THE APPLICATION OF INDUSTRIAL SYMBIOSIS TRANSFORMING PASIR GUDANG TOWARDS GREEN INDUSTRIAL PARK

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Specially dedicated to my beloved father and mother, my dearest uncles and aunts

Your patience, sacrifice and encouragement…

For making this day a reality.

To my lecturers

My friends and colleagues

Because of you, I grow stronger and tougher…

Will continue to challenge the uncertainty life of urban planning professions

Bravery and fearlessly.

To my Dharma master and venerable

Your kindness, love and friendliness in Buddhist teaching…

Enlighten my life

Cultivating good values and not to do any evil.

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ABSTRACT

Pasir Gudang, one of the renowned and largest industrial cities in Malaysia envisions being 'Glorious, Sustainable and Prosperous'. In order to attain such status, one of the possible solutions to deal with such challenge is to apply industrial symbiosis concept into the Pasir Gudang Industrial Park, home to major industries of Pasir Gudang today. Industrial symbiosis is an idea that calls for traditionally separate industries in a collective approach to gain competitive advantage through physical exchange of materials, energy, water, by-products and shared use of utility. However, industrial symbiosis is a new topic under discussion in Malaysia. This research aims to explore the concept and examine the influencing factors of industrial symbiosis development. In the research, literatures suggest that a set of complex twelve (12) essential factors are necessary to be considered in developing industrial symbiosis. Furthermore, the research also investigates into the present industrial symbiosis of Pasir Gudang Industrial Park in better understanding for future improvement. This research employs qualitative method and case study approach. During the empirical case study, it involves non-probability purposive sampling technique and structured interview. Twenty five (25) industries from the entire five hundreds (500) industries of Pasir Gudang Industrial Park are selected for this study. The acquired data are examined by adopting material flow analysis and spatial analysis. Consequently, the empirical case study has identified ten (10) categories of symbiotic connections which can be grouped into five (5) dominant industrial symbiosis clusters. However, the present industries among these industrial symbiosis clusters are not organised in the proper spatial cluster form. Drawing from the lessons from best practices and the findings from empirical study, the research also proposes a conceptual spatial model for future industrial symbiosis clustering improvement in Pasir Gudang Industrial Park.

ASTRAK

Pasir Gudang, merupakan salah sebuah bandar industri yang terbesar di Malaysia. Malah, bandar ini terkenal dengan aktiviti industrinya yang ingin mencapai status "Indah, Mapan dan Sejahtera". Dalam usaha untuk mencapai status tersebut, salah satu penyelesaian untuk menangani cabaran tersebut adalah melalui konsep simbiosis industri. Simbiosis industri adalah suatu idea di mana, daya saing yang sihat dapat dicapai antara industri-industri yang bekerjasama secara kolektif melalui pertukaran fizikal bahan, tenaga, air, produk sampingan dan berkongsi penggunaan utiliti. Simbiosis industri adalah merupakan suatu subjek yang baru di Malaysia. Justeru, kajian ini bertujuan mengkaji konsep serta faktor yang mempengaruhi pembangunan simbiosis industri. Literatur dalam kajian ini mencadangkan bahawa pembangunan simbiosis industri memerlukan dua belas (12) faktor utama yang komplek. Selain itu, kajian ini juga menyiasat terhadap simbiosis industri semasa di Taman Perindustrian Pasir Gudang untuk pemahaman yang lebih dalam bagi kemajuan pada masa hapadan. Kajian ini menggunakan kaedah kualitatif dan pendekatan empirikal. Dalam kajian empirikal, ia melibatkan teknik persampelan '*non-probability purposive'* dan temu bual berstruktur. Dua puluh lima (25) industri dari keseluruhan lima ratus (500) industri dalam Taman Perindustrian Pasir Gudang telah dipilih untuk kajian ini. Data yang diperolehi dari akan dianalisis dengan menggunakan analisis aliran bahan dan analisis spatial. Sepuluh (10) kategori hubungan simbiosis dan lima (5) kelompok simbiosis industri telah dikenalpasti dalam hasil kajian empirikal. Walau bagaimanapun, industri yang tergolong dalam kalangan kelompok simbiosis industri semasa ini tidak mempunyai bentuk kelompok ruang yang jelas. Dengan mengambilkan hasil pengajaran dari amalan dan empirikal, kajian ini juga mencadangkan suatu spatial konsep model kelompok simbiosis industri masa depan bagi penambahbaikan Taman Perindustrian Pasir Gudang.

