UNIVERSITI PUTRA MALAYSIA

PUBLIC PREFERENCE AND PARTICIPATION IN SUSTAINABLE REDEVELOPMENT OF A CLOSED LANDFILL SITE IN AYER HITAM, SELANGOR, MALAYSIA

ASHKAN NOCHIAN

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By

ASHKAN NOCHIAN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

May 2018

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DEDICATION

To whom they thought me to care about our environment and humanity!

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy

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May 2018

Chair: Osman Mohd Tahir, PhD
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Landfill is one of the most common methods of waste disposal besides incineration and recycling. However, issues arise with what to do at the end of their lifecycle. These issues are more pertinent with landfills that are located in or in close vicinity of urban areas where land is scarce, more valuable, and environmental hazards from landfills are taken seriously. Perhaps a solution to these closed landfills is to redevelop them into other successful sustainable uses. A sustainable redevelopment approach for landfill redevelopment (LR) reduces the risk of failure. One of the factors in sustainable development is public participation (PP) but to engage the public in the redevelopment effort is to consider public preferences towards the projects. Therefore, the goal of this study is to obtain and understand public preferences and affecting factors of different types of open spaces use for landfill redevelopment, public participation and affecting factors in landfill redevelopment, and the influence of the public preference on public participation for a sustainable a sustainable landfill redevelopment project. The study employed the explanatory sequential mixed-methods with closed-ended questionnaires distributed to 382 respondents to obtain public opinion regarding the Ayer Hitam Sanitary Landfill (AHSL) redevelopment. This survey was supported by interviews and field observations. A face-to-face interview was carried out with 13 AHSL site users and followed by field observations on major landfill issues and site users' behavior. Results revealed that respondents preferred nature open space slightly higher than recreation and sport open spaces. In addition, perceived benefit and participant's experiences were the most significant predictors for preference. The proposed model for public preference which includes the dependent and all independent and controlling variables was significant as a whole. Perceived benefit, concern, experience, age, and ethnic group all had significant relationships with preference. Regarding public participation (PP), the majority (75.7%) of the respondents agreed to participate in the LR project. Among factors affecting PP, preference, education and ethnic group were found to be significant. The model

which consists of all independent and controlling variables with PP was found to be significant. Meanwhile preference, education and ethnic group had significant associations with PP. The primary implications of this study are that public preferences should be a core factor in the redevelopment plan because it increases public participation and therefore reduce the risk of project failure. The findings of this study may be useful for those dealing with landfills. The research findings, research framework, and methodology of the study can also be used for other studies related to landfill redevelopment as open spaces.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Doktor Falsafah

PILIHAN DAN PENGLIBATAN AWAM DALAM PEMBANGUNAN LESTARI BEKAS TAPAK PELUPUSAN SAMPAH DI AYER HITAM, SELANGOR, MALAYSIA

Oleh

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Tapak pelupusan adalah salah satu kaedah pembuangan sisa yang lazim di samping pembakaran dan kitarsemula. Walau bagaimanapun, beberapa isu timbul berkaitan dengan apa yang perlu dilakukan pada akhir kitaran hayat tapak ini. Isu-isu ini menjadi lebih penting berkaitan tapak pelupusan yang terletak dalam ataupun berhampiran kawasan bandar di mana terdapat kekurangan tanah, tanah lebih berharga dan bahaya alam sekitar darpadai tapak pelupusan diberi perhatian yang lebih serius. Salah satu kemungkinan bagi menyelesaikan masalah tapak pelupusan yang telah lupus ini ialah dengan pembagunan semula tapak kepada kegunaan lestari lain yang berjaya. Pendekatan pembangunan semula pembangunan semula tapak pelupusan (LR) secara lestari mengurangkan risiko kegagalan. Salah satu faktor kejayaan dalam pembangunan lestari ialah penyertaan awam (PP). Tetapi untuk melibatkan orang ramai dalam usaha pembangunan semula adalah dengan memberi pertimbangan kepada persepsi awam terhadap projek. Oleh itu, kajian ini cuba i) untuk mengenal pasti dan mengkaji persepsi awam untuk jenis ruang terbuka yang digunakan untuk LR dan faktor yang memberi kesan terhadapnya, ii) untuk mengenal pasti dan mengkaji kadar, sebab yang mendasari, dan faktor yang mengesani PP dalam projek LR, iii) untuk menentukan hubungan antara persepsi awam ke arah pelbagai jenis ruang terbuka dan PP dalam projek LR serta faktor-faktor memberi kesan kepada hubungan ini, iv) untuk menguna implikasi kajian ini dalam pembinaan LR sebagai projek lestari. Kajian ini menggunakan kaedah campuran berurutan menggunakan soal selidik tertutup yang diedarkan kepada 378 responden untuk mendapatkan pendapat umum mengenai pembangunan semula Tapak Pelupusan Sanitari Ayer Hitam (AHSL). Kajian ini disokong oleh temu bual dan pemerhatian lapangan. Temuduga tatap muka dilakukan dengan 13 penguna tapak AHSL dan diikuti dengan pemerhatian lapangan mengenai isu-isu pelupusan sampah utama dan tingkah laku penguna tapak. Keputusan kajian menunjukkan bahawa responden lebih gemar sedikit kepada ruang terbuka alam daripada ruang terbuka rekreasi dan

