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"The Search of Knowledge is a sacred duty imposed upon every Muslim"
(Sahih Al Bukhari: The Book of Knowledge)

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MESSAGE FROM THE PRESIDENT

Dear Readers,

It is an honor for me to be a part of this second edition of the Malaysian Institute of Planners Journal. I believe this journal plays as one of the medium of communication between Institute and its members as well as to the general public.

This journal is an important book of knowledge to many of us because it contains valuable information and research materials related to town and country planning. Reading this journal will continue to enhance our knowledge on the various topics written by the authors.

The publication of this journal is a result of excellent effort undertaken by authors and the editor team led by Associate Prof. Dr Alias Abdullah. Therefore I take this opportunity to thank all that have contributed to make this journal published. I express my hope that this journal continuous to be published every year.

Thank you.

Mohamad Nazri b. Jaafar
PRESIDENT
(2003-2005)

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CREATING THE ESSENCE OF CITIES: THE PUTRAJAYA'S EXPERIENCE

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Abstract

The creation of a new Federal Government Administrative Centre at Putrajaya marks a new chapter in the development history of modern Malaysia. The development of this new administrative centre was prompted by the need to balance and disperse development to areas outside of Klang Valley. It is a decision motivated by the government's desire to improve the urban environment and quality of life, and to ease the pressure on the infrastructure in Kuala Lumpur and the Klang Valley in general. In city planning terms, it provides a golden opportunity and a challenge to embark on something new and innovative representing Malaysian values and culture. Putrajaya the new Federal Government Administrative Centre, is to be equipped with the latest facilities and technologies for improved effectiveness and productivity, as well as, amenities that shall contribute to quality living and working environment. However the challenge also lies in fostering the spirit, sense of purpose and identity for the new city. This paper provides an insight to some of the basic principles and concepts behind the endeavor towards realizing this planning vision.

Keywords: Garden City, Urban Design, Quality Urban Living, Caring City

INTRODUCTION

Background to the Planning Process

On 2nd June 1993 the Federal Government decided on an area in Perang Besar, Sepang, Selangor Darul Ehsan to be the site for the new Federal Government Administrative Centre. Thereafter, the planning process for Putrajaya went into full swing with the setting up of Putrajaya Development Committee and the Putrajaya Development Unit within the Prime Minister's Department. In 1994, five alternative concept schemes by local consultants and a group of government agencies led by the Federal Department of Town and Country Planning and the Public Works Department were presented to the Cabinet. Of the five schemes, the Government selected the "Garden City" concept as the guiding theme for the new city. A master plan was subsequently developed

based on this theme. The Putrajaya Master Plan was given Government approval in February 1995. It later underwent a review upon which a final approval was obtained in April 1997. To implement the plan, Perbadanan Putrajaya (Putrajaya Corporation) was established in 1996 with the main role of developing, managing and administration of the city area. Putrajaya Holdings Sdn. Bhd., a government-owned company, was also formed to act as the master developer responsible for construction of government offices, commercial areas, residential premises and the main infrastructure.

PUTRAJAYA MASTER PLAN

The Putrajaya Master Plan covers an area of approximately 4,600 hectares. The Garden City concept is clearly evident in the amount of land area dedicated to open space within the city, which is 1,826.5 hectares (37.0 %). In brief, the major features of the Master Plan are:

i. A large proportion of the city area is designated as green open space;

ii. A large water body (man-made lake) and wetlands was formed by utilizing the small rivers which run through the area;

iii. The lake created a 38 kilometers long waterfront area;

iv. The city is divided into 20 precincts with the 'core employment and commercial precincts' (Core Area) located on an island within the man-made lake;

v. 'Peripheral' (residential) precincts planned based on the neighbourhood planning concept to accommodate a mix of residential, neighborhood commercial, and public amenities;

vi. A 4.2 km long boulevard forms the central spine of the city;

vii. Projected residential population of 330,000; with 67,000 housing units;

viii. The Master Plan is supplemented with urban design guidelines, policy documents, and local plans prepared to meet statutory requirements.