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LIST OF ABBREVIATIONS

API	-	Air Pollution Index
BAU	-	Business as Usual
CDM	-	Clean Development Mechanism
DOE	-	Department of Environment
EPU	-	Economic Planning Unit
GDP	-	Gross Development Product
GEC	-	Global Environment Centre Foundation
GHGs	-	Greenhouse Gases
ICLEI	-	International Council for Local Environment Initiatives
IRDA	-	Iskandar Regional Development Authority
JPY	-	Japanese Yen
KeTTHa	-	Ministry of Energy, Green Technology and Water
MITI	-	Ministry of International Trade and Industry
MPPG	-	Majlis Perbandaran Pasir Gudang
OECD	-	Organisation for Economic Co-operation and Development
SMEs	-	Small and Medium Enterprises
UNEP	-	United Nations Environment Programme
UNFCC	-	United Nations Framework Convention on Climate Change
UNIDO	-	United Nations Industrial Development Organisation
USD	-	United States Dollar

LIST OF SYMBOLS

t	-	tonne
kt	-	kilo tonne
MLD	-	million litre day
MW	-	mega watt

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CHAPTER 1

1.1 Introduction

Pasir Gudang is one of the largest industrial city and renowned manufacturing hubs in Malaysia. Furthermore, it is also highlights as one of the key flagship zones of Iskandar Malaysia (formerly known as the South Johor Economic Region), the third largest region envisions being a sustainable metropolis with international standing in 2025 (Khazanah Nasional, 2006). Pasir Gudang is aspired to be "Glorious, Sustainable, and Prosperous" (MPPG, 2010). In attaining the status of glory, sustainability and prosperity, without high quality of environment is impossible. Good environment improves quality of life of the community, draws and retains talent workers, raises productivity of employee, valuable assets for attracting businesses for further investment, builds resilient economy and so it makes city more glorious, sustainable and prosperous. Unfortunately, environment has been always overlooked by many developing nations including Malaysia which experiencing rapid development today. Disproportion fast paced industrialisation accelerates economic development but in contrast applying great pressure on environment. To meet large market demand, industry sector consume vast volume of resources and generate massive amount of wastes. Air pollutant, wastewater, hazardous substance, solid waste and greenhouse gases (GHGs) emission from industry activities bring negative impacts to local, regional and global environment, harming the health of communities and future generations (UNIDO, 2011).

As industries continue to grow, Pasir Gudang does face the problem of environmental pollution. Ten years back in 2001, an incident of large scale illegal dumping of hazardous industrial waste (1,000 tonne of metal ashes) took place at the adjacent town named Ulu Tiram, about 27km away from Pasir Gudang. These metal ashes are toxic in nature were believed being dumped by foreign based smelting industry from Pasir Gudang (Mohamed, 2009). Besides, according to the Malaysia Environmental Quality Report 2005 and 2010 documented by the Department of Environment, air pollutant index (API) of Pasir Gudang had increased with fewer days with good air quality (see Table 1.1). The water quality from numerous rivers of the Pasir Gudang river basin is heavily contaminated and the pollution sources are mainly industrial effluents and discharges (see Table 1.2). Furthermore, it is expected the energy and water demand and solid waste generation in Pasir Gudang will double within a short period of 15 years' time from 303.94 MW/year to 784.53 MW/year, 76.4 MLD to 156.4 MLD and 81,984 tonne/year to 174,159 tonne/year (see Table 1.2). Based on the projected rapid urbanisation and industrialisation, the GHGs emission is expected to increase proportionally if the government is pursuing business as usual (BAU) urban policy. Hence, Pasir Gudang will have high GHGs emission and pollution problem if appropriate strategy are not adopted by the local authority.

