water is influenced by bad solid waste management, on this case, the related problem is known as inadequate solid waste disposal. When the contaminated water from flooding managed to reach some of water sources, the quality of this water source will unassumingly be compromised. Thus, reducing the quantity of available clean water that can be used as water source for human consumption. Therefore, regardless the lack of significant correlation between poor quality of drinking water and difficulty in accessing clean water, it can be contemplated that these two particular problems have a one-way causality relationship.

However, when it is examined carefully, there is one problem that becomes the trigger of other problems. Inadequate solid waste disposal is the causal of difficulty in accessing clean water, bad air quality and flooding. As it was mentioned before, inadequate solid waste disposal contributes to the difficulty in accessing water in Indonesia. The pile of solid waste has covered most of rivers in big cities where automatically reducing the clean water availability for the observed city itself. It is well known that environmental problems tend to occur from other environmental problems. When it comes to the water subject, quality of drinking water is influenced by the source of raw water or in other words, how and where the water is generated will influence its quality. When source of raw water is prone to the contamination resulting of bad waste water management, the difficulty of having a clean water will increase due to the polluted water sources.

Furthermore, rivers covered by pile of solid waste will decrease their capacity to carry water that comes from both from upstream as well as rain water which consequently leads to flooding. Mixture between flooding water and surface materials as well as solid waste will produce high humidity and bad air quality in the exposed area. Henceforth, this particular solid waste problem needs to be handled in order to tackle other problems in Indonesia.

In most of poor and developing countries, waste management is an important issue to be considered, starting with collection of the waste, how it is being transported and its last disposal place and process. Urban area in Jakarta and Surabaya with high population density are the places where all human activities are taken place, thus produce high numbers and type of waste. Solid waste is one of the biggest problem that has been faced by local authority and needs to be handle in a more effective and efficient way.

Uneasily decomposed solid waste like plastic garbage has becoming am environmental problem in Indonesia for the last two decades. The use of various products made from plastic and its environmentally unfriendly use, causing a variety of serious environmental problems

which If not managed seriously, garbage pollution of this type would be very dangerous for the continuation of the planet Earth. In 2016 Indonesia as the fourth most populous country in the world contribute second biggest amount of garbage after China in the first place. It was also mentioned that the total amount of garbage Indonesia in 2019 will reach 68 million tons, and plastic waste is expected to reach 9.52 million tons, or 14 percent of the total garbage. When it is studied furthermore, lack of good waste management like separation of household waste is the obvious problem that can actually be solved by forcing the system onto society. However, the tricky point on the separation of household garbage has to be accompanied by a consistent separation at the last garbage disposal site. With that in mind, it will be much easier to continue the decomposition process for non-plastic garbage and the recycle process of the plastics ones.

In Jakarta and Surabaya, where the traffic intensity is relatively high compare to other big cities in the country, it is quite important to review the transportation system of collected garbage from every household. For example, transportation process that is done during peak hours of traffic in the observed cities will cause more emission from the garbage vehicles as well as bad odour that contribute to the air quality in the urban area. Hence, the problem of inadequate waste management has caused another environmental problem that will be hard to taken care of and cause more financial damage. Therefore, in order to tackle most of household problems in Indonesia, it is highly recommended to start with a better waste management.

Nonetheless, existing green building certification system or building assessment system in Indonesia failed to pinpoint this particular problem as the most important problem that needs to be considered with a higher weighting system. GREENSHIP allocated 12.87% of its total weighting system to the main category of Building Environmental Management where garbage management holds two out of seven criteria available, making its contribution way below its importance.

7.2.3 Causality Model among Housing Problems using Cross Impact Analysis

Based on the previous sub-chapter where the causality model is being drawn based on both empirical and literature studies, a more analytical approach using cross impact analysis will be conducted to support the main causality model in order to have a more substantial overview concerning housing problems in Indonesia.

Cross impact analysis is a methodology developed by Theodore Gordon and Olaf Helmer in 1996. This method is aimed to define relationship between events and how this relationship might influence or might impact the resulting events which led to reducing of future uncertainty[202]. When it comes to the relationship between events, a cross-impact matrix is developed to allow a better visualization of the analysis itself.

[202] Gordon, Theodore Jay: Cross Impact Method, United Nations University Millennium Project, p 1. 1994.

7.2.3.1 Cross Impact Matrix for Housing Problems

On cross impact matrix, each field of the matrix will represent the influence of each variable on the corresponding variable. This square matrix is built with range of weight or strength. For the purpose of this research, a range of 0 to 3 is used to allocate the power of influence of each variable to others existing variables.

The horizontal sums of the matrix represent the role of each variable in how actively it can influence other variables on the matrix. This horizontal sum is also known as active sum (AS). Meanwhile, the vertical ones or also known as passive sum (PS) represent the degree of reactivity, or in the other words PS shows degree of reactivity of the respective variable to all others. By comparing these two sums (AS and PS) of each variable, a more detail conclusion can be seen whether a variable is rather active (strongly influencing) or reactive (strongly influenced). A list of variables containing this data denotes the power of influence. [203]

Following table showing the matrix of sensitivity represented the causality relationship of problems in the Indonesian housing industry. The value weighted to each causality differs from zero to three, with zero means there is no relationship between two problems and three means there is strong relationship between two problems.

Table 64: Matrix of Sensitivity for Housing Problems

		1	**2**	**3**	**4**	**5**	**6**	**AS**
1	Difficult Access Water	x	0	1	1	0	3	5
2	Poor Quality of drinking Water	3	x	0	0	0	1	4
3	Flooding and Storm Water	3	3	x	2	1	3	12
4	Unreliable Electricity Supply	0	0	0	x	0	0	0
5	Inadequate solid waste disposal & Service Collection	3	3	3	0	x	3	12
6	Bad air quality	2	3	0	0	0	x	5
	PS	11	9	4	3	1	10	

The combination of these two values allows characterizing the criticality P = AS. PS of a node. Meanwhile, the ratio Q =AS / PS denotes the parameter of control ranging from actively in control of the system (if high) to the reactive on the low side if strongly responding to

[203] Zimmermann, Josef: Project Management. Lecture Notes, Lehrstuhl für Bauprozessmanagement der TU München, 2013.

modifications. Following conditions can be drawn base on the value of P and Q:

- P: AS large, PS large → strong influence and strong impact → critical
- P: AS small, PS small → little influence and little impact → buffering
- Q: AS large, PS small → strong influence and little impact → active
- Q: AS small, PS large → little influence and strong impact → reactive

Base on the previous matrix, a role of allocation can be drawn to categorize the variables to the seven zones as can be seen on the following figure.

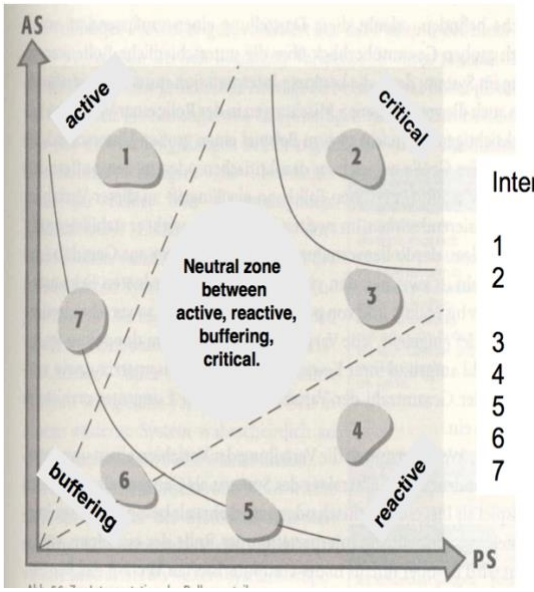


Figure 88: Interpretation of Roles[204]

Moreover, a role allocation graph of defined serious problems is drawn based on the sensitivity matrix (Table 64). Six defined serious housing problems are plotted to the AS and PS graph where each problem represents their specific role on the system. Even though the position of each variable on the graph can already represent a starting point of each behavior in the system as whole, a long term behavior of each variable must be identified in order to have a more precise perspective through period of time. Therefore, a normalized matrix is conducted to see the pattern movement of each variable on the allocation of role graph.

Figure 89 describes the behavior of each variable through period of times using normalization approach (hundred times of iteration) that can be explained with following formula:

$$\bar{1}^{T} \cdot A_{w} = \overline{PS} \text{ and } \left(A_{w} \cdot \bar{1}\right)^{T} = \overline{AS}$$

[204] Zimmermann, Josef: Project Management. Lecture Notes, Lehrstuhl für Bauprozessmanagement der TU München, 2013.

As it can be seen, Inadequate solid waste disposal and collection service is located on the active zone of the graph indicating that it has the role of effective lever to stabilize the system and the role is getting stronger to the active zone after being normalized. This position means that this particular housing problem is actively influencing other problems in the system. The next second most active variable/problem is Flooding and Inadequate Storm Water. Even though it is located in the active zone, after period of time through a normalized approach, it can be seen that the position of the variable is moving toward a buffering zone indicating that its role on the system is not as actively influencing as the previous variable. Meanwhile, three others variables can be found on the reactive zones, these variables are Difficulty in Accessing Clean Water, Bad Air Quality and Poor Quality of Drinking Water. Two of these variables are moving towards more reactive zone after normalization whilst poor quality of drinking water problem is moving toward the buffering zone. Variable Unreliable Electricity Supply is located on the buffering zone indicating this particular problem is nor influencing or is influenced by other existing variables.

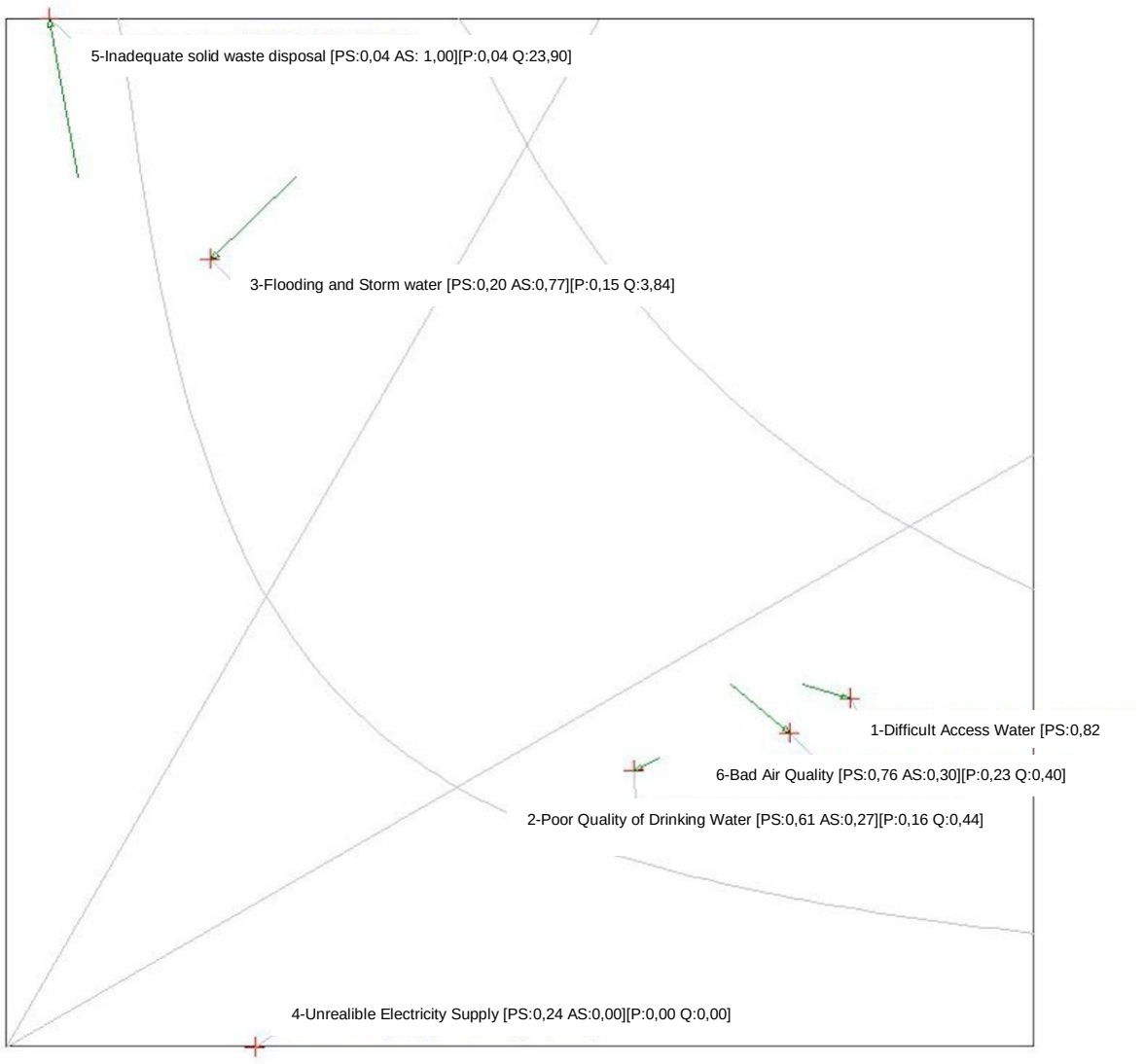


Figure 89: Cross Impact Role (Role of Allocation) of Defined Serious Housing Problems

The result from this cross impact analysis supports the initial causality model of housing problems in Indonesia. Where Inadequate solid waste disposal and collection service has the most important role in influencing the existence or severe of other defined serious housing problems in Jakarta and Surabaya as observed cities.