TABLE 1:
Master Plan Land Use Components

Land Use	***Hectares***	*%*
Government	284.6	5.8
Commercial	139.4	2.8
Housing	1,173.7	23.8
Civic & Cultural	10.6	0.2
Public Facilities	452.0	9.2
Utility & Infrastructure	1044.2	21.2
Open Space	1,826.5	37.0
Total	**4,931.0**	**100.0**

CREATING THE ESSENCE OF CITIES

The main function of town planning as argued by Foley is to provide a good physical environment, essential for the promotion of a healthy and civilized life. Given that improvement in quality of life is the Government's underlying aim for developing Putrajaya, the city planners have been quick to take the cue by making "quality urban living" as the basic objective for planning Putrajaya. This explains the adoption of the Garden City concept for guiding its physical development. The intention is not only to create a city where social activities take place within an ideal landscape where nature permeates into all aspects of life, but also one which would display a combination of the following features:

- Efficient accessibility to amenities, services and places of work
- Integrated Neighbourhood and community atmosphere
- Proximity to nature
- Ample facilities for recreation
- Dynamic, lively and economic vitality
- A city with identity and character
- Conducive Urban Environment for quality & healthy Life-style

Through careful planning – supported by good urban management and governance – these concepts were translated physically, complemented by appropriate social, environmental and economic programs, and in the process created the essence of the city that is Putrajaya.

QUALITY URBAN LIVING THROUGH NEIGHBOURHOOD PLANNING

Quality urban living involves more than just providing places of work and residence. If we examine on other cities with proven reputation for high urban quality of life, essential ingredients would include facilities and amenities for individual fulfillment and community life, i.e. for cultural, recreational, social interaction and other activities. In Putrajaya, the planners have been ever mindful of the fact that we are not just building an administrative centre; we are trying to build a new community. Meeting the various socio-cultural needs of the inhabitants is therefore a top priority.

Foremost in priority is of course adequate and suitable housing. A broad mix of residential development type is planned for the city including luxury bungalows, semi-detached and terrace-type housing, condominiums, apartments and affordable housing for the lower income group. This brings people of diverse age, races, and income to Putrajaya, strengthening the personal and civic bonds essential to build a new community. The residential development is further enhanced by having mixed land use to encourage multi-functions in close juxtaposition. The outcome is a neighbourhood with a variety of urban amenities for worshiping, shopping, health, learning, sports and recreation, and even working. In close proximity, are community facilities such as Suraus (places of worship), convenience shops, clinics, schools, multi-purpose halls, markets and local parks are provided. In line with the Garden City theme, a large proportion of the city area is designated as parks and open spaces ranging from metropolitan parks to local neighbourhood playgrounds. Reinforcing these facilities are urban features such as landmarks, squares, plazas and bridges that form part of the cityscape, providing a wide range of spatial experiences that further enhance the spatial quality of the city. Connecting these nodes are some carefully planned safe streets and pedestrian routes which is from interesting part of the urban feature that function as space for 'face-to-face' interaction. The planners are ever mindful of Lewis Mumford's warning that 'we need to make sure we don't make the city more attractive to vehicles temporarily and infinitely less attractive to human beings permanently'.

What is significant in Putrajaya is that all these amenities and facilities are found in close proximity to the residents which is achieved through the adoption of the neighbourhood concept in the planning of its residential precincts. The size of the neighborhood is such that a majority of the population is within a five-minutes walking distance of its center (1/4 mile) and where the needs of daily life are mostly available within this area. These reduce the number and

length of automobile trips, and conserve energy. It also expands transportation choices where people can not or do not have to drive.

All these are of concern around the urban development scenario in other countries too. In 1994 the Equitable Real Estate Investment Management Inc in their annual report entitled 'Emerging Trends' were of the view that;

"For the future we believe the premier investments will be in the nation's 24 hour cities. These markets *whether urban or suburban* are places where people can comfortably and securely live, work and shop..... attractive neighbourhoods lie within hailing distance of the office, and at the very least you don't have to spend a major fraction of your life commuting to work. It's a short walk to take the kids to the park. The supermarket is within easy reach, you can pick up a litre of milk any time.....Mass transit also helps the success of an area...." The planning of Putrajaya has been done with great understanding and awareness that we hope to build a city where *"people live where they work, work where they shop and shop where they live."*

REVISITING THE TRADITIONAL ESSENCE: *FOSTERING THE SPIRIT AND PURPOSAL OF THE CITY*

When we talk about traditionalism the precise meaning of traditional is important. The Latin root 'traditio' means to bring across; to offer guidance from the past into the present. At times, cities are defined as places where everyone is a stranger, whereas villages (*kampung*) are places where they know each other. If there was a difference between the traditional *kampung* way of life of yesteryears and the present day city life-style, it is in the citizen's spirit and sense of togetherness. In Putrajaya, there is an attempt to foster the essence of cities by reference to past land use, spatially relationships and urban form as they might be influenced by local history and culture. It seeks to rediscover and recreate the interactive, spatial efficient and robust qualities of a coherent public realm that earlier urban environments, small towns and villages exhibited most often characterized by an informal, organic layout, a strong sense of community and close proximity to the surrounding natural environment. Whilst it is not practical to recreate the *kampung* within the constraints of our cities today, we can still establish the planning principles to foster social and community values associated with traditional *kampung* living. The objective is to encourage a more pervasive involvement of the residents in activities contributing to the well being of the community. The neighbourhood concept of planning plays a great role here whereby the layout of residential areas and location of amenities

can encourage greater interaction and a sense of neighbourliness among residents.