Table 1.1: Air quality status of Pasir Gudang 2005 – 2010

Air Polluntant Index (API) of Pasir Gudang	Good (0 - 50)	Moderate (51 - 100)	Unhealthy (101 - 200)	Very Unhealthy (201 - 300)	Dangerous (> 300)
Year 2005 (Number of Days)	161	194	2	-	-
Year 2010 (Number of Days)	156	204	8	-	-

(*Source: Department of Environment 2005: 9, 2010: 14*)

Table 1.2: Water quality status of rivers in Pasir Gudang 2010

River Basin	River	Water Quality Index (2010)	Status	Source
Pasir Gudang	Buluh	36 (IV)	Polluted	Industry
	Latoh	57 (III)	Polluted	Urban, Industry
	Perembi	46 (IV)	Polluted	Industry
	Tukang Batu	36 (IV)	Polluted	Industry

(*Source: Department of Environment 2010: 39*)

Table 1.3: Energy demand, water demand and solid waste generation of Pasir Gudang 2010 – 2015

Year	2010	2015	2020	2025
Energy Demand (Million Watt, MW/year)	303.94	365.98	427.91	784.53
Water Demand (MLD, Million Litre/day)	27,886	35,551	42,632	57,086
Solid Waste Generation (tonne/year)	81,984	102,883	118,715	174,149

(Source: Khazanah Nasional 2006: 14-7, Maunsell Malaysia 2010: 3-12, Iskandar Regional Development Authority 2010: 18)

In the light of promoting greater sustainability of Pasir Gudang, no doubt manufacturing industry, being the main activities and key economic driver for Pasir Gudang, is in need of reform to harmonise with the environment. We recognise the importance of industry in economic growth and social development. It contributes a significant portion to the wealth generation and job creation. However, it is essential for industrial growth to emphasise on environmental quality too. The environmental impacts from the industry sector have to be minimal as it is closely associated with the performance of economy and social dimension. With the absence of good environment, strong economic growth and social development are difficult to achieve. The message is clear that, a solution is needed to green the existing industry

and promote green industry into Pasir Gudang, making it more sustainable, prosperous and glorious. The question is how are we going to achieve that? How to conserve the environment of Pasir Gudang while allowing industrial activities continue to rapidly grow?

To address the above challenge, various measures are presently available and one of the best approaches is to nurture innovative industrial symbiosis in Pasir Gudang. Industrial cities/parks that put industrial symbiosis into practice are proven in gaining both environment benefit and economic profit significantly. Kawasaki Eco-town (best-known Japanese industrial city that exercising industrial symbiosis) manage to divert 565 kt of waste from incinerator and landfill and generating economic opportunity of more than 13.3 billion JPY (~130 million USD) annually (van Berkel et al., 2009). In the meanwhile, Jinan, a pilot Chinese industrial city with the promotion of industrial symbiosis under the philosophy of Circular Economy by Chinese government has recorded energy and water consumption reduction by 5.7 million ton annually, waste utilisation rate increased to 90%, coal consumption reduced by 0.67 million tons equivalent and the total economic benefit was over 158 million USD (Dong et al, 2013).

The concept of industrial symbiosis has embraced by experts and international organisations in the effort of green industry development. The United Nations Environment Programme (UNEP) Guidelines for National Programmes on Sustainable Consumption and Production (2008) recognise industrial symbiosis as an instrument to promote resource efficiency. The Organisation for Economic Co-operation and Development, OECD (2010) highlights industrial symbiosis as an excellent example for innovative idea for future green growth. In response to the necessitate of green industry development for robust economic growth and healthier environment in Pasir Gudang, this research attempts to explore the concept drawn from both theory and practice to provide a clearer description and explanation in building industrial symbiosis development. It would be a useful guide for Pasir Gudang local authority and industrial park management committee to move Pasir

Gudang a step forward, closer to being a sustainable green industrial city, associated with strong business growth, good living environment and quality of life.