7.2.4 Shared Responsibility for the Housing Improvement

Housing improvement is always necessary in order to increase the quality of living in general. Regardless the level of income, people living in Jakarta and Surabaya tend to have similar opinion regarding their housing improvement and are willing to pay in order to solve their household problems. However, end users are not willing to pay for improvement of several problems that they have been dealing with, believing that government or local authority has to take some action or compensation for the improvements.

Responsibility to solve or to improve a certain condition is always strongly related with the financial contribution that one has to consider. Table 65 shows shared of responsibility for housing improvement between end user and local authority, anticipating that authority has to take the responsibility when the end user neglect or unwilling to pay for specific improvements although it cannot be forced without certain settlement.

Table 65: Shared Responsibility for Housing Improvement

	End user	Authority
Reduction of nuisance from solid waste disposal site		✓
Good air quality	✓	
Cleaning of litter and illegal pile of solid waste		✓
Adequate solid waste disposal		✓
Reliable Electricity Supply	✓	
Improvement of public transport		✓
Good access for motor vehicle		✓
Prevention and solution for flooding	✓	
Adequate disposal of human excreta		✓
Adequate disposal of waste water	✓	
Good quality of drinking water	✓	
Easy access to clean water	✓	
	50 %	50 %

From the total of twelve improvements, end users are willing to pay for fifty percent, leaving the authority with the rest of fifty percent. In view of the necessity to do certain improvements, which in this case, improvements that are generated from the existing serious problems facing by end users, Table 66 displays the shared responsibility of improvement in order to tackle or to improve certain household condition including good air quality, adequate solid waste disposal,

reliable electricity supply, prevention of flooding as well as improvement of drinking water quality and also easy access to clean water.

Table 66: Shared Responsibility for Important Housing Improvement

	End user	Authority
Good air quality	✓	
Adequate solid waste disposal		✓
Reliable Electricity Supply	✓	
Prevention and solution for flooding	✓	
Good quality of drinking water	✓	
Easy access to clean water	✓	
	83.3%	16,7 %

From total of six improvements that come from six defined serious household problems, end users showed their willingness to pay for 5 of them, leaving the authority be responsible for only one improvement which is adequate solid waste disposal system. First thing to remember that, lack of good solid waste disposal management is stated to be the trigger of other housing problems in big cities in Indonesia. With this in mind, this particular problem can be considered to be even more serious to be handled by the authority in order to prevent the occurrence of other problems. In the extreme case, end users can be introduced to a better understanding concerning this particular problem, since the failure in handling this problem will cost them four other problems to solve (see Figure 87). All things considered, since everyone can take place in improving their local waste disposal system, it is highly recommended that such awareness regarding causality of problems that are triggered by one problem has to be widely introduced in order to have a stronger movement from both society and government/authority.

Meanwhile in Indonesia, waste management has been regulated by government under Law Number 18/2008 about waste management stipulating that waste management is not only a government obligation. Society and industrial as waste generators are as well responsible in creating a clean and healthy living environment. However, based on the empirical study, it can be seen that housing end users are not willing to spend more money in order to improve the quality of waste management in their living area. As it was mentioned before that it is common in residential area in Indonesia that every household has to pay some amount of money to have a so called proper waste collecting service, this fee is differed according to the economic level of each residential area. This occurrence could be the trigger of the unwillingness of end users to invest more in the improvement of the specific problem.

7.2.5 Defined Important Green Building Criteria

Green building criteria aimed to meet the environmental requirements, although this may be the basic idea, by focusing on the core of sustainable development, most all of these criteria have been chosen to be included in the green building assessment or green building certification system due to its connectivity to the current yet not well defined environmental problems. Without jeopardizing the environmental performance of buildings, further awareness has to be considered. End users of hold important role in the sustainability of any investment. Empirical study was conducted to identify the end user perception towards green building criteria, with the premise that green building certification system helps to improve the living quality of the end users, on this case, all observed respondents in Jakarta and Surabaya. With the premise that green building criteria will enhance the environmental performance of certain building or housing, a financial issue will emerge due to either improved technology or extra cost that are needed to be spent in order to reach the benefit of certain criterion.

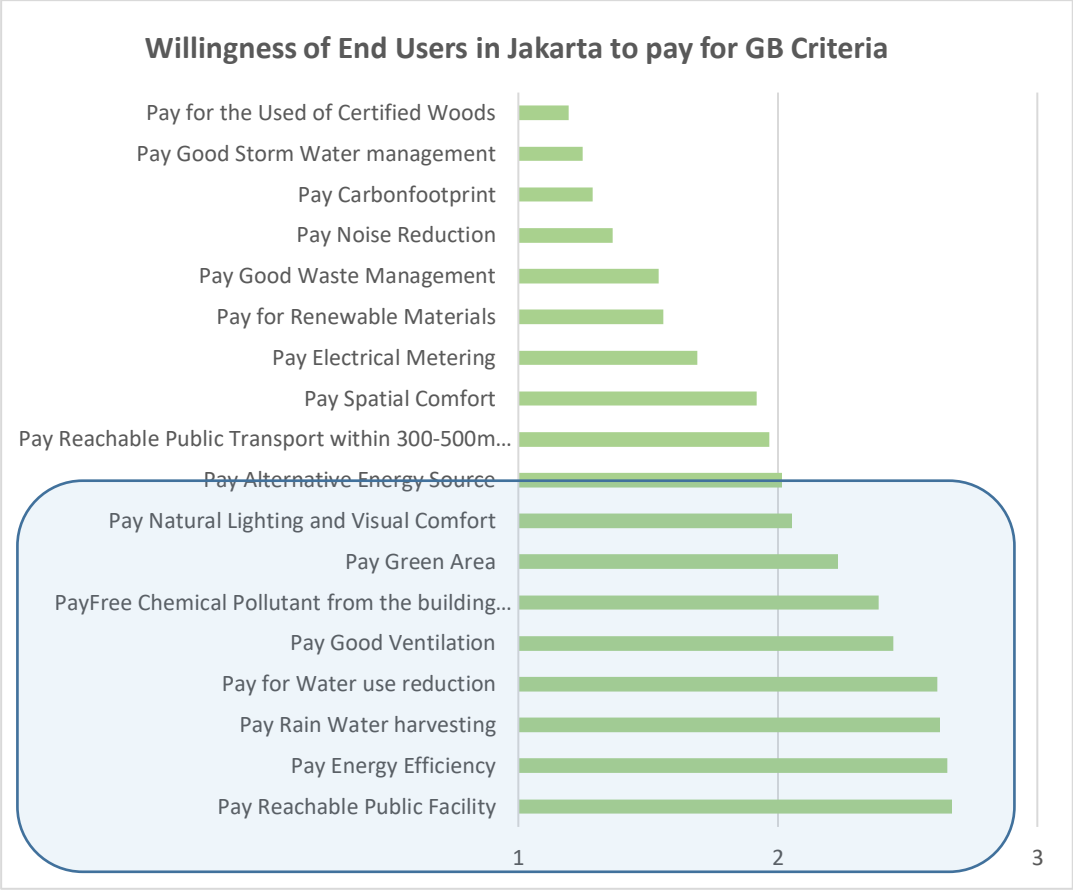


Figure 90: Willingness of the End User in Jakarta to pay for Green Building Criteria

Moreover, criteria that are considered by end users as important ones are not necessarily applicable when the end users are not willing to invest on that particular matters. This particular perspective is based on the basic idea of the vicious circle of blame by David Cadman, where he stated that each of party involves in the commitment of a more sustainable real estate practice, blame each other for the failure of the sustainable development function. However, this

circle of blame can be broken by looking at the nature of an investment. Based on its definition, where to invest means to allocate certain resources with the hope to gaining a benefit in the future. Under this circumstance, investment in green building or in this case in green housing should be beneficial in the future, of course without jeopardizing the environmental requirements. Thus, the question remains, how an investment can be as beneficial as possible in order to ensure that the life cycle of the investment itself remains. Empirical study on the previous chapter used an end user perspective approach to capture the main importance of environmental building performance. Set of criteria were listed as considered important ones and would later be chosen by end users according to their subjectivity understanding concerning quality of living. While some criteria are considered by end users as important criteria to be included in a green building assessment, not all of these criteria are important enough for the end user in order for them to invest in it. These six following criteria are defined as important green building criteria for the household improvement by end users living in Jakarta and Surabaya: Water Use Reduction; Rain Water Harvesting; Alternative Energy Source; Good Ventilation, Natural Lighting and Visual Comfort, Spatial Comfort as well as Good Storm Water Management.

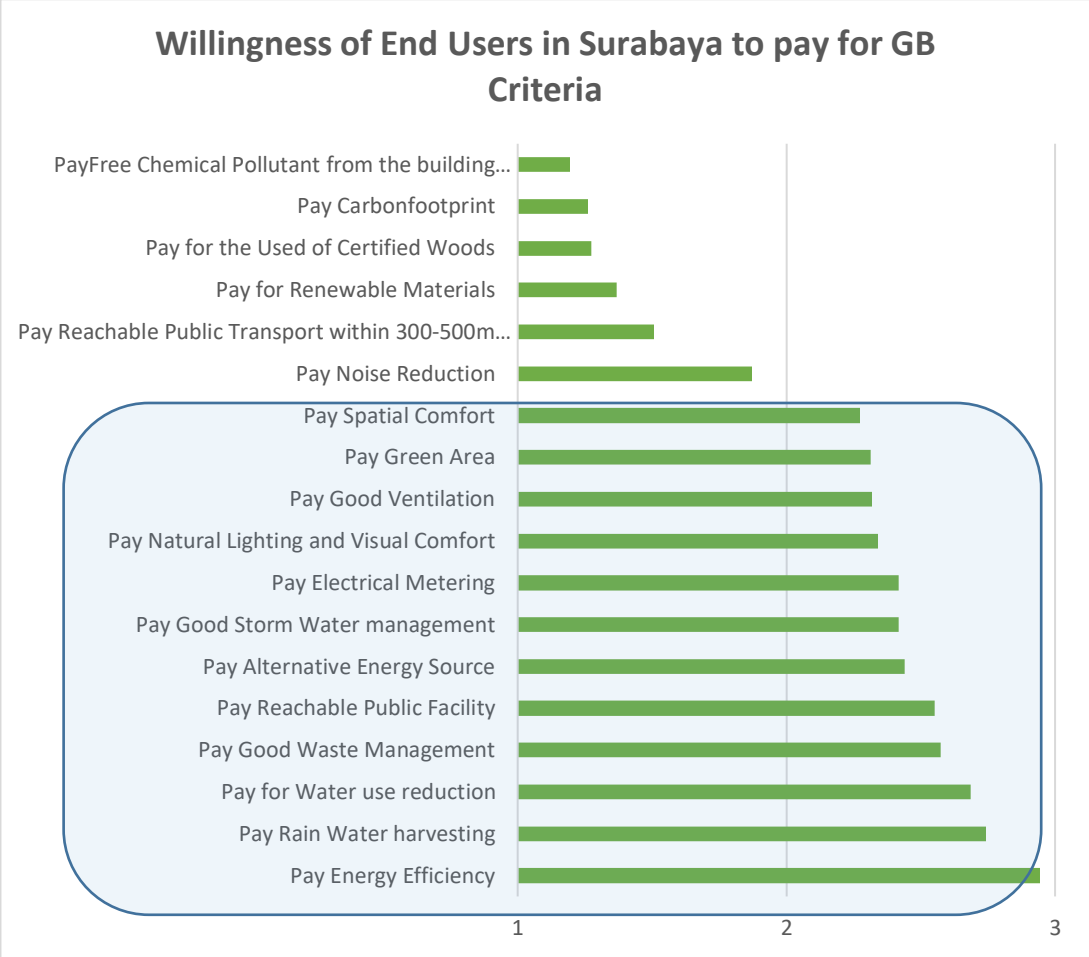


Figure 91: Willingness of End Users in Surabaya to Pay for Green Building Criteria

Figure 90 shows the willingness of end users in Jakarta to pay for green building criteria that they have rated based on its importance on the first place. As can be seen, there are about nine

criteria that the end users are willing to pay for their housing improvement. Meanwhile in Surabaya, there are more criteria that the end users are willing to pay for. Furthermore, based on these collected criteria, a list of considered important criteria can be drawn in order to have a new set of green building criteria that will certainly be beneficial for both end users and the investors. Next thing to remember that since there are two different cities that have been observed on this research, it is necessary to consider the separation of green building criteria based on each observed city.