This may be achieved by influencing the scale, density, form, and structure of urban development. For example streets can be designed to be human-friendly and equitable for both vehicles and pedestrians where people can interact on the streets. Streets in Putrajaya are safe, comfortable, interesting places for people to walk and meet. Most of the buildings open onto sidewalks, rather than parking lots. Windows and doors facing the sidewalk make streets safer, and more interesting, for everyone. Urban spaces in the form of public squares or public parks and fields should also become a meeting place and centre for various community related activities. Nevertheless needs of daily life should be available at the neighbourhood centre within the residential area where people congregate and meet their neighbours. This approach to planning is adopted in most of Putrajaya residential areas, most notably in the design of the Diplomatic Enclave.

THE CARING CITY

Building a city is not just about bricks and mortar. To complement the promotion of the 'traditional essence', pro-active efforts are also necessary to consolidate the sense of community and belonging. For this, consensus through public engagement and outreach activities are carried out in Putrajaya. Programs based on the 'Caring City' and 'Safe City' concepts are being explored and applied.

This is further aided through conscious design efforts as reflected in the Putrajaya Fencing Design Guideline which draws on our culture to create a safe city. This is by encouraging interaction and a caring society through community-policing and "permeability" in development, i.e. the breaking down of walls.

In general, solid fencing along streets and other boundary frontages is discouraged. In its place, permeable fencing options are preferable. This shall be mainly through the use of landscape demarcations such as hedges, shrubs or trees. These solutions contribute to the aesthetic, social and built form character of Putrajaya. More importantly, it enhances security through increased interaction and proactive community involvement and responsibility, as opposed to perpetuating an individualistic island mentality.

CITY IMAGE AND CHARACTER THROUGH URBAN DESIGN AND LANDSCAPE ARCHITECTURE

Building a new city is a monumental task requiring the input of various groups of people with diverse disciplines. Guided by the Garden city concept, and with the aim of achieving a strong image for the city, urban design and landscape architecture are established as essential ingredients complementing good town planning practices.

Urban design is the art of city building (Moughtin et al). It deals with the way places work and how urban spaces are organized and structured. Closely related, landscape architecture is concerned with the design and shaping of external spaces, treating the 'public realm' as part of the total built environment and city experience. In Putrajaya, effort towards good urban design and landscape planning is achieved through the use of the Detailed Urban Design guidelines (DUD).

The DUD is prepared at the precinct level. It outlines the general character and ambience of each particular development plot, but always at the same time, tying it back to the surrounding development parcels and the precinct as a whole. By this, the DUD promotes an urban fabric and language through the composition of its many elements, combining them to reflect a unique sense of place and character.

The DUD achieves this by focusing on elemental guiding principles such as urban structure, urban form and character. Parameters like details on land use, building massing and typology, horizontal and vertical controls of building, provision for pedestrian linkages, open space coverage, streetscape control and so on feature highly in this guideline. The aim is to create towards an urban form that projects visual unity and coherence, affording a distinctive image for the city and quality spatial experience for citizens and visitors alike.

The DUD is now used to create identifiable urban spaces and corridors such as the Putrajaya Boulevard and the Dataran Putrajaya where the National Day Merdeka Parade was held in 2003. The Boulevard is a 4.2 km long 100m wide thoroughfare running from North to South of the Core Island forming the central spine of the city and providing the setting for the main commercial and civic area. The design parameters for the buildings along and in proximity to it are guided by the DUD so that they contribute to a cohesive spatial composition and experience of the Boulevard.

As an extension to the effort of creating an image and character for the city, the Putrajaya Lighting Master Plan has also been formulated to establish the visual and practical architectural lighting criteria that will ensure the night time ambience of Putrajaya is attractive and appropriate of a city of its status and function. It is a unique effort, and it is hoped that this will contribute to bringing more visitors and tourists to come and enjoy Putrajaya during the night.