ruang terbuka sukan. Di samping itu, manfaat dan pengalaman peserta adalah peramal yang paling signifikan untuk menentukan kegemaran. Model yang dicadangkan untuk kegemaran awam mengandugi semua pembolehubah bersandar, bebas, dan mengawal adalah secara keseluruhannya signifikan. Manfaat, keprihatinan, pengalaman, umur, dan kumpulan etnik juga membpunyai kaitan yang signifikan dengan keutamaan. Mengenai penyertaan awam (PP), kebanyakan (75.7%) responden bersetuju untuk menyertai projek LR. Keutamaan, pendidikan dan kumpulan etnik adalah antara faktor yang mempengaruhi PP dengan signifikan. Model yang terdiri daripada semua pembolehubah bebas dan mengawal dengan PP juga didapati signifikan. Sementara itu, keutamaan, pendidikan dan etnik mempunyai kaitan yang tinggi dengan PP. Implikasi utama kajian ini ialah kegemaran awam harus menjadi faktor utama dalam pelan pembangunan semula kerana ia dapat meningkatkan penyertaan awam dan oleh itu mengurangkan risiko kegagalan projek. Penemuan kajian ini berguna bagi mereka yang berurusan dengan tapak pelupusan sampah. Penemuan penyelidikan, kerangka penyelidikan dan metodologi kajian juga boleh digunakan untuk kajian lain yang berkaitan dengan pembangunan semula tapak pelupusan sebagai ruang terbuka.

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I certify that a Thesis Examination Committee has met on 28 May 2018 to conduct the final examination of Ashkan Nochian on his thesis entitled "Public Preference and Participation in Sustainable Redevelopment of a Closed Landfill Site in Ayer Hitam, Selangor, Malaysia" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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This is to confirm that:

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LIST OF ABBREVIATIONS

PP	Public Participation
LR	Landfill Redevelopment
AHSL	Ayer Hitam Sanitary Landfill
SPSS	Statistical Package for the Social Sciences
IAP2	International Association for Public Participation
GFOA	Government Finance Officers Association
MSW	Municipal Solid Waste
MSWLF	Municipal Solid Waste Landfill
LFG	Landfill Gas
$\chi 2$	Chi-square
SD	Sustainable Development

CHAPTER 1

INTRODUCTION

As human progresses into the 21st Century, many living areas are inflicted by numerous environmental, social, and economic problems. Landfills as places to dispose of urban wastes are one of these problems that affect living conditions especially in urban areas. Therefore, a careful consideration must be given right from their planning stage until after they are closed down. A landfill produces environmentally hazardous materials such as leachates, toxic, and stinking gases that cause widespread contamination and other environmental issues (Elbert Dijkgraaf & Vollebergh, 2004). Natural landform and bio-diversity will be negatively altered due to a landfill placement, construction, and long period of use. These are just a few examples of environmental problems associated with a landfill. These coupled with a rapidly growing population in cities caused shortage of land for the placement of landfills. Thus, many landfills are located near or even in the cities where land are scarce. Due to their proximity to human habitation, these landfills can contribute to many social and economic issues for communities living adjacent to them.