1.2 Problem Statement

Industrial symbiosis is an idea that calls for collaboration among industry enterprises to recycle and exchange their by-products in achieving higher resource efficiency and hence minimizing negative impact towards environment. However, the concept is rather a new area under discussion in Malaysia, there is still a lack of research in this subject area. Though the green technology application for green industry has been widely discussed and promoted in Malaysia, since after the introduction of National Green Technology Policy (2009) by the Ministry of Energy, Green Technology and Water (KeTTHa) and strong efforts from our Prime Minister at the United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties 15 (COP15) back in 2009 to make a voluntary pledge that Malaysia would reduce its' carbon intensity of gross domestic product (GDP) by forty percent (40%) as compared to 2005 levels by the year 2020, yet it does not directly involve with the wider concept of industrial symbiosis. Indeed, green technology is one of the key components for encouraging by-products exchange, energy/water cascading or utility sharing between industries nevertheless industrial symbiosis is more than that.

Besides, the Green Industry Unit under Department of Environment, Ministry of Natural Resources and Environment, Malaysia is actively encouraging industries to adopt cleaner production initiatives. Apart of enforcing the Cleaner Production Blueprint for Malaysia (2009), the Green Industry Unit is established to provide consultations and advices to push industry for cleaner production. Cleaner production

is focusing on the individual industry enterprise to apply environmental pollution prevention strategy during the processes, products and services to increase efficiency and reducing risks to human and environment (Department of Environment, 2009). But again, it does not related with industrial symbiosis. Industrial symbiosis involves industries in a collective approach to gain competitive advantage through the physical exchange of materials, energy, water, by-products and share use of utility (Chertow, 2000; 2004; 2007). In terms of benefit, industrial symbiosis could be better than cleaner production. Chertow (2004) highlights that as a group, the industries are able to generate greater benefits than the sum of individual benefits that could be achieved by acting alone. From the above discussion, it indicates that the idea of industrial symbiosis is new in Malaysia and it is worth to explore as a future measure in view of the fact that it provides more effective solution with greater advantages in comparison to the present approach from individual effort.

In fact, industrial symbiosis is relatively fresh for many developing countries, interestingly except in China (Zhu et al., 2007). Most of the industrial symbiosis related studies are mainly found among the countries of Denmark (Jacobsen, 2006), Japan (GEC, 2005; Fujita, 2006; van Berkel et al., 2009), Sweden (Mirata and Emtairah, 2005), United States (Lowe et al., 1996), China (Zhu et al., 2007), England (Mirata, 2004), South Korea (Behera et al., 2012) and Australia (van Beer et al., 2007).

Above and beyond, as industrial symbiosis is an emerging new approach, with a short history of two decades, a lot of researchers are generally focused either on universal theory and principles or narrow engineering context with complex technical details. Much literature are emphasis on conceptual idea of industrial symbiosis and quantification of economic and environment assessment via material flow analysis, life cycle assessment or other analytical tools into symbiotic linkage(s) and a certain particular substance by employing case studies approach. There is a lack of concerted efforts to look into the drivers and barriers of industrial symbiosis across different practices. Understanding various elements influencing the

development of symbiotic linkages between industries is crucial for us to ensure successful industrial symbiosis expansion. Since, the idea of industrial symbiosis is new in Malaysia and potentially to be utilised as the solution to improve the environment quality of Pasir Gudang. Therefore, this research is going to discover the concept of industrial symbiosis and examine factors which affecting the development of industrial symbiosis. The findings from these are vital for Pasir Gudang local municipality to consider during the promotion of industrial symbiosis in Pasir Gudang.