Furthermore, the proposed green building criteria will be based on the combination of the defined serious housing/household problems and the considered important green building criteria that end users are willing to pay for.

7.3 Proposed Green Building Criteria for Housing Industry in Indonesia

The new green building criteria are formed from both existing housing problems and existing green building criteria. The process to propose a new set of green building criteria is undergone several considerations such as the seriousness of the existing problems facing by end users, the willingness of end users to pay for the solution of those problems, importance of green building criteria for housing/household improvement as lastly the willingness of the end users to pay for such improvements offered by green building criteria.

Figure 92: Process of Proposed Green Building criteria

Following table shows a new proposed green building criteria for Indonesian housing industry, generating from the most troubling problems that need to be solved and importance improvement for a better living quality.

Table 67: Proposed Green Building Criteria for the Indonesian Housing Industry

	Defined Serious Problem	Considered Financially Important Green Building Criteria	Proposed Green Building Criteria for Indonesian Housing Industry
Water	1. Difficulty in accessing clean water 2. Poor quality of drinking water	1. Water use reduction 2. Rain water harvesting	1. Water use reduction 2. Rain water harvesting 3. Improved quality of drinking water
Energy	3. Unreliable electricity source	3. Alternative energy source 4. Energy efficiency 5. Electrical Metering	4. Alternative energy source 5. Energy efficiency 6. Electrical metering
Waste & Flooding	4. Inadequate solid waste disposal	6. Good waste management	7. Good waste management
	5. Flooding & inadequate drainage of storm water	7. Good storm water management 8. Green Area	8. Good storm water & drainage management 9. Green area
Air Quality	6. Bad air quality	9. Good ventilation	10. Improved air quality 11. Good ventilation
		10. Natural lighting and visual comfort 11. Free chemical pollutant from building material 12. Reachable public facility 13. Spatial Comfort	12. Natural lighting and visual comfort 13. Free chemical pollutant from building material 14. Reachable public facility 15. Spatial comfort

7.4 Concluding Remark

Green building assessment system or building certification system was designed to improve the environmental performance of buildings. The criteria on these assessment methods are supposed to answer every demand of the end users to both solve and improve their housing quality. Following points explain the finding of this chapter:

- Based on the empirical study conducted in the Indonesian housing industry, it can be seen that the existing Indonesian green building assessment method or also known as

GREENSHIP has failed to provide certain criteria that are believed to be important ones for the continuance of Indonesian housing industry. This is proofed by lack of correlation between existing problems facing by Indonesian housing industry and existing green building criteria provided by GREENSHIP.

- Six housing/household problems are defined to be the most serious problems for Indonesian housing industry especially in Jakarta and Surabaya which consist of Difficulty in accessing clean water, Bad quality of drinking water, Flooding and storm water, Unreliable electricity source, bad air quality, inadequate solid waste disposal and collection service.
- Rational behind the causality among mentioned defined serious problems shows that inadequate of solid waste disposal is the trigger for the occurrence of other problems.
- Cross impact analysis shows that inadequate solid waste disposal and collection service is considered as an active variable which actively influence other variables, or in other words, this particular problem is proved to be the problem that triggers other existing environmental problems in housing industry.
- End users are willing to invest more money in order to solve most of the considered serious problems beside inadequate solid waste disposal and collection service.
- Government is considered responsible by the end users to improve solid waste disposal and collection service.
- Some criteria of the existing certification system are considered by end users as important criteria to be included in a green building assessment, but not all of these criteria are important enough for the end user in order for them to invest in it. These six following criteria are defined as important green building criteria for the household improvement by end users living in Jakarta and Surabaya: Water Use Reduction; Rain Water Harvesting; Alternative Energy Source; Good Ventilation, Natural Lighting and Visual Comfort, Spatial Comfort as well as Good Storm Water Management.
- A sustainable investment is the investment that meets the basic requirement of end users which allowing the end users to pay for the improvement of their housing quality, which at the end makes it doable for investor to invest in such investment. End users have to be considered as the starting point of an investment, where the willingness to pay of end users plays the main role of the accepted investment.
- Set of proposed green building criteria are generated from the defined serious problems and considered financially important criteria of existing green building.

8 Summary and Outlook

It is satisfactory known that the key of a successful sustainable development relies on environment, social and financial aspects of the development itself, they are also known as three pillars of sustainable development. Together with the development of science and technology, it can be seen that there have been tremendous efforts to tackle environmental problems that occur as the impact of human activities.

Indonesia as a developing country has been gone through some several phases of economic condition. Monetary crisis in 1998 had pushed back the economy performance of the country as the escalation of inflation rate reached the two digits. Real estate industry in Indonesia was one of the most impacted sector suffered from the drastic declined from the crisis. However, Indonesia has shown a big improvement and slowly recovered from the crisis by repeatedly increase the economy strength of the country.

The enhancing of global awareness towards environmental protection has encouraged some industries especially real estate sector to come with a better solution in how to build sustainably. It has been known among real estate players that build without compromising the needs of the future generation is the basic idea of sustainable development approach in the industry. Nevertheless, Green Buildings have been considered as an expensive investment without a clear return of investment forecast. High design cost and materials included in a green building project are likely to be reasons that lower the attentiveness in such investment.

Indonesia has been facing the same problem in how to effectively apply a more environmentally friendly system in its building industry. End users as the main market force play an important role in the sustainable building investment as whole. In residential building industry for example, lack of governmental act to promote green building awareness has become one of the main factors hampering the end user from investing in more environmentally friendly buildings.

For this reason, investors are inhibited from further investment in green building segment. With this in mind, there is tremendous need to change the market force in real estate industry in Indonesia towards sustainable development in order to improve quality of life and the economic performance of the country in general.

Many countries use environmental building assessment methods to measure the environmental performance of buildings. These methods incorporate sustainable development as their governing principle and cover economic, social and environmental factors. The method can be applied using a rating system which accommodates a certain level of certification that defines the performance of the building in the market as well as clearly identifying the sustainable components of a building's portfolio that have been taken into consideration. GREENSHIP as the only existing building assessment method in Indonesia has not yet successfully improved the performance of Indonesian building industry towards sustainable development as a result of lack of financial consideration of such investment for both investors and end-users.

In developing countries like Indonesia where the awareness of society towards environmental protection is relatively low compares to developed countries. It is necessary to include government roles in order to take it into consideration the implementation of sustainability principle like Environmental Building Assessment Method onto building industry. The proposed way of thinking is by minimizing possible risk and enhancing probability of profit in the related investment. A survey conducted in Indonesia showed that building managers have some

concern about the global warming but there is not enough of sufficient research to identify whether they are willing to spend more money in order to reduce the effect of Global Warming created by buildings. This problem of course needs to be solved, the awareness of the importance of green building development must be supported by the willingness to take it into further actions.

The main principle of Green Building concept lays on the importance of environmental performance of the building. This however is needed to be improved, since the investment itself requires serious financial consideration in order to make it work in the long run. Sustainable Building is more than just a building that environmentally friendly, sustainable building generates a much wider area to cover, hence it is not only about environmental performance of the building itself but also the sustainable investment which means the investment that continuously and financially beneficial for the parties involved.

This chapter pinpoints the finding of the research based on the research objective described on the very first chapter.

- Key issues that underpin the environmental performance of building in the Indonesian housing industry are the basic need of the end users as building consumers as well as their willingness to pay for the necessary improvements.
- GREENSHIP failed to consider the existing problems facing by the Indonesian housing industry, hence the application of the system itself cannot ensure the sustainable performance of the specified industry.
- Indonesia as developing country still suffers from certain housing/household problems that hampered the housing industry from being sustainable. Improvement or solution for the existing environmental problems such as difficulty in accessing clean water, poor quality of drinking water, flooding, unreliable electricity source, inadequate solid waste disposal and collection service as well as bad air quality are highly necessary.
- Inadequate solid waste disposal and collection service is known as problem that triggers the occurrences of other existing problems. This problem is also found as the only problem which end users are not willing to invest more in.
- Main sustainability consideration in the Indonesian housing industry relies on the end users as the determinant of housing industry. If a certain building assessment method fulfils the needs or the requirements of the end users, they will more likely to invest in such housing. Therefore, a set of new criteria is proposed based on both actual serious problems and considered financially important criteria of the existing green building certification system.

Finally, a further research about a development of financially self-sustaining investment as it was proposed on the previous chapter is recommended in order to speed up the development of sustainable housing industry in Indonesia. Moreover, weighting system is as well needed to be allocated to each new proposed criterion for the development of the green building assessment method in Indonesia.

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Appendix

Appendix A

Survey on:
Main Sustainability Consideration for the Environmental Building Assessment Method in the Indonesian Real Estate Industry

Clear evidence of environmental degradation caused by the activity and product of the construction industry has enhanced awareness of how to protect and to prevent the environment from further damage. Along with an increasing awareness of global environmental problems, the challenge of how to build sustainably has become a significant consideration within the construction industry. Sustainable development emphasizes the concept of meeting the needs of the present generation without compromising the needs and wellbeing of future generations. Applying this concept to the construction industry means to build without abdicating our environmental responsibilities.

This questionnaire explored the perception of Real Estate tenants towards Green Building in Indonesia based on Sustainable Development Principle. This questionnaire aimed to support the research of Sustainable Development in Indonesian Real Estate Industry.

Your opinions according to your experience and knowledge will be very useful to support the main objective of this research. All the data collected from this questionnaire will be used for the purpose of scientific research only.

Thank you for your attention and willingness to take part in this research.

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Part I: General Information

Name: _____

Age:

☐ ≤ 20 ☐ 26-35 ☐ 45-55

☐ 21-25 ☐ 36-45 ☐ > 55

Gender:

☐ Male ☐ Female

Marital Status:

☐ Married ☐ Single ☐ Divorced

City:

☐ Surabaya ☐ Jakarta ☐ Others _____

Monthly Income (in Million Rupiah):

☐ < 2 ☐ 5 - <7.49 ☐ ≥ 10

☐ 2 - <4.99 ☐ 7.5 – 9.99

Part II: Housing Preferences

In which area do you live right now?

☐ Rural ☐ Suburban ☐ Urban

In which area do you prefer to live?

☐ Rural ☐ Suburban ☐ Urban

What is the ownership status of your current residence?

☐ Own ☐ Rent ☐ Etc, please specify

Which type of house do you have/rent currently?

☐ Single-family detached home ☐ Apartment ☐ Other

What is the size of your current house?

☐ <21 m^2 ☐ 22-70 m^2 ☐ 71-100 m^2 ☐ > 100 m^2

If you own a house or plan to buy a house, did you or will you use mortgage to finance your purchase?

☐ Yes ☐ No ☐ not sure

Which type of Bank do you prefer to have your mortgage application and why?

☐ Public ☐ Private

Reason why:

Part III: Potential Household Problems

Table below shows several Potential Households Problems

Column A: Please choose how serious each problem is according to your current household activity

Column B: Please choose whether you are willing to pay more in order to have an improvement on each of the related problem

	A **How Serious the Problem** Not Serious → Very Serious	**B** **Willingness to pay**		
		Yes	No	Not sure
Difficult access to drinking water	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Poor quality of drinking water	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Inadequate disposal of residential wastewater	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Inadequate disposal of human excreta	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Flooding and inadequate drainage of storm-water	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Poor access for motor vehicles	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Lack of public transport	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Unreliable electricity supply	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Inadequate solid waste & collection service	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Presence of litter and illegal piles of solid waste	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Nuisance from solid waste transfer points	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Nuisance from solid waste disposal sites	☐ ☐ ☐ ☐ ☐ ☐	○	○	○

Part IV: Green Building

Have you ever heard about the concept of Green Building?