1.1 Research Background

Resource recycling has become an essential worldwide concept. In addition to recycled reusable materials, recycling has extended to site reuse or land redevelopment. Site reuse, reclamation, and redevelopment was one of the top environmental issues that can contribute to economic and social development (De Sousa, 2003). Site reuse or redeveloping applies to unsuitable land uses (e.g. brownfields, landfills and super-fund sites) that have been restored or reused for more productive developments.

1.1.1 Need for Landfill Redevelopment

There are a few common methods for waste disposal such as landfilling, incineration, and recycling. Landfill is currently the most widely used method of waste disposal and is likely to continue to be the main disposal option for the short to medium term despite considerable efforts in recycling and waste minimization (Ortiz, Pasqualino, Díez, & Castells, 2010). Decreasing the present trust on landfill is one of the major issues to be addressed in current waste management.

In line with the standing policies and economies of scale, many landfill sites are closed or they are in the process of closing down. In addition, landfill creates many environmental hazards such as contaminated leachate, exploding gas, and bad smell. These environmental issues have effects on human health and

quality of life. They can remain to be a problem even after more than 30 years the landfill is closed. There is a need for landfill redevelopment to revive these damaged and problematic areas for the benefits of communities. This is especially important when finding an area especially a large one is problematic (Ayalon, Becker, & Shani, 2006).

1.1.2 Suitable Choice for Landfill Redevelopment

Landfill redevelopment requires general considerations in term of inventory and analysis of climate, landfill client and ownership's (public and private sector) opinion, site geometry, local demand, local recourses, land use zoning, financial conditions like any other land development projects (B. Tansel, Varala, & Londono, 2013). However, as landfill is a specific environment with unique conditions, there are also other factors that associate exclusively with it. The most important factors to consider in determining the choice of a landfill are landfill site characteristics, landfill's environmental impacts and control system, meeting regulation and criteria requirements and consulting with relevant parties, and community opinion and acceptance (Rawlinson, Dickinson, Nolan, & Putwain, 2004).

In general there are five choices for landfill redevelopment. These after-use choices are as i) open space, ii) agricultural land-use, iii) woodland, iv) hard end-use, and v) energy generation (Nochian, Tahir, Maulan, & Mikaili, 2016). Each of the options has its own benefits. Now the question is which of the after-use option would the most suitable one for landfill redevelopment?

As it is adequately explained in the literature review chapter (see sub-section 2.1.6) landfill redevelopment is better suited for open space development rather than for construction and other after-use options. In a short explanation, this is because of i) the inherent environmental problems of landfill and its risks to the community, the cost of redeveloping process, and iii) the risk of physical failure in landfill redevelopment.

Besides the abovementioned technical and environmental reasons, closed landfills have been turned into open spaces by regulations under the law in the past. The Malaysia's National Solid Waste Management Department (NSWMD), which is responsible for waste management system in the country recommended that "At the proposed sanitary landfill, turning the area into a *green area* or *park* is considered the *best option*" (*National Solid Waste Management Department*, 2010).

Further discussions on this topic will be dealt with in the Literature Review section but for now it is sufficed to argue that the most suitable choice of landfill redevelopment in Malaysia is as an open space.

1.1.3 Sustainable Landfill Redevelopment

Landfill redevelopment in many cases refers to the technical issue that can be solved through engineering solutions (Misgav, Perl, & Avnimelech, 2001). However, applying technical solutions alone do not guarantee the success of these redevelopment projects. Therefore, it is the best to follow the principles of sustainability in order to have a beneficial and successful redevelopment project (Ribic, 2008). There is a need to ask an important question: What can be done to increase the chances of a sustainable redevelopment of a closed landfill site when it is reuse as an open space?

The complexity of sustainable redevelopment brings together social, economic, and environmental factors. However, these may vary from one project to another. For instance, in some projects the environmental aspect may be more about ecological issues or technical components of the project. Sustainable redevelopment of landfills is driven by factors such as the demand for developable space, the desire for beneficial re-use of degraded land, and the need to manage contamination risks associated with landfills. A developer should consider a variety of different lifecycle costs and benefits and assess the potential barriers to sustainable redevelopment in evaluating the sustainability of potential redevelopment project, (SUFALNET, 2007). According to SUFALNET (2007), these barriers include financial risk, a perceived lack of market, excessive transaction costs, and a lack of public acceptance.
A landfill redevelopment project is considered sustainable when the three components of sustainability are applied and meet the standards. Figure 1.1 elaborates some benefits of sustainable landfill redevelopments.