At the same time, those have been observed informal patterns of industrial symbiosis practices in Pasir Gudang Industrial Park. Several registered waste recycling and recovery industries were noticed from the open access report of Department of Environment (DOE), Johor and Pasir Gudang Municipal Council (MPPG). Besides, a biomass energy plant is spotted under the Clean Development Mechanism (CDM) supported by the UNFCCC (EcoSecurities International Ltd, 2009). Yet, there is no proper documentation on the existing symbiotic connections among the industries whose exercise waste/by-product exchange in Pasir Gudang Industrial Park at present. To further enhance the industrial symbiosis in Pasir Gudang Industrial Park, examining present industrial symbiosis network is an important part of the entire systematic design approach for the development of industrial symbiosis. By understanding the current industrial symbiosis among the industries, it helps us to identify possible area of improvement in terms of potential symbiotic connection and spatial clustering opportunities. The expansion of industrial symbiosis development in the industrial park of South Korea (Behera et al., 2012) and Japan (Fujita, 2004) are built upon the existing self-organised symbiosis network of conventional industrial complexes. With the introduction of new potential symbiotic connections, it means industrial symbiosis network is expanding and more waste/by-product can be served as resource for industries. However, this subject is much concern with engineering aspect and it will not be discussed within the scope of this research. Beyond the above, the most important aspect of concern for this research is the spatial context of industrial symbiosis activities. From the perspective of urban planning, by bringing group of closely connected industries under similar industrial symbiosis cluster in close proximity is capable to improve business efficiency through transportation, utility and environment compliance cost, reducing

the risk of hazardous waste exposure and creating good opportunity for industries on close interactions in trust building and generating new innovation.

For that reason, this research will look into industrial symbiosis activities and geography context of the industrial symbiosis clusters in Pasir Gudang Industrial Park whose practices waste/by-product exchange and put forward early suggestions to improve the synergies of industrial symbiosis in Pasir Gudang Industrial Park. Furthermore, experience draws from this research on symbiotic network of Pasir Gudang Industrial Park is valuable to disseminate, serve as local case for future industrial symbiosis developement in Tanjung Langsat industrial complex, a new industrial park of Pasir Gudang which is currently developing; or even promoted for other local Malaysia industrial parks to achieve greater sustainability.

1.3 Research Questions

Based on the above background scenario, four (4) research questions have been identified in this research, as follow:

(i) What is industrial symbiosis?

(ii) How do industrial symbiosis relate to the wider sustainable urban development?

(iii) What are the elements that are capable to support and inhibit industrial symbiosis?

(iv) What are the existing industrial symbiosis activities, cluster and their spatial pattern in Pasir Gudang Industrial Park?

(v) What is the ideal spatial conceptual model for industrial symbiosis of Pasir Gudang Industrial Park?

1.4 Research Aims and Objectives

In response to the significant but under-researched topic of industrial symbiosis in addressing environment sustainability and promotion of green industry, this research aims to explore the concept of industrial symbiosis to minimise the resource consumption and waste generation for Pasir Gudang. Towards the end, this research will fulfil the following objectives:

(i) To review the concept, principles and the characteristics of industrial symbiosis;

(ii) To draw a relationship between industrial symbiosis and sustainable urban development;

(iii) To examine the factors which give influence on the industrial symbiosis;

(iv) To investigate the existing industrial symbiosis activities, cluster and spatial pattern of industrial symbiosis in Pasir Gudang Industrial Park; and

(v) To propose ideal spatial conceptual model for improving industrial symbiosis of Pasir Gudang Industrial Park.

1.5 Research Scope

In order to achieve the research aim and objectives, the following scope of research have been identified:

(i) Understanding on the concept of industrial symbiosis, principles and characteristics and its relationship to the sustainable urban development.

(ii) Identifying the factors which likely able to encourage and discourage the development of industrial symbiosis.

(iii) Empirical case study based approach for investigating the waste/by-product exchanges among the enterprises and examining their spatial pattern in Pasir Gudang Industrial Park.

(iv) Developing an ideal spatial clustering conceptual model to enhance the industrial symbiosis synergies in Pasir Gudang Industrial Park.

1.6 Research Design

Basically the research involves four (4) phases; preliminary, literature review, empirical case study and conclusion. Figure 1.1 shows the flow of research, which are divided into four (4) phases: preliminary stage, theoretical review, empirical case study and conclusion.