☐ Yes ☐ No

Do you understand the main concept of Green Building?

☐ Yes ☐ No ☐ not sure

Concept of Green Building

Green building (also known as green construction or sustainable building) refers to a structure and using process that is environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation, and demolition.

The benefits of building green include cost savings from reduced energy, water, and waste; lower operations and maintenance costs; and enhanced occupant productivity and health.

Based on the above description,

Have you ever invested in Green Building?

☐ Yes ☐ No ☐ not sure

Would you like to invest in Green Building?

☐ Yes ☐ No ☐ not sure

Which of these factors could hamper you from Investing in Green Building?
(You can choose more than one answer)

☐ Slightly higher initial cost/upfront cost

☐ Lack of Cost considerations & Implications of Green Building

☐ I do not need the benefits of Green Building

☐ Lack of available Green Building

☐ There are not enough options of available Green Building

☐ Lack of knowledge on Sustainable/Green Building practices

☐ Absence of governmental action to promote Green Building Awareness

Below are criteria that can improve the housing performance

Column A: Please choose how influential each criterion is, in your home buying/rental decision.
Column B: Please choose whether you are willing to pay more in order to have these related criterion as improvement on your house

	A **Level of Influence on Home Buying Decision** Very uninfluential ← → Very influential	**B** **Willingness to pay**		
		Yes	No	Not Sure
Water use reduction	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Rain Water harvesting	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Renewable Materials	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Used of Certified Woods	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Free Chemical Pollutant from the building material	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Good Waste Management	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Good Storm Water management	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Electrical Metering	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Energy Efficiency	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Good Ventilation	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Green Area	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Natural Lighting	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Thermal and Humidity Comfort	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Visual Comfort	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Sustainable Site/ Location	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Reachable Public Facility within 1500m walking distance	☐ ☐ ☐ ☐ ☐ ☐	○	○	○
Reachable Public Transport within 300-500m walking distance	☐ ☐ ☐ ☐ ☐ ☐	○	○	○

- Than k You -

Appendix B

Correlation Among Households Problems

		Difficult Access Water	Poor Quality of drinking Water	Inadequate disposal of Wastewater	Inadequate disposal of human excreta	Flooding and Storm Water	Poor Acess for motor vehicle	Lack of Public Transport	Unreliable Electricity Supply	Inadequate solid waste disposal	Presence of litter and illegal piles of solid	Bad air quality	Nuisance from solid waste disposal site
Difficult Access Water	Pearson	1	.028	,149**	,179**	,218**	-.082	,373**	-.010	,262**	,242**	,370**	-.039
	Sig. (2-		.560	.002	.000	.000	.093	.000	.840	.000	.000	.000	.426
	N	421	421	421	421	421	421	421	421	421	421	421	421
Poor Quality of drinking Water	Pearson	.028	1	.063	,178**	,112*	-.019	-.010	-.073	.087	.087	.052	.033
	Sig. (2-	.560		.196	.000	.021	.701	.830	.134	.076	.073	.287	.503
	N	421	421	421	421	421	421	421	421	421	421	421	421
Inadequate disposal of Wastewater	Pearson	,149**	.063	1	.064	,402**	.044	-.031	,117*	,122*	,165**	,257**	.024
	Sig. (2-	.002	.196		.193	.000	.370	.520	.016	.013	.001	.000	.624
	N	421	421	421	421	421	421	421	421	421	421	421	421
Inadequate disposal of human	Pearson	,179**	,178**	.064	1	.056	-,111*	,298**	-.042	,287**	,307**	,121*	.049
	Sig. (2-	.000	.000	.193		.249	.023	.000	.389	.000	.000	.013	.318
	N	421	421	421	421	421	421	421	421	421	421	421	421
Flooding and Storm Water	Pearson	,218**	,112*	,402**	.056	1	-.045	-,122*	.006	,149**	-.027	,292**	-.022
	Sig. (2-	.000	.021	.000	.249		.359	.012	.897	.002	.574	.000	.659
	N	421	421	421	421	421	421	421	421	421	421	421	421
Poor Acess for motor vehicle	Pearson	-.082	-.019	.044	-,111*	-.045	1	-.077	,103*	-.059	-.064	-,183**	-.039
	Sig. (2-	.093	.701	.370	.023	.359		.115	.035	.230	.192	.000	.427
	N	421	421	421	421	421	421	421	421	421	421	421	421
Lack of Public Transport	Pearson	,373**	-.010	-.031	,298**	-,122*	-.077	1	-,102*	,221**	,462**	,180**	-.084
	Sig. (2-	.000	.830	.520	.000	.012	.115		.037	.000	.000	.000	.085
	N	421	421	421	421	421	421	421	421	421	421	421	421
Unreliable Electricity Supply	Pearson	-.010	-.073	,117*	-.042	.006	,103*	-,102*	1	-.072	-.012	,097*	-.041
	Sig. (2-	.840	.134	.016	.389	.897	.035	.037		.141	.799	.047	.397
	N	421	421	421	421	421	421	421	421	421	421	421	421
Inadequate solid waste disposal	Pearson	,262**	.087	,122*	,287**	,149**	-.059	,221**	-.072	1	,200**	,133**	-.020
	Sig. (2-	.000	.076	.013	.000	.002	.230	.000	.141		.000	.006	.689
	N	421	421	421	421	421	421	421	421	421	421	421	421
Presence of litter and illegal piles of	Pearson	,242**	.087	,165**	,307**	-.027	-.064	,462**	-.012	,200**	1	,183**	-,118*
	Sig. (2-	.000	.073	.001	.000	.574	.192	.000	.799	.000		.000	.015
	N	421	421	421	421	421	421	421	421	421	421	421	421
Bad air quality	Pearson	,370**	.052	,257**	,121*	,292**	-,183**	,180**	,097*	,133**	,183**	1	-.039
	Sig. (2-	.000	.287	.000	.013	.000	.000	.000	.047	.006	.000		.431
	N	421	421	421	421	421	421	421	421	421	421	421	421
Nuisance from solid waste	Pearson	-.039	.033	.024	.049	-.022	-.039	-.084	-.041	-.020	-,118*	-.039	1
	Sig. (2-	.426	.503	.624	.318	.659	.427	.085	.397	.689	.015	.431	
	N	421	421	421	421	421	421	421	421	421	421	421	421

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

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

Appendix B

Correlation between Household Problems and Willingness to pay in Jakarta

		Pay Difficult Access Water	Pay Poor Quality of drinking Water	Pay Inadeqate disposal of waste water	Pay Inadequate disposal of human excreta	Pay Flooding and Storm Water	Pay Poor Acess for motor vehicle	Pay Lack of Public Transport	Pay Unreliable Electricity Supply	Pay Inadequate solid waste disposal	Pay Presence of litter and illegal piles of solid	Pay Bad Air Quality	Pay Nuisance from solid waste disposal site
Difficult Access Water	Pearson	,567**	-.086	,398**	-.039	,374**	,146**	,105*	-.092	,155**	,136**	,235**	-,246**
	Sig. (2-tailed)	.000	.078	.000	.429	.000	.003	.032	.060	.001	.005	.000	.000
	N	421	421	421	421	421	421	421	421	421	421	421	421
Poor Quality of drinking Water	Pearson	,109*	,249**	-.028	,142**	-.040	.081	.026	-,204**	.004	-.015	.024	-,181**
	Sig. (2-tailed)	.025	.000	.568	.004	.418	.097	.596	.000	.943	.757	.631	.000
	N	421	421	421	421	421	421	421	421	421	421	421	421
Inadequate disposal of Wastewater	Pearson	,154**	.046	,147**	,097*	,143**	-.011	.029	-.094	.007	-.032	,147**	.041
	Sig. (2-tailed)	.002	.341	.003	.047	.003	.817	.550	.053	.880	.508	.002	.405
	N	421	421	421	421	421	421	421	421	421	421	421	421
Inadequate disposal of human excreta	Pearson	,137**	.067	,188**	,249**	,155**	.085	.073	-,159**	-.001	-.010	,113*	-,190**
	Sig. (2-tailed)	.005	.168	.000	.000	.001	.080	.133	.001	.986	.839	.020	.000
	N	421	421	421	421	421	421	421	421	421	421	421	421
Flooding and Storm Water	Pearson	,123*	,114*	,097*	.089	,306**	-.035	-.083	-,121*	.022	.013	,199**	-.028
	Sig. (2-tailed)	.012	.020	.046	.067	.000	.469	.089	.013	.657	.796	.000	.563
	N	421	421	421	421	421	421	421	421	421	421	421	421
Poor Acess for motor vehicle	Pearson	-.085	.065	-.082	-.079	-.093	-.081	-.048	.064	,109*	.014	-,102*	,103*
	Sig. (2-tailed)	.083	.184	.093	.106	.057	.098	.322	.192	.025	.777	.036	.035
	N	421	421	421	421	421	421	421	421	421	421	421	421
Lack of Public Transport	Pearson	,176**	-,123*	,358**	-.082	,204**	,120*	,363**	-.040	,103*	,134**	,173**	-,101*
	Sig. (2-tailed)	.000	.011	.000	.093	.000	.014	.000	.412	.034	.006	.000	.039
	N	421	421	421	421	421	421	421	421	421	421	421	421
Unreliable Electricity Supply	Pearson	-.033	-.055	.093	-.023	-.013	-.045	-.057	,320**	-.022	.024	.044	.052
	Sig. (2-tailed)	.493	.260	.058	.635	.795	.356	.244	.000	.654	.624	.363	.287
	N	421	421	421	421	421	421	421	421	421	421	421	421
Inadequate solid waste disposal	Pearson	,177**	-.060	.072	,113*	,123*	.038	.062	-,122*	-.030	-,102*	.085	-,142**
	Sig. (2-tailed)	.000	.220	.138	.020	.012	.442	.206	.012	.541	.037	.081	.004
	N	421	421	421	421	421	421	421	421	421	421	421	421
Presence of litter and illegal piles of solid	Pearson	,116*	-.087	,226**	-.024	.086	,113*	,209**	-.039	.037	.046	,120*	-,198**
	Sig. (2-tailed)	.017	.075	.000	.625	.078	.020	.000	.421	.452	.346	.014	.000
	N	421	421	421	421	421	421	421	421	421	421	421	421
Bad air quality	Pearson	,191**	-.045	,346**	-.001	,338**	,118*	-.060	-,102*	-.028	.007	,550**	-,285**
	Sig. (2-tailed)	.000	.356	.000	.983	.000	.016	.220	.037	.566	.883	.000	.000
	N	421	421	421	421	421	421	421	421	421	421	421	421
Nuisance from solid waste disposal site	Pearson	-.067	-.018	-.020	.040	-.080	-,109*	-.010	-,130**	-.063	-,103*	-.031	,161**
	Sig. (2-tailed)	.169	.717	.682	.418	.102	.025	.832	.008	.198	.035	.528	.001
	N	421	421	421	421	421	421	421	421	421	421	421	421

