

**DEVELOPING AN ENVIROMENTAL RESOURCES
RESILIENCE FRAMEWORK AND INDEX FOR
SELANGOR**

BY

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**A thesis submitted in fulfilment of the requirement for the
degree of Master of Science (Built Environment)**

**Kulliyyah of Architecture and Environmental Design
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ABSTRACT

Rapid urbanization combined with climate change have contributed to the poor environmental performances of cities with the increase of natural disasters. This research aims to assess the resilience of environmental resources for the state of Selangor using a newly developed framework and assessment tool. The objectives of this research (1) to develop an environmental resources resilience framework; (2) to formulate an environmental resources resilience assessment tool; and (3) to generate and map out the environmental resources resilience index statuses for Selangor. For this research, the state of Selangor that has nine districts is chosen as the case study for its abundance of environmental resources and economic importance where resilience in environmental resources is vital towards realising sustainable development. To achieve the objectives of this research, literature review of international and national plans, policies, indexes and studies have undergone content analysis in developing an environmental resources resilience framework. Then necessary literature reviews, data collection and scoring of indicators are done according to the framework in formulating an environmental resources resilience assessment tool. Data extracted from PLAN Malaysia's GIS database system, government annual reports and LANDSAT imagery are input into the assessment tool to generate the environmental resources resilience statuses for nine districts in Selangor and the composite environmental resources resilience status for Selangor. Both these results are then input into the MapInfo software and undergone thematic analysis to produce the mapping of both results in the GIS database system. Through this research, it is identified that all the districts in Selangor have a moderate environmental resources resilience status except Petaling district which is categorised in the low status. Besides, the composite environmental resources resilience for the state of Selangor is also categorised in the moderate status. Findings from this research is that the moderate status of environmental resources resilience for Selangor is due to the negligence of available environmental resources where potential are not being optimised and poor maintenance. Recommendations to further improve this study is with additional framework component such as agriculture soil; inclusivity of coastal area planning; data sharing among agencies; and cooperation among stakeholders.

ملخص البحث

ساهم التحضر السريع المقترن بتغير المناخ في ضعف الأداء البيئي للمدن مع زيادة الكوارث الطبيعية. يهدف هذا البحث إلى تقييم مكون الموارد البيئية في سيلانجور باستخدام إطار عمل مطور حديثاً وأداة تقييم. تتمثل أهداف هذا البحث في (1) لتطوير إطار عمل مرونة الموارد البيئية، (2) صياغة أداة لتقييم مرونة الموارد البيئية، (3) لتوليد ورسم خريطة حالة مؤشر مرونة الموارد البيئية لسيلانجور. ضمن البحث هذا، تم اختيار ولاية سيلانجور التي تضم تسع مناطق بوصفها دراسة حالة لوفرة الموارد البيئية وأهميتها الاقتصادية حيث تعد المرونة في الموارد البيئية أمراً حيوياً لتحقيق التنمية المستدامة. تحقيقاً لأهداف هذا البحث، تعمقت الباحثة في مراجعة عدة الدراسات السابقة للخطط والسياسات الدولية والوطنية لتحليل المحتوى في تطوير إطار عمل مرونة الموارد البيئية. ثم تقوم الباحثة بإجراء مراجعة عدة الدراسات السابقة المهمة، وجمع البيانات، وتسجيل المؤشرات وفقاً للإطار في صياغة أداة تقييم مرونة الموارد البيئية. إن البيانات مستخرجة من نظام قاعدة بيانات GIS في PLAN Malaysia والتقارير السنوية الحكومية وصور LANDSAT هي مدخلات في أداة التقييم لتوليد حالات مرونة الموارد البيئية لتسع مناطق في سيلانجور وحالة مرونة الموارد البيئية المركبة لسيلانجور. وبالتالي، تم إدخال هاتين التيجتين البارزتين في برنامج MapInfo، ويكون تحليلاً موضوعياً لإنتاج خرائط لكلا التيجتين في نظام قاعدة بيانات نظم المعلومات الجغرافية (GIS). من خلال هذا البحث، تم

تحديد أن جميع المناطق في سيلانجور تتمتع بحالة معتدلة من مرونة الموارد البيئية باستثناء منطقة بيتالينغ المصنفة في حالة منخفضة. ومن الملحوظ أيضاً، تُصنف ولاية سيلانجور نفسها في المستوى المعتدل حسب تصنيف مرونة الموارد البيئية المركبة لولاية سيلانجور. أشارت النتائج المستخلصة من هذا البحث إلى أن المستوى المعتدل لمرونة الموارد البيئية لولاية سيلانجور يرجع إلى إهمال الموارد البيئية المتاحة حيث لا يتم تحسين الإمكانيات وضعف الصيانة. ومن توصيات الدراسة العلمية هذه: (1) تحسين الإطار العلمي بمزيد من مكونات إضافية مثل التربة الزراعية، (2) تنفيذ شمولية تخطيط المناطق الساحلية، (3) تبادل البيانات بين الوكالات أو المنظمات، (4) التعاون بين أصحاب المصلحة.

