

SUPERVISOR VERIFICATION

“I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of the degree of Bachelor of Technology Management (Technology Innovation)”

Signature:

Name of Supervisor: Dr. Norfaridatul Akmaliah binti Othman

Date:

A STUDY ON SUSTAINABLE SOLID WASTE
MANAGEMENT IN MALAYSIA'S SMART CITY; WILAYAH
ISKANDAR

FARID AKMAL BIN FADZLI

Partial fulfillment of the requirements for the award of
Bachelor of Technology Management and Technopreneurship with honour
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DECLARATION

“Hereby, I declare that this thesis entitled “*A Study on Sustainable Solid Waste Management in Malaysia’s Smart City; Wilayah Iskandar*” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :

Name : Farid Akmal bin Fadzli

Date :

DEDICATION

I learned patience, perseverance and dedication.

Now I really know myself, and I know my voice.

It's a voice of pain and victory.

To my beloved Big Boss and Ma'am,

My siblings,

My friends,

My Enactus families,

Those who have helped me during my rough times,

Helped shape me into what I've become today,

It's not easy,

I know.

Lastly, to my future wife.

Giving me courage and strength to move forward,

In hoping to meet you one day,

And build our family together.

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ABSTRACT

For the past half decades, the solid waste industry has gone through revolutionary changes globally. Technology and innovation has evolved in almost every aspect of the industry, from the garbage truck up till the modernization of the dumping site. Like other industries, solid waste has been forced to roll with these changes, which has impacted millions of lives and cities. The creation of smart cities have also forced solid waste management to convert from the conventional to a more sustainable method in order to ensure and also promote the sustainability of a smart city. Until recently, the trend of change have arrived in Malaysia with the development of the country's 1st smart city; Wilayah Iskandar. This research will address specifically the changes in technology that has revolved around Wilayah Iskandar. The researcher uses qualitative method as to seek for explanations, ideas and opinions from the organizations involved in managing solid waste in Wilayah Iskandar. In a nutshell, this study will produce essential information for other researchers, organizations and students to gain deeper knowledge towards this topic.

ABSTRAK

Untuk setengah dekad masa lampau, industri sisa pepejal telah melalui perubahan mendadak secara global. Teknologi dan inovasi telah berkembang dalam hampir setiap aspek industri, dari lori sampah sehingga pemodenan tapak pelupusan sampah. Seperti industri lain, sisa pepejal telah dipaksa untuk mengikut arus perubahan ini, yang telah mengasak berjuta-juta nyawa dan bandaraya. Penciptaan bandar pintar turut memaksa pengurusan sisa pepejal menukar dari kaedah konvensional kepada kaedah yang lebih mampan supaya memastikan dan juga menggalakkan ketahanan sebuah bandar raya pintar. Sehingga baru-baru ini, aliran perubahan telah sampai dalam Malaysia dengan pembangunan bandar pintar pertama negara; Wilayah Iskandar. Penyelidikan ini akan memperincikan perubahan yang berlaku dalam teknologi yang telah berputar keliling Wilayah Iskandar. Penyelidik menggunakan kaedah kualitatif sebagai usaha mencari penjelasan, idea dan pendapat dari organisasi terlibat dalam mengurus sisa pepejal di Wilayah Iskandar. Kesimpulannya, kajian ini akan menghasilkan maklumat penting untuk penyelidik lain, organisasi dan pelajar untuk mendapat pengetahuan lebih berkaitan topik ini.

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CHAPTER 1

INTRODUCTION

1.0 Introduction

This research starts with chapter one that explains five elements. The background of study is the first element which elaborates the crucial points in this research, meaning letting the readers and other researchers know what they are reading. Second element is problem statement and research question. The problem statement will state the existing problems in the real situation meanwhile the research question is what this research report going to find out later in the conclusion part. Research objective is the third element, introducing the objectives of this research. Next element is scope, limitation and key assumption of this research study. Of course, every research has its own limitation and key assumption and explaining the scope. Last but not least, the significant of the study, explaining why is this research important so much for future reference.

1.1 Background of Study

Solid Waste Management. As quoted by US Environmental Protection Agency, 2002; “*A local challenge with global impacts.*” Most people nowadays are overlooking this problem because they assumed that it is just a ‘small and tiny’ problem as compared to their daily life crunches. But little do they know that these ‘small and tiny’ problems are giving a very ‘big and huge’ impact to human health, climate changes and most importantly, the environment.

Oxford dictionaries define waste as substance that was eliminated or discarded as no longer useful or required after the completion of a process. In a much simpler words, it is called rubbish or garbage. In a much easier way to look at it, it is simply a substance thrown away after using it for example like unused toys, food wastes, and etc.