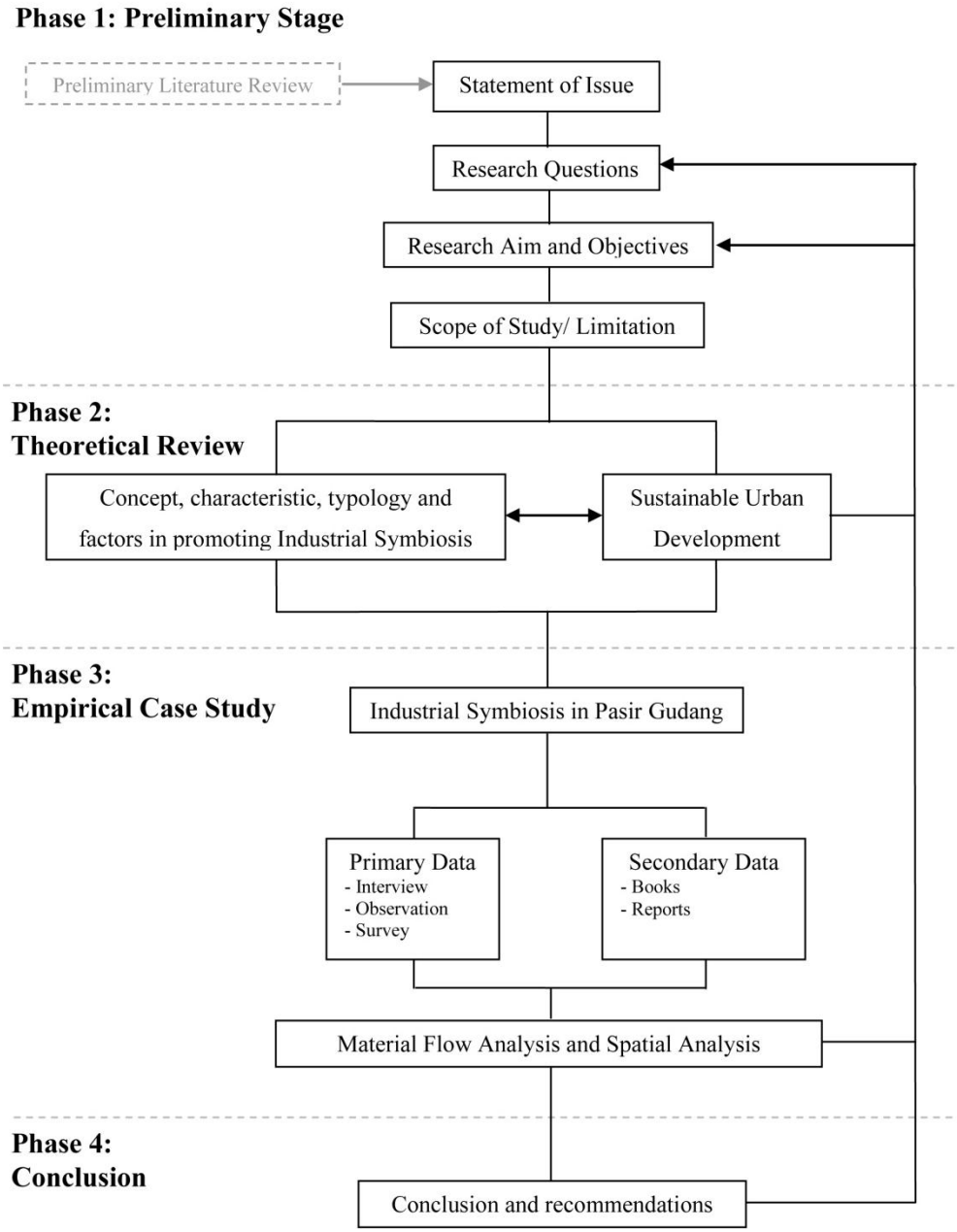

Figure 1.1: Overall research design

The first phase, preliminary stage begins with literature review to identify the issue and problem. Soon after it is translated into problem statements, research aim and objectives and as well as scope of study. This is the most important stage of any research as it defines the background that frame the entire research work.