Correlation between Household Problems and Willingness to pay in Surabaya

Appendix B

		Pay Difficult Access Water	Pay Poor Quality of drinking Water	Pay Inadeqate disposal of waste water	Pay Inadequate disposal of human excreta	Pay Flooding and Storm Water	Pay Poor Acess for motor vehicle	Pay Lack of Public Transport	Pay Unreliable Electricity Supply	Pay Inadequate solid waste disposal	Pay Presence of litter and illegal piles of solid	Pay Bad Air Quality	Pay Nuisance from solid waste disposal site
Difficult Access Water	Pearson	,570**	.101	.002	-.024	.119	.034	,150*	-.043	.090	.021	.028	-.094
	Sig. (2-tailed)	.000	.178	.977	.750	.111	.648	.045	.570	.233	.776	.710	.209
	N	179	179	179	179	179	179	179	179	179	179	179	179
Poor Quality of drinking Water	Pearson	.094	,182*	-.107	.080	-.099	.126	,185*	-.121	.016	.084	.101	-,210**
	Sig. (2-tailed)	.211	.015	.154	.285	.186	.092	.013	.108	.831	.263	.181	.005
	N	179	179	179	179	179	179	179	179	179	179	179	179
Inadequate disposal of Wastewater	Pearson	.127	,202**	.113	.054	,166*	.112	-.078	.079	-.032	-.050	,155*	.119
	Sig. (2-tailed)	.091	.007	.132	.470	.027	.137	.301	.295	.674	.510	.038	.113
	N	179	179	179	179	179	179	179	179	179	179	179	179
Inadequate disposal of human excreta	Pearson	-.007	.047	-.145	,173*	-.076	.083	.077	-.146	-.068	-.126	.021	-,179*
	Sig. (2-tailed)	.930	.530	.052	.021	.312	.270	.307	.051	.366	.093	.776	.017
	N	179	179	179	179	179	179	179	179	179	179	179	179
Flooding and Storm Water	Pearson	.077	,219**	-.098	,149	,246**	-.076	.046	-.055	-.079	-.138	,199**	.113
	Sig. (2-tailed)	.306	.003	.192	.047	.001	.310	.544	.462	.295	.065	.008	.133
	N	179	179	179	179	179	179	179	179	179	179	179	179
Poor Acess for motor vehicle	Pearson	-.076	-.049	-.053	-.072	-.080	.008	-,185*	-.002	.068	-.012	-.118	-.014
	Sig. (2-tailed)	.313	.512	.479	.341	.288	.919	.013	.974	.369	.872	.116	.855
	N	179	179	179	179	179	179	179	179	179	179	179	179
Lack of Public Transport	Pearson	-.040	-.095	.120	-.097	-,194**	,174*	.136	-.058	,217**	,206**	.120	.143
	Sig. (2-tailed)	.591	.204	.110	.198	.009	.019	.069	.443	.004	.006	.111	.057
	N	179	179	179	179	179	179	179	179	179	179	179	179
Unreliable Electricity Supply	Pearson	-.041	-.087	.135	-.007	-.028	-.065	-.103	,539**	.016	.058	.007	.091
	Sig. (2-tailed)	.588	.249	.072	.930	.705	.389	.171	.000	.828	.443	.929	.226
	N	179	179	179	179	179	179	179	179	179	179	179	179
Inadequate solid waste disposal	Pearson	,168*	.002	-,180*	,193**	-.062	.125	.004	-.067	-.088	-.127	-.065	-.092
	Sig. (2-tailed)	.025	.975	.016	.010	.407	.097	.960	.376	.240	.091	.385	.221
	N	179	179	179	179	179	179	179	179	179	179	179	179
Presence of litter and illegal piles of solid	Pearson	-.102	.032	-.006	-.056	-,166*	.041	.082	-.013	.069	.090	.051	-,192*
	Sig. (2-tailed)	.173	.672	.932	.459	.026	.589	.275	.863	.362	.232	.500	.010
	N	179	179	179	179	179	179	179	179	179	179	179	179
Bad air quality	Pearson	.053	,168*	.111	,162*	,181*	.059	-.074	-.016	-,342**	-,211**	,542**	-,208**
	Sig. (2-tailed)	.478	.025	.140	.030	.015	.433	.324	.829	.000	.005	.000	.005
	N	179	179	179	179	179	179	179	179	179	179	179	179
Nuisance from solid waste disposal site	Pearson	-.071	.010	.012	-.130	-.019	-.024	.022	-.105	.047	-.024	-.037	,294**
	Sig. (2-tailed)	.348	.898	.872	.084	.796	.747	.768	.162	.535	.746	.623	.000
	N	179	179	179	179	179	179	179	179	179	179	179	179

Appendix B

Correlation between Household Problems and Green Building Criteria

		Water USe Reduction	Rain Water harvesting	Energy Efficiency	Electrical Metering	Alternative Energy Source	Renewable Materials	Free Chemical Pollutant from the building material	Used of Certified Woods	Good Ventilation	Natural Lighting and Visual Comfort	Spatial Comfort	Noise reduction	Good Storm Water management	Good Waste Management	Green Area	Carbon Footprint	Reachable Public Facility	Reachable Public Transport within 300-500m walking distance
Difficult Access Water	Pearson	,645**	,621**	.075	,135**	-,298**	,152**	-,367**	,141**	,270**	,306**	,133**	.038	.063	-.040	.038	.026	,209**	,109
	Sig. (2-	.000	.000	.124	.006	.000	.002	.000	.004	.000	.000	.006	.433	.195	.417	.436	.596	.000	.025
	N	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421
Poor Quality of drinking	Pearson	,099*	,151**	,187**	-.034	.024	-.013	-.001	.078	-.026	-.066	.013	-.041	-.040	.062	-.034	.055	-.030	.013
	Sig. (2-	.042	.002	.000	.482	.630	.784	.979	.110	.593	.175	.798	.399	.416	.204	.486	.264	.546	.792
	N	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421
Inadequate disposal of	Pearson	,167**	,109*	,233**	.063	.087	.065	.010	.050	-.029	-,256**	-,133**	.046	,370**	-,117*	-.043	-.052	-.043	.051
	Sig. (2-	.001	.025	.000	.200	.073	.186	.838	.309	.553	.000	.006	.343	.000	.016	.376	.289	.383	.293
	N	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421
Inadequate disposal of human	Pearson	.074	,120*	-.040	.013	-,179**	.028	-,193**	-.085	,137**	,146**	,121*	.051	-,181**	.042	,143**	-.072	,179**	.043
	Sig. (2-	.129	.014	.411	.796	.000	.570	.000	.082	.005	.003	.013	.293	.000	.395	.003	.141	.000	.378
	N	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421
Flooding and Storm Water	Pearson	,149**	,226**	-.033	-.061	-.053	.055	-,120*	.095	,165**	-.061	-.012	-.092	,503**	-,209**	.014	.036	-,161**	-.084
	Sig. (2-	.002	.000	.501	.212	.277	.260	.014	.051	.001	.215	.813	.060	.000	.000	.768	.465	.001	.087
	N	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421
Poor Acess for motor	Pearson	-.086	-.054	-,132**	-.001	.066	-,131**	.079	-.043	-,101*	-,223**	.022	.029	.055	.000	-,157**	-.052	-,109*	,173**
	Sig. (2-	.077	.272	.007	.978	.177	.007	.106	.374	.039	.000	.660	.557	.260	.992	.001	.285	.025	.000
	N	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421
Lack of Public Transport	Pearson	,249**	,242**	-.054	.012	-,218**	.029	-,410**	-.050	,232**	,370**	,097*	.044	-,161**	.061	,262**	-.059	,414**	,389**
	Sig. (2-	.000	.000	.272	.808	.000	.559	.000	.302	.000	.000	.047	.365	.001	.213	.000	.226	.000	.000
	N	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421
Unreliable Electricity Supply	Pearson	-.009	.023	.012	-.026	,182**	.008	-.077	.081	-.017	-.061	.073	.058	.021	-.042	-,128**	-.072	-.073	.006
	Sig. (2-	.853	.640	.805	.597	.000	.875	.115	.096	.728	.213	.133	.232	.660	.389	.009	.139	.137	.904
	N	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421
Inadequate solid waste	Pearson	,143**	,136**	.005	-,104*	-,107*	-,112*	-,248**	.011	.068	.048	-.035	.053	.033	.075	,126**	.005	.075	,136**
	Sig. (2-	.003	.005	.920	.033	.028	.022	.000	.828	.166	.323	.470	.278	.494	.126	.010	.917	.123	.005
	N	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421
Presence of litter and illegal	Pearson	,246**	,190**	.032	,113*	-,159**	.039	-,244**	-.068	,105*	,154**	-.055	-.014	-.042	,356**	,151**	-.022	,263**	,260**
	Sig. (2-	.000	.000	.511	.020	.001	.422	.000	.161	.032	.001	.256	.777	.393	.000	.002	.649	.000	.000
	N	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421
Bad air quality	Pearson	,335**	,291**	,099*	.025	-,248**	,174**	-,262**	,116*	,279**	,192**	-.033	.081	,114*	-,123*	-.046	.037	.069	-.054
	Sig. (2-	.000	.000	.043	.616	.000	.000	.000	.017	.000	.000	.494	.096	.019	.011	.349	.454	.159	.268
	N	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421
Nuisance from solid waste	Pearson	-.092	-.061	.065	.089	.074	.041	-.030	-.053	-.033	.006	-.087	-.044	-.091	.019	-.005	-.065	-.037	-.009
	Sig. (2-	.060	.211	.181	.069	.127	.406	.539	.280	.503	.904	.075	.367	.062	.692	.912	.180	.455	.851
	N	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421	421

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

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

Appendix C

Independent Sample Test of Household Problems between Respondent in Jakarta and Surabaya

		Equality of		t-test for Equality of Means						
								Std.	Interval of the	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Error Difference	Lower	Upper
Pay Difficult Access Water	Equal variances assumed	76.889	.000	6.778	419	.000	.441	.065	.313	.569
	Equal variances not assumed			6.407	293.417	.000	.441	.069	.305	.576
Pay Poor Quality of drinking Water	Equal variances assumed	43.729	.000	-3.179	419	.002	-.099	.031	-.160	-.038
	Equal variances not assumed			-3.439	392.791	.001	-.099	.029	-.155	-.042
Pay Inadeqate disposal of waste water	Equal variances assumed	8.297	.004	12.120	419	.000	.937	.077	.785	1.089
	Equal variances not assumed			11.925	359.049	.000	.937	.079	.782	1.091
Pay Inadequate disposal of human excreta	Equal variances assumed	1.382	.240	-.638	419	.524	-.028	.044	-.115	.058
	Equal variances not assumed			-.634	372.784	.527	-.028	.044	-.115	.059
Pay Flooding and Storm Water	Equal variances assumed	281.150	.000	10.981	419	.000	.782	.071	.642	.921
	Equal variances not assumed			10.091	251.415	.000	.782	.077	.629	.934
Pay Poor Acess for motor vehicle	Equal variances assumed	30.957	.000	2.746	419	.006	.182	.066	.052	.312
	Equal variances not assumed			2.864	418.924	.004	.182	.063	.057	.306
Pay Lack of Public Transport	Equal variances assumed	9.045	.003	1.316	419	.189	.127	.097	-.063	.318
	Equal variances not assumed			1.322	389.840	.187	.127	.096	-.062	.317
Pay Unreliable Electricity Supply	Equal variances assumed	3.760	.053	-1.142	419	.254	-.081	.071	-.220	.058
	Equal variances not assumed			-1.154	397.219	.249	-.081	.070	-.218	.057
Pay Inadequate solid waste disposal	Equal variances assumed	30.998	.000	3.498	419	.001	.273	.078	.120	.427
	Equal variances not assumed			3.588	412.013	.000	.273	.076	.124	.423
Pay Presence of litter and illegal piles of solid	Equal variances assumed	46.994	.000	3.932	419	.000	.307	.078	.154	.461
	Equal variances not assumed			4.059	415.911	.000	.307	.076	.158	.456
Pay Bad Air Quality	Equal variances assumed	62.627	.000	6.114	419	.000	.341	.056	.231	.450
	Equal variances not assumed			5.859	315.534	.000	.341	.058	.226	.455
Pay Nuisance from solid waste disposal site	Equal variances assumed	114.634	.000	-6.026	419	.000	-.409	.068	-.543	-.276
	Equal variances not assumed			-5.667	285.085	.000	-.409	.072	-.551	-.267

Appendix C

Independent Sample Test of Household Problems between Respondents living in Suburban and Urban Area