APPROVAL PAGE

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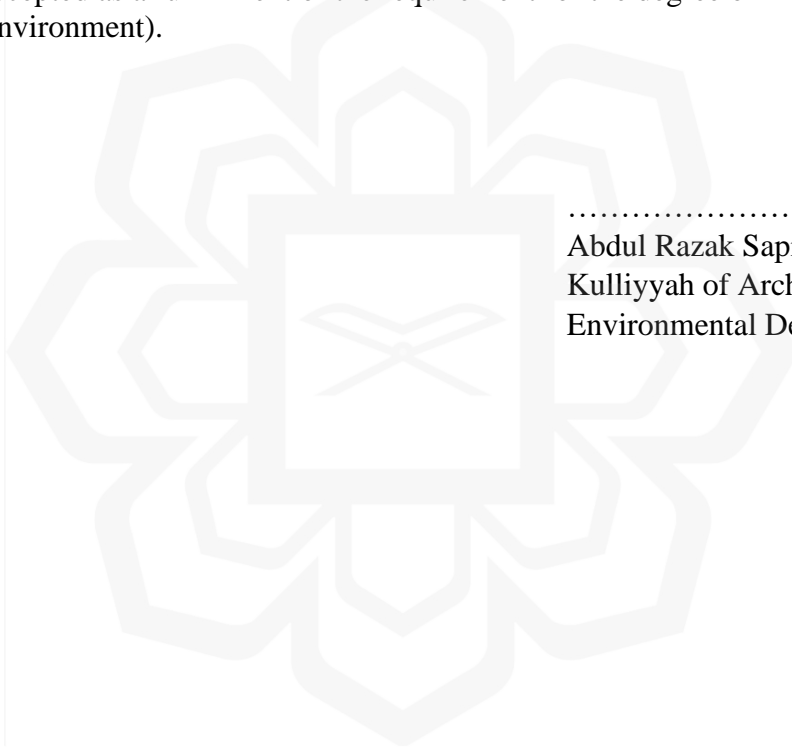
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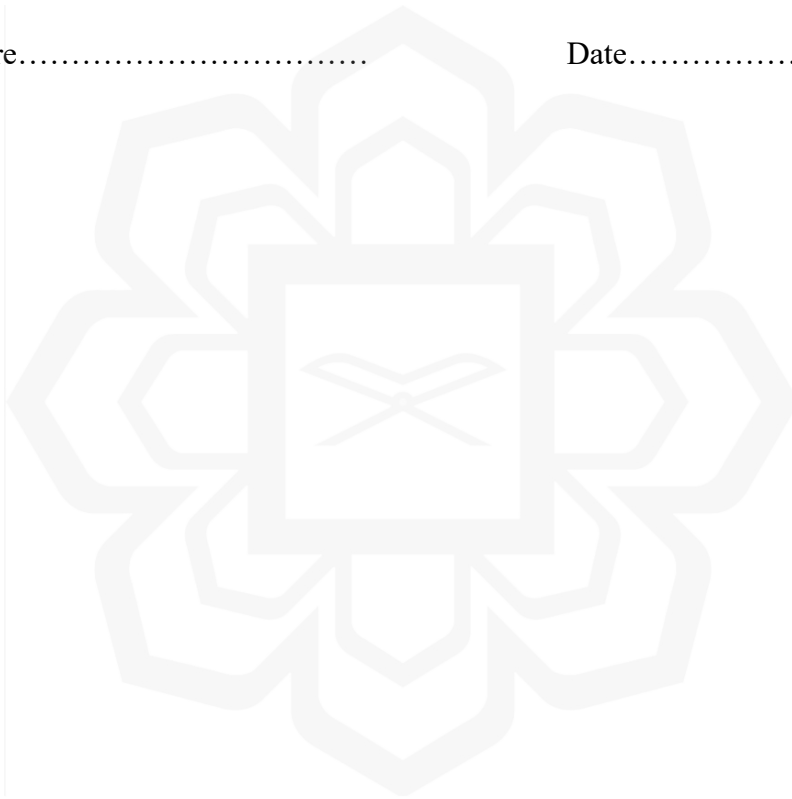
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This thesis is dedicated to everyone that have supported me throughout this wonderful journey in seeking knowledge for the betterment of the Ummah.