RESPECT FOR PEDESTRIANS

The advent of the motor car signaled the overriding importance given to the convenience of the motor traffic over that for pedestrians. This is despite the fact that motor car users – upon reaching their destination, would themselves become pedestrians. This was the scenario which perhaps led Mumford to lament "As soon as the motor car become common, the pedestrian scale of the suburb disappeared, and with it, most of its individuality and charm". Mumford also said "The paradoxical result of this concentration on motorcars is a curbing of freedom of movement, a removal of alternate choices of transportation, the steady reduction of the speed of local travel, and the total defeat of the city itself as a place that offers the maximum possibilities for face-to-face meeting, social cooperation, and transactions of every kind".

Successful cities are about the inter-relationship between wholes and parts. To achieve that Putrajaya has been designed to respect pedestrians. Provision for pedestrians and cyclists increases independence of movement and accessibility to the numerous facilities in the city without resorting to motorized vehicles. It is also compatible with planning for public transport systems. Pedestrian routes in Putrajaya are laid out across the city in an integrated manner. They link major activity centres and nodes such as government precincts, commercial centres, public parks, plazas, community centres and schools together. They also provide clear and direct access to transit stops as well as connections between residential and retail areas.

Supportive urban design is the key to encouraging the usage of pedestrian and cycling facilities. DUD guidelines for core areas identify pedestrian routes and connections throughout each precinct and at each parcel development level. Pedestrian paths are supported by facilities such as arterial crossings where necessary. Landscape treatments are specified for each development parcel to provide shade and comfort for pedestrians. Particular emphasis is given to ease of movement of pedestrians and cyclists through careful consideration to gradient of the paths, 'barrier free' designs and coordinated network of paths.

URBAN ECOLOGY: NATURE IN THE URBAN FABRIC

One of the requisites for a quality urban living environment is to create a city in harmony with nature, i.e. a city which contains natural elements within its urban fabric and one which imposes minimum stress onto the ecosystems. This will not only ensure the long-term sustainable development of the city, but it brings opportunities for recreation and for being close with nature.

Perhaps the most significant effort towards this in Putrajaya is the creation of a water body in the form of a lake and wetlands systems. About 600 hectares or 12% of Putrajaya's consists of lakes and wetlands. The lake is formed by damming Sg. Chuau and Sg. Bisa which passes through the city. The wetland is the first man-made wetlands in Malaysia and one of the largest fully constructed freshwater wetlands in the tropics. Among others, it functions as a natural filtration system removing nutrients and pollutants from the river water before it enters the lake.

The lake and wetlands have turned out to be one of the most valuable assets for Putrajaya. It has brought about intangible values in the unique waterfront image and character of the city. In fact Putrajaya can be considered as a waterfront city bearing the following features and opportunities:

- Development opportunities in prime waterfront location affording a rich mix of development;
- Existence of wetlands, green corridors, parks, and wildlife at the door step of urban dwellers; and
- A range of water recreation and sports activities opportunities.

The 38 kilometers of waterfront area created with the formation of the lake is utilized for development of parks and promenade, i.e. – an integrated network of green spine which connects all the lakefront parks together. It is provided with a whole range of facilities to enhance their enjoyment by the public such as landscaped walkways, seating areas, public beaches, fishing piers, and viewing decks.

With the parks and greenery come wildlife and nature experience. Certain stretches of the promenade and walkways – such as those within the Taman Wetland – have been designed as nature trails providing for people to reconnect with nature. The lakefront parks, including the wetlands, have been successful in introducing a range of habitats for fish, invertebrates, frogs, turtles, as well as, birds such as swifts, moor hens, water hens, wild ducks and kingfishers. In

short, nature and open spaces are as important to Putrajaya as the garden is to the house.

CONCLUDING REMARKS

Town planning is about urban quality of life. In our surge towards a developed nation status, it is crucial that we do not lose sight of the very objectives of planning and the basic principles of good city planning that go with it. This is important, lest we become an affluent yet faceless society, devoid of self-fulfillment, no sense of community, and with the ever-present physical and social problems. This is why in the planning for Putrajaya, we have strived to go back to identifying and creating the essence of cities and trying to answer: what is essential in town-making? The planning of Putrajaya rediscovers and adapts to the principles of traditional urbanism. These principles are more interactive, spatially efficient, as well as environmentally and socially positive.