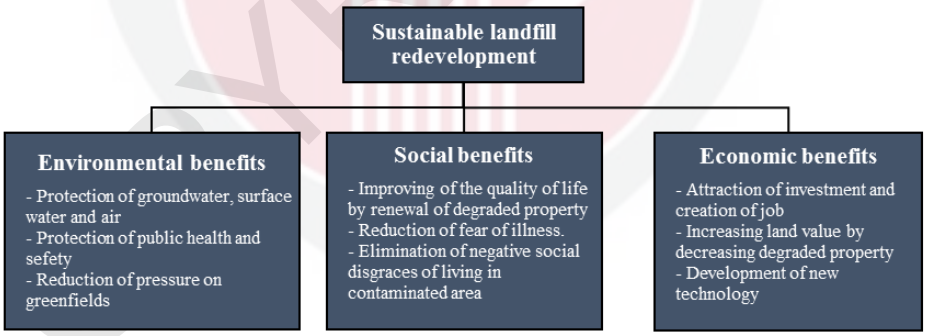

Figure 1.1: Benefits of Sustainable Landfill Redevelopment, Adapted from (SUFALNET, 2007)

1.1.4 Importance of Social Aspect in Sustainable Landfill Redevelopment

From a social perspective, the most serious obstacle to the potential redevelopment of a closed landfill is not actually the presence of contamination, but the perception of contamination. Therefore, the manner in which the potential risk is presented and interpreted and the level of public trust or confidence in the project are crucial (SUFALNET, 2007). Without public acceptance, any landfill

redevelopment project is at risk. An integrated community communication plan that addresses the environmental, economic, and social concerns should be an integral part of any landfill redevelopment program. In fact, a new project would not be financially feasible without social acceptance. And social acceptance would not occur without environmental safety. This connection can create a great difficulty in decision making (W. van Vossen, 2005). It is recommended that the affected public is engaged to increase their acceptance of the redevelopment project. Their participation is expected to increase when their preferences are maximized (Scharff & Kok, 2007). This point is significantly important in redevelopment of a landfill since a landfill is a special and complex environment as well as the perceptions people have on issues regarding the landfill.

1.2 Problem Statement

A successful redevelopment of a degraded land with many hazardous issues depends on multiple factors. This, as mentioned earlier, can be categorized into three main aspects of sustainability, which are environmental, economic, and social. Although there has been numerous studies done on landfill redevelopment, very few studies have focused on the social aspect of sustainable redevelopment of a closed landfill site. Regarding the problem of landfill redevelopment from social perspective Slowey (2016), stated that some criticism could be the result of the negative public relations that often involve these types of projects and that opponents don't understand that many of (the issues they' are worried about) have engineered solutions. Hudgins, Law, Ross, & Su (2010), argued that the unique nature of each landfill can make development of a sustainable landfill strategy a challenge. Therefore successful strategies also require a multi-discipline approach that addresses the many environmental, political and social issues surrounding landfills. Their arguments baring the social issues in to account for achieving a successful strategies of landfill redevelopment. To re-use landfill as an open space Simis & Awang (2014), mentioned that in dealing with issues of insufficient urban spaces for future development, closed landfills nearby urban areas needs to be redeveloped. Proper planning and designing needs to be implemented. Their study suggested that suggests that community opinion should be taken into consideration in determining the suitability of the development of the former landfill to ensure the optimum benefits to the community and development to be widely accepted by the community. They added that, this suggestion is based on the fact that community opinion will determine the success status of the future development, particularly for developing countries who perceive the redevelopment of the closed landfill site as a new field in urban planning.

A comprehensive literature review revealed that many study address technical (engineering) issues and problems in landfill redevelopment and very few researches have focused on the importance of social perspective in landfill redevelopment in order to prevent the failure of the project and increase the chance of its feasibility despite an increased demand in re-using landfills as open space areas for the benefits of communities (Dempsey, Bramley, Power, & Brown, 2011; Misgav et al., 2001). Therefore it is critical to increase the feasibility of landfill redevelopment project by taking social aspects into account. The

feasibility of a redevelopment project will be maximized if the public could participate along in it (Solitare, 2005). More public participations can be expected if public preferences regarding the open space activities and settings are taken into considerations (Elmendorf, Willits, & Sasidharan, 2005). In order to successfully apply public preference, it is necessary to know public opinions regarding the landfill redevelopment project. This is because despite their concerns about the drawbacks of a landfill, they also view it as an opportunity with many perceived benefits. Besides these there are also other factors (e.g. demography background and experience) that affect public decision making to participate in the landfill redevelopment.