The research follows by theoretical review; it involves detail gathering/ revising of information through content analysis from related references and journals. Theoretical review of this research is emphasised on the concept and characteristic of industrial symbiosis and relevant aspects that close to it such as industrial ecology and green industry, factors that influence industrial symbiosis, contribution of industrial symbiosis to sustainable urban development and the practices of industrial symbiosis in various industrial cities/parks of the world. Valuable ideas, perceptions, arguments, criticisms and remarks by experienced experts and researchers are taken into account. The outcome of the theoretical review offer us better understanding and appreciation on the fundamental element of industrial symbiosis given that this is a new topic in our country. Besides, it does provide a clear framework for the Pasir Gudang Industrial Park empirical case study in particular to recognise those industries with applying industrial symbiosis for further analysis.

Subsequent to theoretical review, the research focuses on empirical case study by applying industrial symbiosis to explore the selected study area – Pasir Gudang Industrial Park. Primary and secondary data collection from selected relevant industries which covers information on resource input and waste output are carried out in Pasir Gudang Industrial Park. It involves qualitative approach in the form of discussion and description particularly on the subject matter of material flow and spatial pattern among the existing symbiotic industries in Pasir Gudang Industrial Park. For more detailed discussion on methodology of data collection and analysis, it can be found in Chapter Three.

Towards the conclusion of the research, it provides key findings and highlighting the feature of industrial symbiosis in Pasir Gudang Industrial Park. Last but not least, it recommends possible areas for improvement and future research which are important to look into but not covered within the current scope of study.

1.7 Study Area

Pasir Gudang is a large industrial township, geographically located at the fast growing region of southern Peninsular Malaysia which widely known as Iskandar Malaysia.

Figure 1.2: Regional context of Pasir Gudang.
Source: Adapted from IRDA, 2008

It can be easily access from Johor Bahru City Centre, the heart of Johor State and neighbour country, Singapore, the world's major commercial and financial centre. The population of Pasir Gudang is around 211,300 (AJM, 2010) and its' development is administered by Pasir Gudang Municipal Council (MPPG). The industry sector of Pasir Gudang is expected to experience strong growth as Pasir Gudang has been highlighted as a key economic zone (Flagship D – Eastern Gate Development) for manufacturing industry development under Iskandar Malaysia metropolis 2025 master plan (IRDA, 2008; MPPG, 2011) (Figure 1.2).