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A STUDY TO EVALUATE CHILD-FRIENDLY NEIGHBOURHOODS THROUGH A SET OF CHILD-FRIENDLY INDICATORS

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Abstract

Children[1] constitute the majority of the world's population (UNICEF 1998). They represent the survival of humankind to ensure the continuation of the next generation. Children were born into this world, by nature weak in body, senses and mind. Children are eager to accept education from day to day out of their inner curiosity. Hence, understanding children and creating a good and healthy environment must go hand in hand. In relations, providing a safe environment for children to live, play, run errands, and interacts with others are urban planning priority. However, most of the time, urban designs and housing setting are planned specifically for adults without taking into considerations the needs of the growing number of children. Children must be provided with the most supportive environment possible in order to enhance their capability in coping with their surroundings as well as to increase their capabilities to face challenges in future. For the purpose of these, this paper will have an in-depth study regarding the child-friendly environment, and how the neighbourhoods should be in order to create a safe environment for children. This study has selected three neighbourhoods to be evaluated in terms of the degree of their friendliness towards children. A set of Child-Friendly Indicators is applied as a tool for assessing and evaluating these three neighbourhoods. This paper focuses on diverse aspects pertaining to the child-friendly environment especially on the physical aspects. It will also share some of the recommendations to counter various issues in terms of planning for safe neighbourhoods in the future, as well as the recommendations to improve the developed Child-Friendly Indicators.

Keywords: Children, Neighborhood, Child-Friendly Indicators, *Child-MesraNet* System

[1] The term *"children"* is used here in a broad sense of the United Nations' definition, which includes all people under the age of 18.

INTRODUCTION

Purpose of Study

Malaysia is experiencing a tremendous pace of development. The rapid industrialization has increased the rate of urbanization. Despite the fact that children constitute the majority of the world's population, there are limitations to the incorporation of their views and perspectives. Very often, the towns and cities in Malaysia, for instance, are planned and designed for the 'perfect' adult. Urban streets are laid for cars rather than for people, in general, and children, in particular (Badaruddin, 2002). Apart from being limited to voice out their perceptions on their surrounding environment, children are also too often injured and sometimes killed as a result of the hazards in their environment. Unintentional injury continues to be the greatest cause of mortality, morbidity and disability for children. An accident can be an abrupt, unexpected event, which may result in injury or death. Bartlett (2002) acknowledges that accidents represent the highest number of injury-related deaths among children. In relations, approximately one-third of the children died each year between the ages of one to fourteen, caused by accidents, which kill more children than the five leading fatal diseases. Although not the leading cause of death, accidents are the major cause of disability, permanent or temporary, in children over the age of one year. For children under the age of five, accidents are most likely to take place in the home or childcare centres and after the age of five, accidents outside the home, particularly on the roads, are common (Bartlett, 2002). According to the Ministry of Health Malaysia (2000), more children in Malaysia die as a result of motor-vehicular accidents than from any other injury or disease. This implies the importance of road safety while considering issues of child-safety within the neighbourhoods or cities.

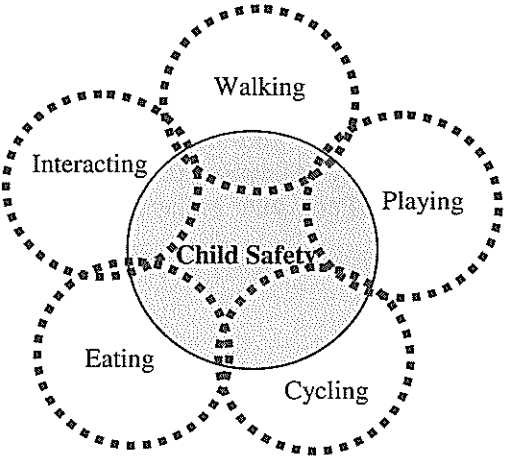


FIGURE 1: Activities of children that need to be safe within the neighbourhoods

Every parent aspires that his or her children will grow up healthy, well-nourished, educated, and protected from harm and ready to face the life ahead. Since we profess love and care for our children, does our planning and urban design produce a child-friendly environment? Children should be able to share in all things cities have to offer, but most often cities are designed as worlds for adults by adults without considering the needs of children. The designated places for children such as playgrounds, schoolyards, and child-care centres, must be appropriately designed according to the standard and needs of the children. Among other things, water fountains, toilets, public telephones are still being built too high for young children to reach. The importance of creating a child-friendly environment has a positive impact in helping the children's development process as well as enhancing the lives of children. Apart from developing their mental growth, the creation of safe environments for children can also help in developing their physical growth.

It is indisputable that the present neighbourhood areas do give consideration to the creation of a child-friendly environment. However, how far does the implementation meet the needs of children? This question will be followed with other questions arguing many other aspects. Among the issues that are often raised with regards to child-friendly environment, in particular the neighbourhood environments are seldom planned with the concern of children in mind. Deficient housing conditions, congestion, pollution, unsuitable locations of children's playground, to name a few, are among the various problems that pose many risks and challenges to the well-being of children.