		Equality of		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Differen	Interval of the	
									Lower	Upper
Pay Difficult Access Water	Equal variances assumed	31.051	.000	2.828	419	.005	.219	.077	.067	.371
	Equal variances not assumed			3.298	247.173	.001	.219	.066	.088	.349
Pay Poor Quality of drinking Water	Equal variances assumed	24.607	.000	-2.640	419	.009	-.094	.035	-.163	-.024
	Equal variances not assumed			-2.259	143.955	.025	-.094	.041	-.176	-.012
Pay Inadeqate disposal of waste water	Equal variances assumed	8.913	.003	2.881	419	.004	.292	.101	.093	.491
	Equal variances not assumed			3.044	199.899	.003	.292	.096	.103	.481
Pay Inadequate disposal of human excreta	Equal variances assumed	.961	.328	-.526	419	.599	-.026	.050	-.125	.072
	Equal variances not assumed			-.535	186.313	.593	-.026	.049	-.124	.071
Pay Flooding and Storm Water	Equal variances assumed	.023	.880	.119	419	.905	.011	.092	-.170	.192
	Equal variances not assumed			.119	180.719	.906	.011	.092	-.171	.192
Pay Poor Acess for motor vehicle	Equal variances assumed	.456	.500	.334	419	.738	.025	.076	-.124	.175
	Equal variances not assumed			.327	174.085	.744	.025	.078	-.128	.179
Pay Lack of Public Transport	Equal variances assumed	.490	.484	7.524	419	.000	.780	.104	.576	.984
	Equal variances not assumed			7.581	183.079	.000	.780	.103	.577	.983
Pay Unreliable Electricity Supply	Equal variances assumed	18.235	.000	2.050	419	.041	.164	.080	.007	.322
	Equal variances not assumed			2.307	227.898	.022	.164	.071	.024	.305
Pay Inadequate solid waste disposal	Equal variances assumed	1.872	.172	1.346	419	.179	.121	.090	-.056	.299
	Equal variances not assumed			1.321	175.086	.188	.121	.092	-.060	.303
Pay Presence of litter and illegal piles of solid	Equal variances assumed	9.527	.002	2.225	419	.027	.200	.090	.023	.378
	Equal variances not assumed			2.110	165.824	.036	.200	.095	.013	.388
Pay Bad Air Quality	Equal variances assumed	.043	.835	.240	419	.810	.016	.066	-.114	.146
	Equal variances not assumed			.238	177.417	.812	.016	.067	-.116	.148
Pay Nuisance from solid waste disposal site	Equal variances assumed	.375	.541	.152	419	.879	.012	.081	-.146	.171
	Equal variances not assumed			.148	172.253	.882	.012	.083	-.151	.176

Independent Sample Test of the Importance of Green Building Criteria between Respondents in Jakarta and Surabaya

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									Interval of the	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Water USe Reduction	Equal variances assumed	7.750	.006	10.919	419	.000	1.037	.095	.850	1.224
	Equal variances not assumed			10.865	376.475	.000	1.037	.095	.849	1.225
Rain Water harvesting	Equal variances assumed	2.770	.097	11.048	419	.000	1.058	.096	.870	1.246
	Equal variances not assumed			10.973	373.705	.000	1.058	.096	.868	1.248
Energy Efficiency	Equal variances assumed	187.060	.000	-1.340	419	.181	-.237	.177	-.584	.111
	Equal variances not assumed			-1.257	281.501	.210	-.237	.188	-.607	.134
Electrical Metering	Equal variances assumed	8.198	.004	1.287	419	.199	.225	.175	-.119	.569
	Equal variances not assumed			1.266	358.655	.206	.225	.178	-.125	.575
Alternative Energy Source	Equal variances assumed	7.765	.006	-8.631	419	.000	-1.305	.151	-1.603	-1.008
	Equal variances not assumed			-8.363	333.708	.000	-1.305	.156	-1.612	-.998
Renewable Materials	Equal variances assumed	6.436	.012	3.302	419	.001	.415	.126	.168	.662
	Equal variances not assumed			3.347	400.782	.001	.415	.124	.171	.659
Free Chemical Pollutant from the building material	Equal variances assumed	726.388	.000	-13.115	419	.000	-1.920	.146	-2.208	-1.632
	Equal variances not assumed			-11.622	207.125	.000	-1.920	.165	-2.245	-1.594
Used of Certified Woods	Equal variances assumed	57.714	.000	3.560	419	.000	.180	.051	.081	.279
	Equal variances not assumed			4.039	296.129	.000	.180	.045	.092	.268
Good Ventilation	Equal variances assumed	116.302	.000	11.330	419	.000	1.084	.096	.896	1.272
	Equal variances not assumed			9.994	202.336	.000	1.084	.108	.870	1.298
Natural Lighting and Visual Comfort	Equal variances assumed	1.458	.228	10.377	419	.000	1.007	.097	.817	1.198
	Equal variances not assumed			10.507	399.640	.000	1.007	.096	.819	1.196
Spatial Comfort	Equal variances assumed	6.788	.010	3.143	419	.002	.431	.137	.161	.700
	Equal variances not assumed			3.091	358.494	.002	.431	.139	.157	.704
Noise reduction	Equal variances assumed	1.266	.261	.713	419	.476	.130	.183	-.229	.490
	Equal variances not assumed			.718	393.485	.473	.130	.182	-.227	.488
Good Storm Water management	Equal variances assumed	6.482	.011	1.587	419	.113	.243	.153	-.058	.543
	Equal variances not assumed			1.610	401.890	.108	.243	.151	-.054	.539
Good Waste Management	Equal variances assumed	27.538	.000	-2.213	419	.027	-.350	.158	-.660	-.039
	Equal variances not assumed			-2.144	333.477	.033	-.350	.163	-.670	-.029
Green Area	Equal variances assumed	2.686	.102	3.036	419	.003	.403	.133	.142	.664
	Equal variances not assumed			2.992	361.784	.003	.403	.135	.138	.668
Carbon Footprint	Equal variances assumed	.796	.373	-.663	419	.508	-.056	.084	-.220	.109
	Equal variances not assumed			-.698	417.618	.485	-.056	.080	-.212	.101
Reachable Public Facility	Equal variances assumed	13.721	.000	4.704	419	.000	.698	.148	.406	.990
	Equal variances not assumed			4.810	409.348	.000	.698	.145	.413	.983
Reachable Public Transport within 300-500m walking distance	Equal variances assumed	.229	.632	1.883	419	.060	.299	.159	-.013	.612
	Equal variances not assumed			1.892	390.295	.059	.299	.158	-.012	.610

Independent Sample Test of the Importance of Green Building Criteria between Respondents Living in Suburban and Urban Area

Appendix C

		Levene's Test for		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Difference	Error Differen	95% Confidence Lower	Upper
Water USe Reduction	Equal variances assumed	10.323	.001	1.334	419	.183	.163	.122	-.077	.404
	Equal variances not assumed			1.438	208.174	.152	.163	.113	-.060	.387
Rain Water harvesting	Equal variances assumed	6.415	.012	.232	419	.817	.029	.124	-.215	.272
	Equal variances not assumed			.257	219.603	.798	.029	.112	-.192	.250
Energy Efficiency	Equal variances assumed	13.537	.000	-.852	419	.395	-.172	.201	-.567	.224
	Equal variances not assumed			-.926	211.967	.355	-.172	.185	-.536	.193
Electrical Metering	Equal variances assumed	6.954	.009	1.978	419	.049	.393	.199	.002	.784
	Equal variances not assumed			1.886	167.197	.061	.393	.209	-.018	.805
Alternative Energy Source	Equal variances assumed	5.629	.018	-2.233	419	.026	-.415	.186	-.780	-.050
	Equal variances not assumed			-2.334	195.778	.021	-.415	.178	-.766	-.064
Renewable Materials	Equal variances assumed	1.178	.278	-.684	419	.494	-.099	.145	-.384	.186
	Equal variances not assumed			-.738	208.058	.461	-.099	.134	-.364	.166
Free Chemical Pollutant from the building material	Equal variances assumed	19.009	.000	-3.001	419	.003	-.588	.196	-.973	-.203
	Equal variances not assumed			-3.299	216.710	.001	-.588	.178	-.939	-.237
Used of Certified Woods	Equal variances assumed	37.009	.000	-2.856	419	.005	-.165	.058	-.279	-.052
	Equal variances not assumed			-4.616	392.313	.000	-.165	.036	-.236	-.095
Good Ventilation	Equal variances assumed	6.583	.011	2.009	419	.045	.249	.124	.005	.493
	Equal variances not assumed			2.435	271.012	.016	.249	.102	.048	.450
Natural Lighting and Visual Comfort	Equal variances assumed	4.892	.028	4.744	419	.000	.573	.121	.336	.810
	Equal variances not assumed			5.035	201.718	.000	.573	.114	.349	.797
Spatial Comfort	Equal variances assumed	16.283	.000	3.399	419	.001	.529	.156	.223	.835
	Equal variances not assumed			3.823	227.681	.000	.529	.138	.257	.802
Noise reduction	Equal variances assumed	7.586	.006	1.444	419	.150	.300	.208	-.109	.709
	Equal variances not assumed			1.370	165.941	.172	.300	.219	-.132	.733
Good Storm Water management	Equal variances assumed	11.417	.001	-4.789	419	.000	-.814	.170	-1.148	-.480
	Equal variances not assumed			-4.340	155.103	.000	-.814	.188	-1.185	-.444
Good Waste Management	Equal variances assumed	32.165	.000	3.731	419	.000	.664	.178	.314	1.014
	Equal variances not assumed			3.322	151.422	.001	.664	.200	.269	1.059
Green Area	Equal variances assumed	6.185	.013	3.718	419	.000	.559	.150	.264	.855
	Equal variances not assumed			3.516	164.983	.001	.559	.159	.245	.873
Carbon Footprint	Equal variances assumed	8.398	.004	-2.231	419	.026	-.212	.095	-.399	-.025
	Equal variances not assumed			-2.426	211.945	.016	-.212	.087	-.384	-.040
Reachable Public Facility	Equal variances assumed	3.141	.077	10.438	419	.000	1.612	.154	1.309	1.916
	Equal variances not assumed			9.874	165.090	.000	1.612	.163	1.290	1.935
Reachable Public Transport within 300-500m walking	Equal variances assumed	3.397	.066	5.076	419	.000	.896	.176	.549	1.243
	Equal variances not assumed			4.727	161.259	.000	.896	.190	.522	1.270

Independent Sample Test of the Willingness to pay for Household Problems between Respondent in Jakarta and Surabaya

		Equality of		t-test for Equality of Means						
									Interval of the	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Differen	Lower	Upper
Pay Difficult Access Water	Equal variances assumed	.009	.923	-.134	419	.893	-.008	.058	-.122	.106
	Equal variances not assumed			-.134	375.905	.894	-.008	.058	-.122	.107
Pay Poor Quality of drinking Water	Equal variances assumed	27.311	.000	-2.567	419	.011	-.100	.039	-.176	-.023
	Equal variances not assumed			-2.745	407.235	.006	-.100	.036	-.171	-.028
Pay Inadeqate disposal of waste water	Equal variances assumed	8.297	.004	12.120	419	.000	.937	.077	.785	1.089
	Equal variances not assumed			11.925	359.049	.000	.937	.079	.782	1.091
Pay Inadequate disposal of human excreta	Equal variances assumed	1.382	.240	-.638	419	.524	-.028	.044	-.115	.058
	Equal variances not assumed			-.634	372.784	.527	-.028	.044	-.115	.059
Pay Flooding and Storm Water	Equal variances assumed	281.150	.000	10.981	419	.000	.782	.071	.642	.921
	Equal variances not assumed			10.091	251.415	.000	.782	.077	.629	.934
Pay Poor Acess for motor vehicle	Equal variances assumed	30.957	.000	2.746	419	.006	.182	.066	.052	.312
	Equal variances not assumed			2.864	418.924	.004	.182	.063	.057	.306
Pay Lack of Public Transport	Equal variances assumed	9.045	.003	1.316	419	.189	.127	.097	-.063	.318
	Equal variances not assumed			1.322	389.840	.187	.127	.096	-.062	.317
Pay Unreliable Electricity Supply	Equal variances assumed	3.012	.083	-4.262	419	.000	-.395	.093	-.577	-.213
	Equal variances not assumed			-4.283	390.445	.000	-.395	.092	-.576	-.214
Pay Inadequate solid waste disposal	Equal variances assumed	30.998	.000	3.498	419	.001	.273	.078	.120	.427
	Equal variances not assumed			3.588	412.013	.000	.273	.076	.124	.423
Pay Presence of litter and illegal piles of solid	Equal variances assumed	46.994	.000	3.932	419	.000	.307	.078	.154	.461
	Equal variances not assumed			4.059	415.911	.000	.307	.076	.158	.456
Pay Bad Air Quality	Equal variances assumed	21.810	.000	5.985	419	.000	.354	.059	.238	.471
	Equal variances not assumed			5.887	358.586	.000	.354	.060	.236	.473
Pay Nuisance from solid waste disposal site	Equal variances assumed	114.634	.000	-6.026	419	.000	-.409	.068	-.543	-.276
	Equal variances not assumed			-5.667	285.085	.000	-.409	.072	-.551	-.267

Independent Sample Test of the Willingness to pay for Household Problems between Respondent Living in Suburban and Urban Area