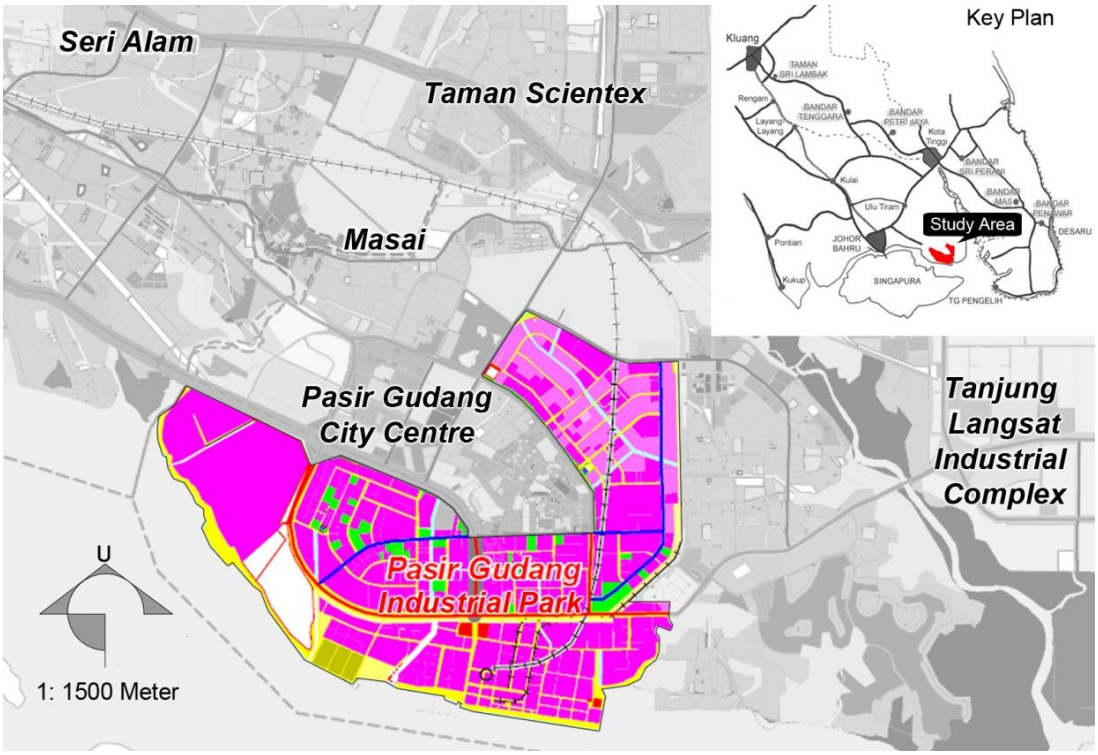

Figure 1.3: Boundaries of the study area.

Source: Adapted from JPBD Negeri Johor, 2007

Pasir Gudang city, consist of two industrial parks namely Pasir Gudang Industrial Park and Tanjung Langsat Industrial Complex. This research focuses solely on Pasir Gudang Industrial Park. In comparison with Pasir Gudang Industrial Park, Tanjung Langsat Industrial Complex is rather new since it was developed in the past few years. Despite the fact that many plots of Tanjung Langsat Industrial Complex are sold still not much of industries to be found (AJM, 2010).

At the moment, Pasir Gudang Industrial Park is much established and intensely with about 500 factories is operating at this time (IRDA, 2013). In fact, from the literature it is observed that much recognised industrial symbioses are built upon the existing industry parks. The most significant now, Pasir Gudang Industrial Park is the key industrial hub in Iskandar Malaysia, the most developed region in Southern Peninsular Malaysia and set to be the global economic node. It is the icon representing the region as well Malaysia. The outline of the study area is shown as the Figure 1.3 above. The main focus of the research is the existing industrial symbiosis network of the industries from Pasir Gudang Industrial Park.

1.8 Structure of Thesis

This thesis contains five (5) chapters and each chapter is addressing the following topic.

Chapter 1: Introduction

Beginning with the first chapter, it introduces background issues and the need to initiate industrial symbiosis in Pasir Gudang, the research aim, objectives, questions and scope that structure this research; and outlines the research strategy that are applied in this research

Chapter 2: Understanding Industrial Symbiosis

Chapter Two reviews the theory and concept of industrial symbiosis and focuses on the characteristics of industrial symbiosis to set a framework for the discussions of influencing factors on industrial symbiosis and the subsequent case

study in Pasir Gudang Industrial Park (Chapter Four). Besides, this chapter do highlight the significance of the industrial symbiosis to urban planning by drawing links between industrial symbiosis and sustainable urban development.

Chapter 3: Research Methodology

Chapter Three discusses about the technique and instrument in detail during the data collection and data analysis for the industrial symbiosis empirical case study in Pasir Gudang Industrial Park. The rationales of the methodology adopted in this research are clarified in this section.

Chapter 4: Industrial Symbiosis in Pasir Gudang

Chapter Four investigates the industrial symbiosis practices in Pasir Gudang towards green industrial park. This section begins with background of study area-Pasir Gudang and profile of companies whose practice waste/by-product exchange. This is followed with investigation on the activities and cluster, and examination on spatial pattern of the industrial symbiosis in Pasir Gudang Industrial Park. The findings from this assessment are set to establish future improvement on symbiotic synergy in term of spatial clustering.

Chapter 5: Conclusion and Future Suggestions

Finally, Chapter Five summarises on the findings from theoretical review (Chapter Two) and empirical case study (Chapter Four); concludes on the conceptual spatial proposal for Pasir Gudang Industrial Park to enhance the present industry symbiosis and so transform into green industrial park, and recommends possible future research directions in the topic.

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