Ideally, this study will focus on evaluating and assessing the selected neighbourhoods to establish whether they comply with a child-friendly environment or otherwise. It is important to note that the selected neighbourhoods will be evaluated through a set of Child-Friendly Indicators that has been extracted from the *Child-MesraNet* System developed by the International Islamic University Malaysia (IIUM) for the Federal Department of Town and Country Planning, Peninsular Malaysia.

SCOPE OF THE STUDY

i) Selecting neighbourhoods for the study.
ii) Understanding and outlining the Child-Friendly Indicators available in the *Child-MesraNet* System, selecting appropriate indicators, and incorporating new indicators derived from the literature review. Also providing further improvements to the Child-Friendly Indicators.
iii) Testing the Child-Friendly Indicators on the identified neighbourhoods, whereby the questionnaires are distributed for 50 residents for each neighbourhood.
iv) Assessing and measuring the performance of the neighbourhoods.
v) Proposing recommendations with regard to the neighbourhoods

METHODOLOGY

The study has been carried out through four stages. Stage one started with the identification of the research problem, which gave the description of what the study was all about. Stage two was the data collection. Two types of data were collected which was the primary and secondary data. The primary data, which was the first hand data, were obtained from the field study in which data were collected directly from the real environment through site observations, questionnaire distributions, and informal interviews with the residents. Different sets of questionnaires were given to both adult and child respondents. The secondary data were obtained through literature review. The literatures were extracted from various sources such as books, established journals and documents, and also from the Internet. Stage three was the process of compiling and editing raw data. The data were analyzed to figure out the result pertaining to the present conditions of the selected neighbourhoods. The data collected, particularly through questionnaires survey and observations were evaluated through a set of Child-Friendly Indicators. Stage four, which was the last stage of the study, emphasizes on the conclusions and recommendations on the

subject matter. This stage addressed the issues and problems arouse from the development of existing neighbourhoods. The solutions were given in such a way to overcome not only the issues at the study areas but also to improve the development of neighbourhoods in the future.

STUDY AREAS

For the purpose of getting a general perception of the community on the issue raised, a survey questionnaire was administered to three case study areas, namely, Taman Samudera, Taman Sri Gombak, and Sekyen 3 Petaling Jaya. The selection criteria of these three neighbourhoods were one old established neighbourhood; an intermediate one, and one newly established neighbourhood. Taman Samudera was the newly established neighbourhood, which has been established for less than 10 years, Taman Sri Gombak was the intermediate established neighbourhood as it has been resided for 25 years, and Seksyen 3 Petaling Jaya was the old established neighbourhood, which has been established for 50 years.

CHILD-FRIENDLY INDICATORS

As have been mentioned earlier, the study areas were evaluated in terms of their friendliness towards the children through a set of Child-Friendly Indicators extracted from the *Child-MesraNet* System. There were 67 indicators outlined in the *Child-MesraNet* System. This set of indicators has been formulated in order to measure the minimum quality of children's safety that has to be achieved by each neighbourhood or city in the country. The indicators were grouped into seven sectors namely, Demographic; Utility and Infrastructure; Public Facilities and Recreation; Environment; Sociology and Social Impact, Transportation and Accessibility; and Land Use sector. Due to unavoidable constraints, only 33 out of the 67 indicators have been selected, and three additional indicators derived from the literature review were included in the study.

Generally, for all sectors, the measurement index was varied but the scores were fixed into 3 which are score 1, score 2, and score 3. Score 3 showed the highest while score 1 was the lowest. The higher the score obtained for each indicator, the more child-friendly the area was. On the whole, a neighbourhood, a town or a city was considered as 'child-friendly' if obtained 75.0% or more of the overall scores. The measurement index, scores, and the calculation of the scores were adapted from the *Child-MesraNet* System. The 'child-friendly' target,

which was a minimum of 75.0% of the scores, has emerged based on the Malaysian standard of measurement, which suits the Malaysian context.

FINDINGS AND DISCUSSION

Utility and Infrastructure Sector

The indicators grouped under this sector were related to the cleanliness of the neighbourhoods. This aspect was very important as cleanliness affects the health and well-being of the children in particular. The study has found out that Taman Samudera and Taman Sri Gombak showed a high satisfaction rate in this aspect, whereas Seksyen 3 Petaling Jaya, only showed a moderate rate. In Taman Samudera, the high satisfaction rate towards the cleanliness level of the neighbourhood was due to the effectiveness of the garbage collection system, which was done three times in a week. From the observation it also showed that most of the areas within the neighbourhoods, including school areas and children's playgrounds were well and properly maintained.