On the other hand, solid waste management refers to the supervised handling of material from generation at the source through the recovery processes to disposal. It is simply saying that solid waste management is managing the garbage that is disposed of everyday.

Solid waste management is a very popular and important topic that is discussed almost by everyone from leaders to academician and even to the citizens themselves. Talked about not for their advantages and benefits, but rather the opposite. Like it or not, the world is facing a huge problem in managing its solid waste. The amount of waste produced exceeds the effort in disposing them. This is by far a very crucial stage the world has entered in.

In businesses, firms and organizations will have to deal with a very big problem when supply exceeds demand. When this happens, prices of product will be lowered and it will take more time for firms to obtain their profit. Likewise in this case, when citizens produced too much waste (supply), and responsible parties could not manage them (demand), then the world will be at stake. Why? It is simple. Because unorganized solid waste is one of the major factors that contribute to pollution, greenhouse effects and many others negative impact to the environment.

Let's look at one example of the effects from unorganized solid waste. When organic waste decomposes in landfills and uncontrolled dumps, it produces methane, which is one of the major gases contributing to greenhouse effect which also give effect to climate change. US Environmental Protection Agency states that; *countries in Asia, Latin America and Africa account for nearly 40 percent of annual methane emissions from landfills*. The figure mentioned can already be considered as absurd, not to forget that figure is directly proportional to amount of population today. Now imagine what will happen in the next 20-30 years. Rolf Stein, 2013 clarifies in his article that *The United Nation Population Fund predicts that the population in Asia-Pacific region is set to increase from 4 billion to 5 billion by 2050*. We know that waste generation increases as population increases. Now imagine to what degree the amount of methane emissions will increase to when the population of Asia-Pacific increases as well, and that amount does not include countries from Latin America and Africa yet, not to mention the rest part of the world.

In general, unorganized solid waste can cause more than just mere pollution. It can bring far greater effects to the world, sometimes things cannot possibly imagine. That is why solid waste management has been a very popular topic in discussions everywhere around the world. Academician talks about the effects, debaters compare them, policy makers create strategies and leaders implement them in their practices.

Another great subject that is being discussed currently is the emerging of smart cities around the world. A brief definition of smart city is that it is a city well performing in the integration of economy, environment and social. A smart city stands on 6 pillars that are being accounted for. They are; Smart Economy, Smart Governance, Smart Environment, Smart Mobility, Smart People and last but not least Smart Living.

Every smart city around the world was built based on these 6 pillars and not just that, it is embedded into their daily life activity so that people would always remember why their city was called 'smart'. *"In a smart city there will be integration among all concepts and tools in a variety of areas such as urban planning, mobility, energy efficiency and population management, all with a view to ensuring sustainable urban development. Innovation and technology leads to greater efficiency in the provision of*

clean energy, smart buildings, open government systems, better water and waste management, sustainable resource management, smart vehicles, integrated transportation, and so on.” (M Ramachandran, 2012)

In his article, M Ramachandran clearly clarifies that what does it takes for a city and its citizen to be smart. He explained very well not just from the aspects of the 6 pillars but he also adds some interesting ideas such as the development of ICT, connectivity, information and so on. It can almost be said that the pillars maybe 6 in numbers but actually they have covered almost every aspect of business and life.

The number of smart cities is increasing in every part of the world but the most eye-catching is Europe and Japan. A very well planning is crucial in order for city planners to develop a smart city. Normally they will divide the development into stages or phases and usually the whole process takes about 10-20 years before it reaches the final stage. The time taken is very essential because Rome itself was not built overnight, much less a smart city.

The same process was used in developing Malaysia’s very own smart city, Iskandar Malaysia. The city is a 20 year development program which was divided into 3 phase; Planning and Building the Foundation, Strengthening and Generating Growth and Sustain and Reinvigorate. A city that was build based on the same pillars but maybe a different approach in order to achieve the same vision, Smart City.