Therefore, this study seeks to identify public preferences and the factors that interact with these preferences to increase the willingness of the public to participate in achieving a sustainable redevelopment of a closed landfill site as an open space area in the Malaysian context.

1.3 Research Questions

Main and sub-research questions of this study are:

Main research question: How do public preferences and affecting factors influence public participation in a sustainable landfill redevelopment project?

Sub-research question 1: What are public preferences and affecting factors of different type of open spaces use for landfill redevelopment?

Sub-research question 2: What are public participation and affecting factors in landfill redevelopment project?

Sub-research question 3: How does public preference of different type of open spaces relate to public participation in landfill redevelopment project and the factors that affecting this relationship?

Sub-research question 4: How can the implications of this study be applied to make landfill redevelopment sustainable as an open space?

1.4 The Study Goal and Objectives

The goal of this study is to obtain and understand public preferences and affecting factors of different types of open spaces use for landfill redevelopment, public participation and affecting factors in landfill redevelopment, and the influence of the public preference on public participation for a sustainable a sustainable landfill redevelopment project.

This leads to the following study objectives:

Objective 1: To identify and examine public preferences and factors affecting them for different types of open spaces for landfill redevelopment.

Objective 2: To identify and examine public participations and the factors affecting them in landfill redevelopment project.

Objective 3: To determine the relationships between public preferences of different types of open spaces and public participation in landfill redevelopment project and the factors affecting these relationships.

Objective 4: To infer the implications of this study for a sustainable landfill redevelopment as an open space.

1.5 Definition, Scope and Limitation of the Study

There are many criteria and phenomena that can affect the sustainability of a landfill redevelopment project. These factors vary from types of landfill, the stages of landfill restoration, and so on. However, this study will focus only on the stated scope and limitations as outlined below.

1.5.1 Definition

The key terms used in this study are as stated in the following. A more detailed explanation of these terminologies will be given in Chapter 2.

1.5.1.1 Active Landfill versus Closed Landfill

An active landfill refers to those landfills currently operating and receiving waste. Closed landfill refers to a landfill which has reached its final capacity and is no longer taking waste and is being monitored under certain regulations (Abdulrahman et al., 2016; Adelopo, Alo, Haris, Huddersman, & Jenkins, 2017; C.-J. Liu, 1999).

1.5.1.2 Sanitary Landfill versus Non-sanitary Landfill (open dump site)

A sanitary landfill is a waste disposal site that is meant to be designed, operated, and restored so as to decrease environmental and health hazards, including gas, odor and water pollution from runoffs and leaching. An open dump has no management and/or environmental controls (Tuan, 2008). In addition, the main

differences between a sanitary landfill and an open dump is that sanitary landfills have a liner, a leachate control system, gas venting, regular soil coverage, and anti-bacterial measures. These infrastructure are absent at open dumps (S. H. Fauziah & Agamuthu, 2012).

In this study the term “landfill” refers to sanitary landfill.

1.5.2 Scope

Sustainable development is a broad concept comprising of the three aspects of sustainability which are environment, economic, and social. As mentioned earlier in this chapter (see sub-section 1.1.3), a landfill will be successfully redevelop when those three aspects consider in planning process. From project complexity point of view, environmental aspect which can be categorized in technical (engineering) area talks about risk and what is acceptable and how much it cost (Khabbaz & Fatahi, 2011). Environmental aspect analyzing the opportunities in and constraints of a project from an engineering perspective, integrating risk assessment and post-closure measures. Taking into account environmental risk, environmental benefits, site and landfill issues characterization, and engineering solutions are some important factors that consider in environmental aspect in landfill redevelopment project (Environmental Protection Agency, 1999; RIGILLO, IACOVIELLO, CANONICO, & Milite, 2007). In addition to environmental aspects, Economic aspects which can be categorized in financial area focuses on what is the return on the project and if there are any litigation or liability risks. It assessing the redevelopment life cycle costs, the economic benefits of the project, and the involvement of private sector. Financial risk, economic benefits, lifecycle cost, and public incentives are some factors that usually are part of economic aspect in landfill redevelopment project (L. Hao, 2012; Ribic, 2008). Finally, social aspects which can be categorized in administrative are of redevelopment project consider the need of social acceptance for a successful redevelopment project (SUFALNET, 2007). Social aspects checking if redevelopment plans meet local opinion and expectations, considering if the redevelopment project can improve health and well-being, and concerning about revitalization of communities and neighborhoods. Social risks, social benefits, public opinion, and community participation are some factors that consider in social aspect for achieving sustainable landfill redevelopment (Dixon, 2014).