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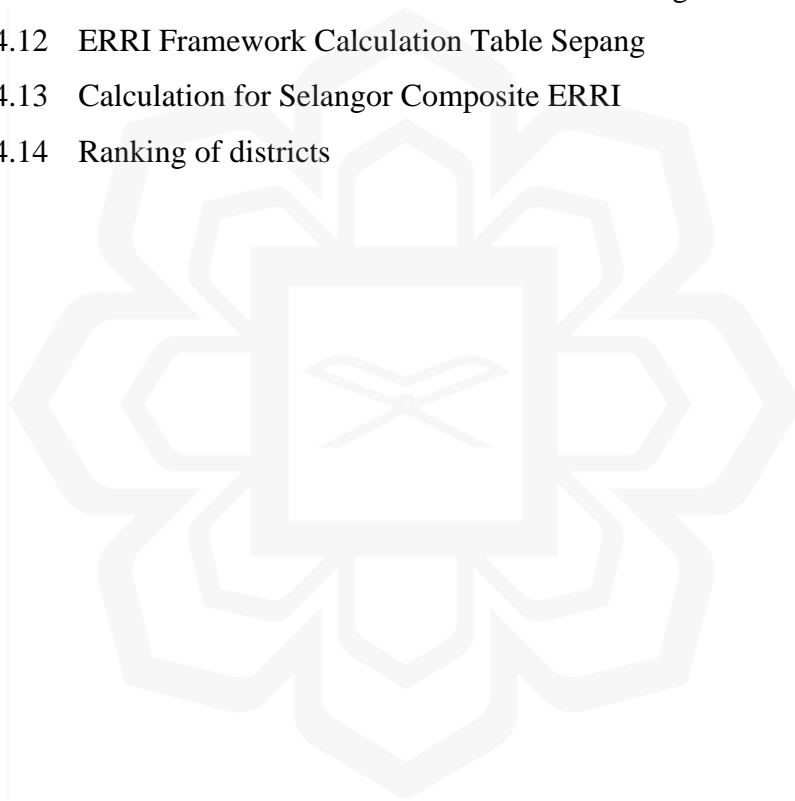
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CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

Today, global climate change has significantly impacted the local environmental context of towns worldwide. Earth provides an environment that provides basic human needs such as food and shelter as well as raw materials for economic benefits and profits. However, through the excessive alteration of the natural environment by human throughout the years, it has resulted to environmental degradation that is depletion of resources which includes biotic and abiotic elements from our environment (Maurya et al., 2020) (refer Figure 1.1). This adversity is also faced in Malaysia with frequent and unpredicted pattern of natural disaster such as floods, earthquakes, landslides, and haze, naming a few types of environmental degradation. Incidentally, environmental sensitive areas such as forest areas, coastal areas, wetlands, and many others are vital in providing ecosystem services and natural defence system in providing resilience in towns.

Conversely, questions arise whereby if environmental resilience can be operationalised and measured as a tool in aiding local planning authorities in assessing the environmental performance in their municipality. With that, this thesis aims to assess the resilience of environmental resources based on the three main keywords from this study are environmental resources, resilience, and index. Environment can be defined as physical factors surrounding humans such as land, water, air, climate, noise, and biological factors such as animals and plants as well as social factors (PLANMalaysia, 2017). The relationship between the environment and human has strong interrelationships as the environment can shape the community's lifestyle such as lifestyle and economic resources through the availability and abundance of natural raw resources (water, food, minerals etc.) and climate (humidity, rainfall, and temperature). On the other hand, environmental resources can be defined as any

material, service or information from the environment that is valuable to the society (encyclopedia.com, n.d.). For example, forests are important as a water catchment area, habitat for wildlife and produces logs that are valuable materials.

The term resilience emerged from the concept of sustainable development with no standard definition as it is used by many fields such as physics, engineering, and ecology. Synthesising definition of resilience by various authors such as (Suárez, Gómez-Baggethun, Benayas, & Tilbury, 2016), (Hassler & Kohler, 2014) and (Saunders & Becker, 2015), the buzzword can be defined as the ability of complex systems (built environment) to change, adapt, and transform during disturbance (disasters) and to bounce back or forward to its previous state (post disaster recovery). With the characteristics of resilience to operationalise sustainability, it bridges ideas in developing frameworks or indexes.

From the Barbados Programme of Action (United Nations, 1994) and Environmental Vulnerability Index (EVI) (Pratt, Kaly, & Mitchell, 2004), the term index can be synthesised as a statistical measure by quantifying indicators of interested study topic, in the case of EVI, the formulated index is used as a quantitative indicator to measure environmental vulnerability statistically. Therefore, a framework that evaluate the selected environmental resources indicators suitable to the local environmental context of Malaysia. Currently, local planning authorities (LPAs) uses the MURNINets frameworks in assessing the urban sustainability of a municipal on one hand, and Environmental Impact Assessment as a prerequisite for development approvals from the developer's side for environmental sensitive areas (ESAs) on the other hand.