The 6 focus areas are defined with several characters and indicators

<p>SMART ECONOMY (Growth & Competitiveness)</p> <ul style="list-style-type: none"> • Economic Growth and Value Creation • Innovative economic growth • Equitable Wealth Distribution • Entrepreneurship 	<p>SMART ENVIRONMENT (Natural resources)</p> <ul style="list-style-type: none"> • Clean environment • Environmental protection • Green development • Green infrastructure • Smart Growth • Green Economy 	<p>SMART PEOPLE (Social and Human Capital)</p> <ul style="list-style-type: none"> • Caring community • Racial Harmony • Skilled and Talented Human Capital
<p>SMART GOVERNANCE (Efficient & Participation)</p> <ul style="list-style-type: none"> • Public Participation • Efficient Public and social services • Private Public Partnership • Transparent governance 	<p>SMART MOBILITY (Connectivity & ICT)</p> <ul style="list-style-type: none"> • Road accessibility • Public transportation • Non motorized accessibility • Availability of ICT infrastructure 	<p>SMART LIVING (Quality of Life)</p> <ul style="list-style-type: none"> • Safety and security • Low Carbon lifestyle • Housing quality • Educational quality • Health Conditions • Cultural facilities • Touristic/recreational attractiveness

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Figure 1.1: 6 pillars of Iskandar Malaysia

Iskandar Malaysia was build in the state of Johor for maybe one reason which is because the state itself is becoming not just a smart city but a smart state instead. This is because Johor consistently contributes more than 9 percent to national GDP, top 3 contributors to national GDP in manufacturing, construction and services and unemployment rate falls under 3 percent. Johor is also the southern gateway into Malaysia and mainland Asia.

The question that should be asked now is that how does solid waste management relates to smart city? For any smart city, solid waste management is actually a small part of smart city foundation and it falls under the smart environment pillar. Even though it is not discussed as a main topic, but developers and city planners realized that solid waste management plays an important role in producing a cleaner environment for smart city, might as well say that, the absence of solid waste management may cause a city not to be ‘smart’.

The next question that should be asked is what is the similarity between solid waste management and smart city? There maybe a few answers that can be used but there is 1 which is very intriguing; Sustainability. The word itself brings great value. Conventional waste management systems are not well suited to deal with the ever increasing amount of waste and also new and special waste streams. Therefore it is crucial that the word sustainability comes into mind. When sustainability is added to solid waste management, then technologies and innovation will take part as well in order to make sure that the solid waste management system can definitely pull of the supply-demand situation and hence contribute to a more sustainable smart city.

1.2 Problem Statement

For the past ten years, countries worldwide have started to change their perspective towards having a better city and also a more sustainable world. Some have even started earlier. Working for that cause, governments have started on planning to create smart cities which have a smarter system overall including solid waste management.

The word smart does not come by itself. When it is used, normally it will bring together with it a package of sustainability. It applies to every aspect of life. When it comes to smart city, the package it brings together in terms of saving the environment is a sustainable solid waste management.

But the question arises was that, what makes solid waste management in smart cities differ from a normal city that it could sustain not just the city itself but also the whole world? Is it the system? Why does solid waste management in normal cities seems could not afford to make such measures?

Based on the highlighted problems, the researcher has found out the needs for sustainable solid waste management. Thus the objective of this project research is to determine how far does sustainable solid waste management contributes to sustainable smart city.

1.3 Research Questions

1. What are the type(s) of waste produced in Malaysian smart city?
2. What is the current system being used to manage solid waste in Malaysian smart city?
3. How far can solid waste management contribute to sustainable smart city?

1.4 Research Objectives

1. To determine the type(s) of waste produced in Malaysian smart city.
2. To investigate the current system being used to manage solid waste in Malaysian smart city.
3. To measure the effectiveness of sustainable solid waste management.

1.5 Research Scope, Limitations and Key Assumptions

The researcher has determined to study on the adoption of sustainable solid waste management in smart city. The scope of the study is based on solid waste management in Malaysia, Malaysia smart city, the integration and sustainability of both.

Due to the time constraints, this research will only cover a few areas of the adaptation of solid waste management in smart city. To be more specific, the researcher will only study on the system used and to measure the sustainability rate.

Because the researcher chose to study on Malaysia smart city, therefore this research is only limited to Iskandar Malaysia as it is the only smart city in Malaysia. Other than that, the researcher may have some other limitation that will occur because Iskandar Malaysia is still in a growing phase and therefore might not have adequate information this research requires.

As the researcher also has monetary limitations, the researcher might have to reduce the number of site visit as the location of study is quite far. This may limit the researcher to some problems occurring in the city. Therefore, the reliability and validity of this research is truly depending on the response and cooperation from those who are involved.

1.6 Significance of Study

The researcher will try to provide a very strong thesis by answering the research questions that was prepared accurately. The researcher will not just answer the questions with words but will also provide graphs or statistics that is related to any of the research questions if needed.

This research will provide statistics that may be useful to the Solid Waste Management and Public Cleansing Corporation (PPSPPA) and also to the Department of National Solid Waste.