From the questionnaires given to the residents in Taman Sri Gombak, it has been found that most of the respondents were satisfied with the provision of garbage disposal facilities and the maintenance and collection system in the residential areas. However, in terms of the garbage facility and the maintenance of this facility in public areas, many of them claimed low satisfaction levels. This was due to the fact that most of the residents, particularly those who resided in Phase 2, were threatened by the heap of rubbish thrown near their residential areas during the night market every Monday. They also claimed that the maintenance of this area was rather low and thus it has encouraged the breeding of certain disease vectors that caused health implications to the children's well-being. In Seksyen 3 Petaling Jaya, the moderate level of residents' satisfaction in this aspect was particularly due to the inadequate provision and low maintenance and collections system of garbage disposal facility in the residential and public areas. Based on the questionnaires, most of them claimed that the inadequacy of garbage bins provided and low maintenance of this facility have worsened the cleanliness level of the neighbourhoods especially in areas that were mostly frequented by children such as schools, playgrounds, and housing areas, thus children's likelihood of playing at these areas become lower. On the other hand, the low level of cleanliness of this neighbourhood could also be due to the attitude of the residents who have the tendencies of throwing rubbish not in the proper places. As acknowledged by Bartlett & Chawla (2002), the cleanliness of the neighbourhoods may ensure the comfort, good health and safety of the residents,

particularly the children. In terms of the issue of drains, the site observation showed that the three neighbourhoods faced the same problems of uncovered drains. They were mostly left uncovered and some of them were broken. Informal interviews conducted with the adult residents of these neighbourhoods found out that the majority of them were anxious about their child's safety usually during rainy seasons when the drains were mostly filled with water thus unintentionally causing accidents to their children. Table 1 summarizes the findings of this sector for the three neighbourhoods.

TABLE 1:
Summary of Findings for Utility and Infrastructure Aspect

Indicators	**Taman Samudera**		**Taman Sri Gombak**		**Seksyen 3 Petaling Jaya**	
	Findings	Score	Findings	Score	Findings	Score
Provision of garbage disposal facility (garbage bins) in residential area	60.0%	3	64.0%	3	36.0%	2
Provision of garbage disposal facility (garbage bins) in public areas.	60.0%	3	46.0%	2	42.0%	2
Maintenance and implementation level of garbage disposal and collection system in residential area.	68.0%	3	76.0%	3	38.0%	2
The frequency of garbage collection in residential area.	64.0%	3	62.0%	3	76.0%	3
Maintenance and implementation level of garbage disposal and collection system in public area	60.0%	3	48.0%	2	44.0%	2
The frequency of garbage collection in public areas.	Daily	3	Daily	3	Daily	3
Drains condition	Not covered	1	Not Covered	1	Not Covered	1
(Total score) / (3 is the highest score x 7 indicators) x 100	**90.5%**	**19**	**81.0%**	**17**	**71.4%**	**15**

Public Facilities and Recreational Sector

The public facilities highlighted in this study comprised several elements that were important to be used by children. The data from the questionnaires given to the adult and child respondents in the three neighbourhoods indicates that the satisfaction level towards the provisions of public facilities for children's use

such as public phones, public toilets, bus stops, and children's crossings only showed a moderate rate. There were residents in Taman Sri Gombak and Seksyen 3 Petaling Jaya who claimed that the maintenance of these facilities was not up to standard. Most of the public phones were not in working conditions. It has been observed that the public phones were not specifically designed to cater for children's needs since they were built too high for children's reach. As Malone (1999) acknowledged, public phones should be built at an appropriate height for children's use and should be provided in adequate numbers in areas that were most frequented by children, especially at schools, for their safety and comfort. Public phones facility was important for children to communicate with parents when they were not under their parents' supervision. The other facility which was bus stops were not designed in such a way that provides safety to children, whereby no appropriate divider was put to separate the road from the bus stops even in an area where the roads are busy. The provision of this facility was very important especially to children who used school bus or public buses as a mode of transportation to school.

In terms of the children's crossing area, it showed that the satisfaction levels of the respondents in the three neighbourhoods were moderate and very far below the target. It has been observed in Taman Samudera and Seksyen 3 PJ that the crossing facilities were not provided in school areas, thus pose many risks and hazards to school children. In the issue of children's playgrounds, the questionnaires in the three neighbourhoods have shown a moderate level of satisfaction, especially in Taman Sri Gombak and Seksyen 3 Petaling Jaya. This was due to the inappropriate planning and designs of the playground and play equipment, which do not take into consideration the needs of children in terms of the location and play equipment provided. It has been observed in Taman Samudera and Taman Sri Gombak that there were uncovered drains near the playground that created hazards and accidents to young children.