Appendix C

		Equality of		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Differen	Interval of the Lower	Upper
Pay Difficult Access Water	Equal variances assumed	15.184	.000	2.116	419	.035	.139	.066	.010	.268
	Equal variances not assumed			2.311	213.709	.022	.139	.060	.020	.257
Pay Poor Quality of drinking Water	Equal variances assumed	7.274	.007	-1.534	419	.126	-.068	.044	-.156	.019
	Equal variances not assumed			-1.463	167.104	.145	-.068	.047	-.160	.024
Pay Inadeqate disposal of waste water	Equal variances assumed	8.913	.003	2.881	419	.004	.292	.101	.093	.491
	Equal variances not assumed			3.044	199.899	.003	.292	.096	.103	.481
Pay Inadequate disposal of human excreta	Equal variances assumed	.961	.328	-.526	419	.599	-.026	.050	-.125	.072
	Equal variances not assumed			-.535	186.313	.593	-.026	.049	-.124	.071
Pay Flooding and Storm Water	Equal variances assumed	.023	.880	.119	419	.905	.011	.092	-.170	.192
	Equal variances not assumed			.119	180.719	.906	.011	.092	-.171	.192
Pay Poor Acess for motor vehicle	Equal variances assumed	.456	.500	.334	419	.738	.025	.076	-.124	.175
	Equal variances not assumed			.327	174.085	.744	.025	.078	-.128	.179
Pay Lack of Public Transport	Equal variances assumed	.490	.484	7.524	419	.000	.780	.104	.576	.984
	Equal variances not assumed			7.581	183.079	.000	.780	.103	.577	.983
Pay Unreliable Electricity Supply	Equal variances assumed	2.277	.132	.838	419	.403	.090	.108	-.121	.302
	Equal variances not assumed			.848	184.830	.397	.090	.106	-.120	.300
Pay Inadequate solid waste disposal	Equal variances assumed	1.872	.172	1.346	419	.179	.121	.090	-.056	.299
	Equal variances not assumed			1.321	175.086	.188	.121	.092	-.060	.303
Pay Presence of litter and illegal piles of solid	Equal variances assumed	9.527	.002	2.225	419	.027	.200	.090	.023	.378
	Equal variances not assumed			2.110	165.824	.036	.200	.095	.013	.388
Pay Bad Air Quality	Equal variances assumed	7.092	.008	2.086	419	.038	.146	.070	.008	.283
	Equal variances not assumed			2.126	186.973	.035	.146	.069	.011	.281
Pay Nuisance from solid waste disposal site	Equal variances assumed	.375	.541	.152	419	.879	.012	.081	-.146	.171
	Equal variances not assumed			.148	172.253	.882	.012	.083	-.151	.176

Independent Sample Test of the Willingness to Pay for Green Building Criteria between Respondents in Jakarta and Surabaya

		Levene's Test for		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Difference	Error Differen	95% Confidence Lower	Upper
Pay for Water use reduction	Equal variances assumed	.723	.396	-1.100	419	.272	-.071	.065	-.199	.056
	Equal variances not assumed			-1.091	370.660	.276	-.071	.066	-.200	.057
Pay Rain Water harvesting	Equal variances assumed	11.270	.001	-1.808	419	.071	-.119	.066	-.248	.010
	Equal variances not assumed			-1.848	409.345	.065	-.119	.064	-.246	.008
Pay Energy Efficiency	Equal variances assumed	125.584	.000	-5.034	419	.000	-.291	.058	-.405	-.178
	Equal variances not assumed			-5.553	358.533	.000	-.291	.052	-.394	-.188
Pay Electrical Metering	Equal variances assumed	3.791	.052	-8.417	419	.000	-.729	.087	-.899	-.559
	Equal variances not assumed			-8.480	393.603	.000	-.729	.086	-.898	-.560
Pay Alternative Energy Source	Equal variances assumed	.003	.958	-5.841	419	.000	-.425	.073	-.568	-.282
	Equal variances not assumed			-5.960	407.613	.000	-.425	.071	-.565	-.285
Pay for Renewable Materials	Equal variances assumed	5.272	.022	2.458	419	.014	.189	.077	.038	.340
	Equal variances not assumed			2.460	385.041	.014	.189	.077	.038	.340
PayFree Chemical Pollutant from the building material	Equal variances assumed	132.618	.000	16.345	419	.000	1.193	.073	1.049	1.336
	Equal variances not assumed			17.437	409.557	.000	1.193	.068	1.058	1.327
Pay for the Used of Certified Woods	Equal variances assumed	9.396	.002	-1.550	419	.122	-.080	.051	-.180	.021
	Equal variances not assumed			-1.505	336.608	.133	-.080	.053	-.183	.024
Pay Good Ventilation	Equal variances assumed	18.739	.000	1.557	419	.120	.128	.082	-.034	.289
	Equal variances not assumed			1.523	349.527	.129	.128	.084	-.037	.293
Pay Natural Lighting and Visual Comfort	Equal variances assumed	61.569	.000	-3.781	419	.000	-.287	.076	-.436	-.138
	Equal variances not assumed			-3.637	321.860	.000	-.287	.079	-.442	-.132
Pay Spatial Comfort	Equal variances assumed	2.415	.121	-3.933	419	.000	-.356	.091	-.534	-.178
	Equal variances not assumed			-3.916	377.159	.000	-.356	.091	-.535	-.177
Pay Noise Reduction	Equal variances assumed	131.099	.000	-6.008	419	.000	-.508	.085	-.674	-.342
	Equal variances not assumed			-5.755	314.695	.000	-.508	.088	-.682	-.334
Pay Good Storm Water management	Equal variances assumed	36.521	.000	-17.250	419	.000	-1.171	.068	-1.305	-1.038
	Equal variances not assumed			-16.810	343.339	.000	-1.171	.070	-1.308	-1.034
Pay Good Waste Management	Equal variances assumed	1.534	.216	-12.836	419	.000	-1.034	.081	-1.192	-.876
	Equal variances not assumed			-12.824	382.340	.000	-1.034	.081	-1.193	-.876
Pay Carbonfootprint	Equal variances assumed	.487	.486	.345	419	.730	.023	.065	-.106	.151
	Equal variances not assumed			.347	391.606	.729	.023	.065	-.105	.150
Pay Green Area	Equal variances assumed	60.405	.000	-.977	419	.329	-.081	.083	-.245	.082
	Equal variances not assumed			-1.014	417.930	.311	-.081	.080	-.239	.076
Pay Reachable Public Facility	Equal variances assumed	60.743	.000	4.098	419	.000	.261	.064	.136	.386
	Equal variances not assumed			3.886	298.358	.000	.261	.067	.129	.393
Pay Reachable Public Transport within 300-500m	Equal variances assumed	6.967	.009	5.160	419	.000	.459	.089	.284	.633
	Equal variances not assumed			5.207	395.542	.000	.459	.088	.285	.632

Independent Sample Test of the Willingness to Pay for Green Building Criteria between Respondents Living in Suburban and Urban Area

Appendix C

		Levene's Test for		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Differen ce	Error Differen	95% Confidence Lower	Upper
Pay for Water use reduction	Equal variances assumed	.333	.564	-.423	419	.672	-.031	.074	-.177	.114
	Equal variances not assumed			-.419	177.946	.676	-.031	.075	-.179	.116
Pay Rain Water harvesting	Equal variances assumed	.028	.868	-.252	419	.801	-.019	.075	-.167	.129
	Equal variances not assumed			-.255	183.970	.799	-.019	.075	-.166	.128
Pay Energy Efficiency	Equal variances assumed	.048	.826	.124	419	.901	.008	.068	-.125	.142
	Equal variances not assumed			.124	181.624	.901	.008	.068	-.125	.142
Pay Electrical Metering	Equal variances assumed	3.462	.064	-.473	419	.636	-.050	.107	-.260	.159
	Equal variances not assumed			-.481	186.286	.631	-.050	.105	-.257	.156
Pay Alternative Energy Source	Equal variances assumed	12.585	.000	.601	419	.548	.052	.086	-.118	.221
	Equal variances not assumed			.663	218.529	.508	.052	.078	-.102	.205
Pay for Renewable Materials	Equal variances assumed	.507	.477	-.373	419	.710	-.033	.088	-.206	.141
	Equal variances not assumed			-.378	185.093	.706	-.033	.087	-.205	.139
PayFree Chemical Pollutant from the building material	Equal variances assumed	1.472	.226	2.216	419	.027	.234	.106	.026	.442
	Equal variances not assumed			2.181	175.914	.030	.234	.107	.022	.446
Pay for the Used of Certified Woods	Equal variances assumed	.592	.442	-.037	419	.971	-.002	.059	-.117	.113
	Equal variances not assumed			-.042	235.417	.967	-.002	.051	-.103	.099
Pay Good Ventilation	Equal variances assumed	1.820	.178	.869	419	.386	.081	.094	-.103	.266
	Equal variances not assumed			.889	188.099	.375	.081	.092	-.099	.262
Pay Natural Lighting and Visual Comfort	Equal variances assumed	3.445	.064	1.058	419	.291	.093	.088	-.080	.266
	Equal variances not assumed			1.121	201.147	.264	.093	.083	-.070	.256
Pay Spatial Comfort	Equal variances assumed	.315	.575	-1.722	419	.086	-.180	.105	-.386	.026
	Equal variances not assumed			-1.727	181.615	.086	-.180	.104	-.386	.026
Pay Noise Reduction	Equal variances assumed	.592	.442	-.557	419	.578	-.056	.100	-.253	.141
	Equal variances not assumed			-.561	182.522	.576	-.056	.100	-.253	.141
Pay Good Storm Water management	Equal variances assumed	26.857	.000	-4.076	419	.000	-.404	.099	-.599	-.209
	Equal variances not assumed			-4.405	209.188	.000	-.404	.092	-.585	-.223
Pay Good Waste Management	Equal variances assumed	.060	.806	-1.633	419	.103	-.176	.108	-.389	.036
	Equal variances not assumed			-1.630	180.173	.105	-.176	.108	-.390	.037
Pay Carbonfootprint	Equal variances assumed	3.355	.068	.983	419	.326	.073	.074	-.073	.219
	Equal variances not assumed			.934	166.268	.352	.073	.078	-.081	.227
Pay Green Area	Equal variances assumed	59.073	.000	7.137	419	.000	.641	.090	.464	.817
	Equal variances not assumed			8.570	264.995	.000	.641	.075	.493	.788
Pay Reachable Public Facility	Equal variances assumed	4.829	.029	1.105	419	.270	.082	.074	-.064	.227
	Equal variances not assumed			1.179	203.918	.240	.082	.069	-.055	.218
Pay Reachable Public Transport within 300-500m	Equal variances assumed	1.092	.297	7.191	419	.000	.708	.098	.515	.902
	Equal variances not assumed			7.088	176.322	.000	.708	.100	.511	.905

Appendix D

ANOVA Willingness to Pay for Household Problems based on Level of Income

		Sum of Squares	df	Mean Square	F	Sig.
Pay Difficult Access Water	Between Groups	18.873	4	4.718	15.633	.000
	Within Groups	125.555	416	.302		
	Total	144.428	420			
Pay Poor Quality of drinking Water	Between Groups	3.823	4	.956	6.388	.000
	Within Groups	62.239	416	.150		
	Total	66.062	420			
Pay Inadeqate disposal of waste water	Between Groups	15.961	4	3.990	5.002	.001
	Within Groups	331.853	416	.798		
	Total	347.815	420			
Pay Inadequate disposal of human excreta	Between Groups	7.463	4	1.866	10.196	.000
	Within Groups	76.115	416	.183		
	Total	83.577	420			
Pay Flooding and Storm Water	Between Groups	12.153	4	3.038	4.698	.001
	Within Groups	269.049	416	.647		
	Total	281.202	420			
Pay Poor Acess for motor vehicle	Between Groups	15.975	4	3.994	9.426	.000
	Within Groups	176.263	416	.424		
	Total	192.238	420			
Pay Lack of Public Transport	Between Groups	16.208	4	4.052	4.329	.002
	Within Groups	389.431	416	.936		
	Total	405.639	420			
Pay Unreliable Electricity Supply	Between Groups	29.278	4	7.320	8.540	.000
	Within Groups	356.536	416	.857		
	Total	385.815	420			
Pay Inadequate solid waste disposal	Between Groups	11.038	4	2.760	4.412	.002
	Within Groups	260.206	416	.625		
	Total	271.245	420			
Pay Presence of litter and illegal piles of solid	Between Groups	15.731	4	3.933	6.361	.000
	Within Groups	257.205	416	.618		
	Total	272.936	420			
Pay Bad Air Quality	Between Groups	12.583	4	3.146	8.647	.000
	Within Groups	151.327	416	.364		
	Total	163.910	420			
Pay Nuisance from solid waste disposal site	Between Groups	5.223	4	1.306	2.578	.037
	Within Groups	210.710	416	.507		
	Total	215.933	420			