For this study, the state of Selangor is chosen as the presence and availability of ESAs in addition to the economic vitality of the state are both at high stake. Through the development of an environmental resources resilience framework and assessment tool, it provides an additional systematic tool for LPAs and stakeholders to assess, monitor and evaluate the environmental condition of an area through the identification

of development controls that is crucial for development approval as different areas have different level of development suitability. Through this assessment too, disaster management can be optimised in urban and physical planning while reducing the impacts of anthropogenic (man-induced) disasters in moulding a strategic and dynamic urban area. This is also supported by Quranic verses on the importance of responsibility, accountability and ammar ma'ruf nahi mungkar as stated in Surah Maryam, verse 59 and Surah Rum, verse 41 as below.

فَخَلَفَ مِنْ بَعْدِهِمْ خَلْفٌ أَضَاعُوا الصَّلَاةَ وَاتَّبَعُوا الشَّهْوَاتِ فَسُوفَ يَلْقَوْنَ عَذَابًا

Then there succeeded even after them a succession who wasted the prayer and closely followed lusts; so they will eventually meet misguidance.

(Surah Maryam, verse 59)

ظَهَرَ الْفَسَادُ فِي الْبَرِّ وَالْبَحْرِ بِمَا كَسَبَتْ أَيْدِي النَّاسِ لِيُذِيقَهُمْ بَعْضَ الَّذِي عَمِلُوا لَعَلَّهُمْ يَرْجِعُونَ

Calamities have appeared on land and sea because of what the hands of the people have earned, so that He (Allah) makes them taste some of what they did, in order that they may return (to the right way).

(Surah Rum, verse 41)

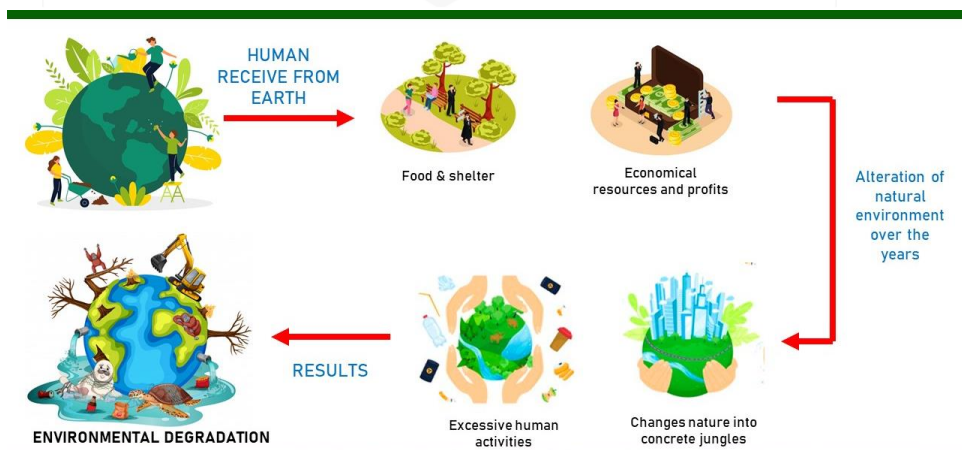


Figure 1.1 Diagram of human activities resulting to environmental degradation.

1.2 STATEMENT OF PROBLEMS

Statement of problems are important in identifying the existing scenario as well as determining the existing gap in the subject matter. In regards to the field of environmental resilience in Malaysia, three problem statements are highlighted which are environmental degradation due from industrial activities, environmental degradation due from urbanisation and climate change and the role of LPAs towards environmental sustainability. The statement of problems helps in formulating the aim and objectives of this study.

1.2.1 Environmental degradation due from industrialization activities

Malaysia has always been known for its abundance in natural resources such as gold, silver, tin, and copper as well as high value plants such as black paper, clove and nutmeg bringing traders to the land and a reason leading to the colonization of Malaya (Ariffin, 2013). After being part of the British colony in 1867, Malaya contribute the export of rubber to Britain as raw material used for industrialization (Easton, Carrouds, Delaney, McArthur, & Smith, n.d.). Though throughout the years, the industries have changed to meet profitable economic income, it has resulted to environmental degradation. One of the industrialisation activities that would be elaborated as an example would be the palm oil industry as a type of commodity.

In the year 2021, Malaysia is the second highest exporter of palm oil in the world after Indonesia with the production of 16,220 thousand tonnes metric, exporting mainly to China and India (Statista, n.d.; United States Department of Agriculture, n.d.). However, due to the impacts of palm oil towards the environment as propagated by the European Union, it results to the volatility of palm oil prices as shown in Figure 1.2 (Mohammad Fazli Sahbuiddin, Abdul Rahman Arif Azhari, Azan Dzuhri Mohamed, & Mohd Hasdi Muda, 2021; Trading economics, 2022)