As it explained above many topics and areas are involved in sustainable development of a closed landfill. Even in term of social aspects there are various factors that can be study. Therefore to narrow down the research and following the research problem which found after a comprehensive literature review, this study seeking for a sustainable approach in term of social aspect towards closed landfill redevelopment.

1.5.3 Limitation

This study is limited to only sanitary landfill for municipal solid waste (MSW). This choice is based on the fact that this type of landfill is the most current and popular method of municipal solid waste management in Malaysia as well as many other countries. In fact, sanitary landfills in Malaysia are beginning to replace non-sanitary landfills for MSW disposal under "SOLID WASTE AND PUBLIC CLEANSING MANAGEMENT ACT 2007" (SWPCM Act 2007) and it is expected that future landfills will be of the sanitary type (Agamuthu & Fauziah, 2011).

The study also selects a sanitary landfill that were no longer in operation (already closed) to allow a factual understanding of redevelopment project by the people. Another factor that needs to be taken into account was the selection of a sanitary landfill that has been closed for more than five years. This is because a newly closed landfill will still be having many issues (e.g. odors) that can affect people's perceived benefits for the redevelopment project.

1.6 Significance of the Study

Currently, there are about twelve existing sanitary landfills that had reached their capacity and will soon face closure in Malaysia. The sites will become potential areas that are suitable for open space development when these are finally closed. Closed landfills may be the few lands remaining for open space development in some urban areas as available land is scarce. Thus, a sustainable use of these closed landfills will actually bring benefits to the landfill companies, community's residents, and government agencies involved. It is also important to use closed landfills effectively as their numbers will most likely increase in the future as the authorities will continue to rely on landfills for waste disposal.

However, public preferences and subsequently public participation play an essential role in the success of a landfill redevelopment. Therefore, this study will attempt to seek and bring significant benefits to this redevelopment effort. Among the expected benefits will include:

- Providing information about public preferences and their underlying factors for future planning and management.
- Facilitating future landfill redevelopment and making a more productive use of the closed landfill sites.
- Providing the necessary understanding of the concerns and benefits that influence public perceptions of landfills in order to develop better planning and design approach for any brownfield lands in Malaysia and elsewhere.
- Contributing to policy formation regarding sustainable use of degraded lands resources by effectively redeveloping these potential idle lands as open space areas.

1.7 Organization of the Thesis

This thesis is organized into 7 chapters. This first chapter describes the background and importance of landfill redevelopment. It also provides a statement of the problem, research objectives, and the significance of the study as well as outlines the definitions, scopes, and limitations of the study.

The second chapter provides a critical review of the literature that has assisted to define the study direction by providing a theoretical understanding of sustainable landfill redevelopment from a social perspective. The literature review also helps to identify concerns (perceived risk) and perceived benefits towards landfill redevelopment, understanding of public participation, landscape preference, and factors that potentially affect public's preferences for landfill redevelopment.

The third chapter explains the methods used and the reasons for their choices. It also discusses the procedure used for survey questionnaire, interviews, and field observations (e.g. type of instrument, sample size, administration, measured variables, and data analysis). The discussion also includes reliability and validity of data.

Chapter four presents the findings of the quantitative research related to the public's preferences of different types of open spaces use for landfill redevelopment. It also includes discussion on the relationship of the public preference and its affecting factors. The underlying reasons for willing or unwilling to participate and factors affecting public participation are also discussed. Fifth chapter present the result of qualitative data analysis including interview and field observation data.

Chapter six presents the analysis of findings through quantitative and qualitative concerning significant factors that can conduct the result to implicate sustainable approach about landfill redevelopment in the area of study.

Finally, chapter seven summarizes all the significant findings and information in accordance with the research objectives. It also includes the significance of the study recommendations for future studies and conclusion.

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