Appendix D

ANOVA Willingness to Pay for Green Building Criteria based on Level of Income

		Sum of Squares	df	Mean Square	F	Sig.
Pay for Water use reduction	Between Groups	12.214	4	3.053	7.470	.000
	Within Groups	170.052	416	.409		
	Total	182.266	420			
Pay Rain Water harvesting	Between Groups	2.021	4	.505	1.127	.343
	Within Groups	186.397	416	.448		
	Total	188.418	420			
Pay Energy Efficiency	Between Groups	5.223	4	1.306	3.675	.006
	Within Groups	147.789	416	.355		
	Total	153.012	420			
Pay Electrical Metering	Between Groups	17.545	4	4.386	5.062	.001
	Within Groups	360.455	416	.866		
	Total	378.000	420			
Pay Alternative Energy Source	Between Groups	29.858	4	7.465	14.325	.000
	Within Groups	216.778	416	.521		
	Total	246.637	420			
Pay for Renewable Materials	Between Groups	21.771	4	5.443	9.543	.000
	Within Groups	237.265	416	.570		
	Total	259.036	420			
PayFree Chemical Pollutant from the building material	Between Groups	60.238	4	15.059	19.836	.000
	Within Groups	315.824	416	.759		
	Total	376.062	420			
Pay for the Used of Certified Woods	Between Groups	6.105	4	1.526	5.878	.000
	Within Groups	108.005	416	.260		
	Total	114.109	420			
Pay Good Ventilation	Between Groups	5.161	4	1.290	1.869	.115
	Within Groups	287.172	416	.690		
	Total	292.333	420			
Pay Natural Lighting and Visual Comfort	Between Groups	7.545	4	1.886	3.146	.014
	Within Groups	249.448	416	.600		
	Total	256.993	420			
Pay Spatial Comfort	Between Groups	104.233	4	26.058	41.254	.000
	Within Groups	262.769	416	.632		
	Total	367.002	420			
Pay Noise Reduction	Between Groups	5.583	4	1.396	1.765	.135
	Within Groups	329.001	416	.791		
	Total	334.584	420			
Pay Good Storm Water management	Between Groups	14.041	4	3.510	4.483	.001
	Within Groups	325.764	416	.783		
	Total	339.805	420			
Pay Good Waste Management	Between Groups	38.719	4	9.680	11.468	.000
	Within Groups	351.129	416	.844		
	Total	389.848	420			
Pay Carbonfootprint	Between Groups	2.281	4	.570	1.305	.267
	Within Groups	181.757	416	.437		
	Total	184.038	420			
Pay Green Area	Between Groups	26.796	4	6.699	10.193	.000
	Within Groups	273.408	416	.657		
	Total	300.204	420			
Pay Reachable Public Facility	Between Groups	8.430	4	2.107	5.054	.001
	Within Groups	173.456	416	.417		
	Total	181.886	420			
Pay Reachable Public Transport within 300-500m walking distance	Between Groups	14.443	4	3.611	4.320	.002
	Within Groups	347.666	416	.836		
	Total	362.109	420			

Appendix E

Willingness to pay for Green Building Criteria			
	N	Mean	Std. Deviation
Pay Energy Efficiency	421	2.78	.604
Pay Reachable Public Facility	421	2.70	.658
Pay Rain Water harvesting	421	2.67	.670
Pay for Water use reduction	421	2.65	.659
Pay Good Ventilation	421	2.39	.834
Pay Green Area	421	2.27	.845
Pay Alternative Energy Source	421	2.20	.766
Pay Natural Lighting and Visual Comfort	421	2.18	.782
Pay Spatial Comfort	421	2.07	.935
Pay Electrical Metering	421	2.00	.949
Pay Good Waste Management	421	1.98	.963
PayFree Chemical Pollutant from the building material	421	1.88	.946
Pay Reachable Public Transport within 300-500m walking distance	421	1.77	.929
Pay Good Storm Water management	421	1.75	.899
Pay Noise Reduction	421	1.58	.893
Pay for Renewable Materials	421	1.48	.785
Pay Carbonfootprint	421	1.28	.662
Pay for the Used of Certified Woods	421	1.23	.521

Appendix E

Willingness to pay for Green Building Criteria in Jakarta

	N	Mean	Std. Deviation
Pay Reachable Public Facility	242	2.67	.624
Pay Energy Efficiency	242	2.65	.720
Pay Rain Water harvesting	242	2.62	.708
Pay for Water use reduction	242	2.62	.642
Pay Good Ventilation	242	2.45	.778
PayFree Chemical Pollutant from the building material	242	2.39	.858
Pay Green Area	242	2.23	.927
Pay Natural Lighting and Visual Comfort	242	2.05	.677
Pay Alternative Energy Source	242	2.02	.778
Pay Reachable Public Transport within 300-500m walking distance	242	1.97	.924
Pay Spatial Comfort	242	1.92	.907
Pay Electrical Metering	242	1.69	.897
Pay for Renewable Materials	242	1.56	.783
Pay Good Waste Management	242	1.54	.815
Pay Noise Reduction	242	1.36	.740
Pay Carbonfootprint	242	1.29	.674
Pay Good Storm Water management	242	1.25	.635
Pay for the Used of Certified Woods	242	1.19	.473

Willingness to pay for Green Building Criteria in Surabaya

	N	Mean	Std. Deviation
Pay Energy Efficiency	179	2.94	.330
Pay Rain Water harvesting	179	2.74	.610
Pay for Water use reduction	179	2.69	.681
Pay Good Waste Management	179	2.58	.820
Pay Reachable Public Facility	179	2.55	.773
Pay Alternative Energy Source	179	2.44	.679
Pay Good Storm Water management	179	2.42	.755
Pay Electrical Metering	179	2.42	.853
Pay Natural Lighting and Visual Comfort	179	2.34	.881
Pay Good Ventilation	179	2.32	.902
Pay Green Area	179	2.31	.721
Pay Spatial Comfort	179	2.27	.935
Pay Noise Reduction	179	1.87	.994
Pay Reachable Public Transport within 300-500m walking distance	179	1.51	.870
Pay for Renewable Materials	179	1.37	.778
Pay for the Used of Certified Woods	179	1.27	.579
Pay Carbonfootprint	179	1.26	.648
PayFree Chemical Pollutant from the building material	179	1.20	.541

Willingness to pay for Household Problems

	N	Mean	Std. Deviation
Pay Difficult Access Water	421	2.54	.694
Pay Poor Quality of drinking Water	421	2.91	.318
Pay Inadeqate disposal of waste water	421	2.13	.910
Pay Inadequate disposal of human excreta	421	1.12	.446
Pay Flooding and Storm Water	421	2.51	.818
Pay Poor Acess for motor vehicle	421	1.31	.677
Pay Lack of Public Transport	421	1.82	.983
Pay Unreliable Electricity Supply	421	2.61	.717
Pay Inadequate solid waste disposal	421	1.50	.804
Pay Presence of litter and illegal piles of solid	421	1.47	.806
Pay Bad Air Quality	421	2.65	.590
Pay Nuisance from solid waste disposal site	421	1.37	.717
Valid N (listwise)	421		

Willingness to pay for Household Problems in Jakarta

	N	Mean
Pay Difficult Access Water	242	2.73
Pay Poor Quality of drinking Water	242	2.87
Pay Inadeqate disposal of waste water	242	2.53
Pay Inadequate disposal of human excreta	242	1.11
Pay Flooding and Storm Water	242	2.84
Pay Poor Acess for motor vehicle	242	1.39
Pay Lack of Public Transport	242	1.88
Pay Unreliable Electricity Supply	242	2.58
Pay Inadequate solid waste disposal	242	1.62
Pay Presence of litter and illegal piles of solid	242	1.60
Pay Bad Air Quality	242	2.79
Pay Nuisance from solid waste disposal site	242	1.19
Valid N (listwise)	242	

Willingness to pay for Household Problems in Surabaya

	N	Mean
Pay Difficult Access Water	179	2.29
Pay Poor Quality of drinking Water	179	2.97
Pay Inadeqate disposal of waste water	179	1.59
Pay Inadequate disposal of human excreta	179	1.14
Pay Flooding and Storm Water	179	2.06
Pay Poor Acess for motor vehicle	179	1.21
Pay Lack of Public Transport	179	1.75
Pay Unreliable Electricity Supply	179	2.66
Pay Inadequate solid waste disposal	179	1.35
Pay Presence of litter and illegal piles of solid	179	1.30
Pay Bad Air Quality	179	2.45
Pay Nuisance from solid waste disposal site	179	1.60
Valid N (listwise)	179	

Appendix E

Importance of Green Building Criteria in Jakarta

	N	Mean
Water USe Reduction	242	4.85
Rain Water harvesting	242	4.74
Energy Efficiency	242	3.04
Electrical Metering	242	3.17
Alternative Energy Source	242	2.66
Renewable Materials	242	2.00
Free Chemical Pollutant from the building material	242	1.36
Used of Certified Woods	242	1.22
Good Ventilation	242	5.79
Natural Lighting and Visual Comfort	242	5.17
Spatial Comfort	242	3.87
Noise reduction	242	2.96
Good Storm Water management	242	4.53
Good Waste Management	242	2.93
Green Area	242	3.05
Carbon Footprint	242	1.38
Reachable Public Facility	242	3.13
Reachable Public Transport within 300-500m walking distance	242	3.07
Valid N (listwise)	242	

Importance of Green Building Criteria in Surabaya

	N	Mean
Water USe Reduction	179	3.81
Rain Water harvesting	179	3.68
Energy Efficiency	179	3.27
Electrical Metering	179	2.94
Alternative Energy Source	179	3.97
Renewable Materials	179	1.58
Free Chemical Pollutant from the building material	179	3.28
Used of Certified Woods	179	1.04
Good Ventilation	179	4.71
Natural Lighting and Visual Comfort	179	4.16
Spatial Comfort	179	3.44
Noise reduction	179	2.83
Good Storm Water management	179	4.29
Good Waste Management	179	3.28
Green Area	179	2.64
Carbon Footprint	179	1.44
Reachable Public Facility	179	2.43
Reachable Public Transport within 300-500m walking distance	179	2.77
Valid N (listwise)	179	

Seriousness of Household Problems in Jakarta		
	N	Mean
Difficult Access Water	242	5.52
Poor Quality of drinking Water	242	5.38
Inadequate disposal of Wastewater	242	3.57
Inadequate disposal of human excreta	242	1.83
Flooding and Storm Water	242	4.89
Poor Acess for motor vehicle	242	3.23
Lack of Public Transport	242	3.41
Unreliable Electricity Supply	242	5.38
Inadequate solid waste disposal	242	4.01
Presence of litter and illegal piles of solid	242	3.78
Bad air quality	242	5.21
Nuisance from solid waste disposal site	242	2.25
Valid N (listwise)	242	

Seriousness of Household Problems in Surabaya		
	N	Mean
Difficult Access Water	179	3.80
Poor Quality of drinking Water	179	5.42
Inadequate disposal of Wastewater	179	3.23
Inadequate disposal of human excreta	179	1.12
Flooding and Storm Water	179	3.93
Poor Acess for motor vehicle	179	3.52
Lack of Public Transport	179	1.78
Unreliable Electricity Supply	179	5.35
Inadequate solid waste disposal	179	3.02
Presence of litter and illegal piles of solid	179	2.68
Bad air quality	179	3.73
Nuisance from solid waste disposal site	179	2.44
Valid N (listwise)	179	

Appendix E

Green Building Understanding and Barriers

City of Residence	Knowledge of GB	Understanding of GB	Past GB investment	Willingness to Invest in GB	Slightly higher initial cost/upfront cost	Lack of Cost considerations & Implications of Green Building	Lack of available Green Building	Lack of knowledge on Sustainable/ Green Building practices	There are not enough options of available Green Building	Absence of governmental action to promote Green Building Awareness
Jakarta	2.55	2.00	1.00	1.28	.67	1.00	1.00	.60	1.00	1.00
Surabaya	2.63	1.95	1.00	1.23	.72	1.00	1.00	.56	1.00	1.00
Total	2.58	1.98	1.00	1.26	.69	1.00	1.00	.58	1.00	1.00