Besides that, this research maybe can be of use to the responsible parties who is in charge of Iskandar Malaysia's solid waste management.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

A literature review is a critical an in-depth evaluation of previous research. It is a summary and synopsis of a particular area of research, allowing anybody reading the paper to establish the objectives of the research's topic or program. It is also a critical analysis of a segment from published body of knowledge through summary, classification, and comparison of prior research studies, reviews of literature, and theoretical articles.

2.1 Sustainability Theory

When the word ‘smart’ comes into any kind of topic, the first thing that will be mentioned and discussed is ‘sustainability’ and this also implies in the case of solid waste and smart city. The word sustainability was derived from the Latin word which is ‘sustinere’ (to hold up). Dictionaries provide more than ten meanings for the word ‘sustain’, the main one would be ‘maintain’, ‘support’ and ‘endure’. However, since the 1980’s, sustainability has been used more in the sense of human sustainability on planet Earth and this has resulted in the most widely quoted definition of sustainability as a part of the concept sustainable development.

Nowadays, sustainability is being widely used in every aspect including the field of construction, biotechnology, automotive and etc. When sustainability is added into the topic, the development of the mentioned topic will have to meet the needs of the present so that it can be brought to the future.

“Sustainable development is development that meets the needs of the present without compromising the ability of the future generations to meet their own needs. It contains within it two key aspects:

1. *The concept of **needs**, in particular the essential needs of the world’s poor, to which overriding priority should be given; and*
2. *The idea of **limitations** by the state of technology and social organization on the environment’s ability to meet present and future needs.”* (Brundtland, 1987)

As mentioned earlier, solid waste and smart city have been going through sustainable development over the years. For example, Czech Republic is one of the countries that have showed tremendous sustainable development for their solid waste management.

Waste is among those areas which are significant to environmental protection that was legally recognized only after 1990 in the Czech Republic. The first waste

management act was enforced in the year 1991. Until then, most municipal waste was disposed of at uncontrolled and unsecured landfills. The last of them was closed in 1996. The waste disposal system has been expanding and because of constant technological innovation, the amount of landfilled waste has been reduced. Up till date, there are 199 landfills for other wastes in the Czech Republic, used mainly for depositing municipal waste, with a total capacity of 53 315 750 m³. Next are three municipal waste incinerators that convert heat into energy and 29 hazardous waste incinerators.

Czech Republic have proved that they are worthy of being called one of the countries that can sustain their environment due to constant sustainable development of solid waste management in their country.

2.2 Solid Waste Systems

The management of solid waste varies in each country. Some are using the conventional method of managing their solid waste, some are starting to venture into the integrated solid waste management system and there are even those countries that have implemented it for a long time.

In the United Kingdom, the government there treats the waste accordingly to the type. The ways of handling the waste varies from disposing it normally, recycling and there are also waste that will be incinerated. Domestic waste for examples will be treated in the recycling centre since most of the materials can be recycled. On the other hand, rules and regulations were created in order to handle medical and chemical waste since there are some items that may be hazardous and thus cannot be disposed of in the landfills. This method of managing waste is quite similar to another country which is the United States of America.

Both of the countries showed an example of some of the conventional method used in managing solid waste in the country. A normal country or city would normally possess the basic technology of solid waste management. It is not said that a

conventional method cannot handle waste properly but the method was proved unable to cope with the 'supply-demand' situation right now.

A country that still has a lot of land may still be fit to use the conventional method as there are still a scarce of land to be used for landfills. But for country like Japan, land is very limited and valuable. Therefore, landfills cannot be simply constructed here and there. That is why the government of Japan has shifted the method of managing solid waste from conventional to a more sustainable method by simply standing on one principle which is Mottainai. It is a practice of treasuring and using all things as long as possible.

Among the technologies used in Japan is the 'Transport Station'. This station act as a rendezvous point for the 2-tonne garbage truck collector to dispose all of the wastes collected. Next, the garbage will be compressed into one container. The container will then be carried by a bigger truck to the disposal site or incineration plant. This method alone did not just lead to cost reduction, but it also reduces CO2 emissions which contribute to the prevention of global warming. Killing two birds with one stone. Manage waste, reduce cost and protect the environment.

Other than that, Japan is also practicing and using a safe and sound municipal waste incineration and high-efficiency power generation. Japan's Ministry of Environment, 2012 states that Japan's possesses the world's leading garbage incineration facilities with 1243 incineration facilities that incinerate garbage using several methods; stoker furnaces, fluidized bed furnaces and gasification fusion resource furnaces with the objective of ash recycling.

Not only that, Japan also practices several other methods in order to manage solid waste in the country including PET bottle recycling technology, home appliance recycling technology, biomass utilization technology and etc. This country have proves that a more integrated method is crucial towards having a more sustainable city and society.