In Seksyen 3 Petaling Jaya, the lower satisfaction level on the provision of children's playgrounds was due to the fact that their neighbourhood lacks this facility within the residential areas. From observation, there was only one children's playground available in the neighbourhood. Children were seen playing inside their house compounds and some play on streets. These scenarios may pose many risks and hazards to children thus having a negative impact on children's physical and mental growth. The children's playgrounds were not properly maintained. They are littered and unclean. Broken equipment and play things were in bad repair. In terms of street lighting, the majority of the respondents in Taman Samudera and Seksyen 3 Petaling Jaya claimed that their neighbourhoods were well lit during night time thus providing safety to their children if the children were to go out for tuition classes or to buy groceries.

However, in Taman Sri Gombak, most of the respondents claimed that better lightings should be provided as the children usually go out at night to attend tuition class at school. Table 2 summarizes the findings of this sector for the three neighbourhoods.

TABLE 2:
Summary of Findings for Public Facilities and Recreational Aspect

Indicators	Taman Samudera		Taman Sri Gombak		Seksyen 3 Petaling Jaya	
	Findings	Score	Findings	Score	Findings	Score
Provision of public facilities used by children. i) Public Phone	26.0%	1	46.0%	2	22.0%	1
Provision of public facilities used by children. ii) Public Toilet	12.0%	1	26.0%	1	20.0%	1
Provision of public facilities used by children. iii) Bus Stop	32.0%	1	62.0%	3	66.0%	3
Provision of crossing facilities for children	30.0%	2	52.0%	2	40.0%	2
Maintenance level of children's crossing facility	Observation	1	Observation	2	Observation	2
Provision of appropriate and safe play equipments on playgrounds in residential area	60.0%	3	44.0%	2	44.0%	2
Provision of appropriate playground for children	62.0%	3	52.0%	2	42.0%	2
*Provisions of adequate lightings within the neighbourhoods	64.0%	3	26.0%	1	52.0%	2
Maintenance of playground	Observation	3	Observation	1	Observation	1
(Total score) / (3 is the highest score x 9 indicators) x 100	**66.7%**	**18**	**59.3%**	**16**	**59.3%**	**16**

* New indicators derived from the literature review

Environment Sector

The findings on this aspect showed that most of the respondents in the three neighbourhoods claimed that there were no dangerous areas such as rivers, mines and lakes in their neighbourhood areas that might pose hazards to the residents, especially the children. On the other hand, the majority of the respondents were satisfied with the noise levels in their neighbourhoods. Yet,

there were a few respondents in Taman Samudera who claimed that their families have been bothered by a loud noise that came from a nearby construction site. The construction site, which was located beside the school area, has somehow distracted the pupils' concentration, especially during the examination period. In Taman Sri Gombak, the noise pollution could be due to the heavy traffic flow. Most of the adult and child respondents who resided in Phase 3 are affected by the loud noise that came from the nearby commercial area. In Seksyen 3 Petaling Jaya, the analysis showed that the satisfaction level towards the odour pollution was only moderate. This could be due to the garbage that has not been collected for a long time. This bad odour or smell was caused by piles of rubbish that were left unattended for a long time. This phenomenon was clearly seen through observation in some places mostly in residential areas. The residents also claimed that the bad smells have attracted wild dogs, thus creating dangers to their children. Table 3 summarizes the findings of this sector for the three neighbourhoods.

TABLE 3:
Summary of Findings for Environment Aspects

Indicators	**Taman Samudera**		**Taman Sri Gombak**		**Seksyen 3 Petaling Jaya**	
	Findings	Score	Findings	Score	Findings	Score
Dangerous abandoned areas, e.g. rivers, lakes, and hill slopes	76.0%	3	76.0%	3	64.0%	3
Noise Level at children's residential areas (that are close to source of loud noise)	68.0%	3	42.0%	2	62.0%	3
Odour Pollution Near Area Where Children Live	76.0%	3	78.0%	3	44.0%	2
(Total score) / (3 is the highest score x 3 indicators) x100	**100.0%**	**9**	**88.9%**	**8**	**88.9%**	**8**

Sociology and Social Impact Sector

This sector was related to the safety and security of children within the neighbourhood areas. Feedback gathered from the respondents of the three neighbourhoods showed a high satisfaction rate for this sector. Adult and child respondents in Taman Samudera and Taman Sri Gombak claimed that they felt safe to be within their neighbourhood areas including, the school areas. This could be due to the reason that there was a tight community bonding among the residents. The interaction among neighbours has created a sense of security for

the children to play and socialize. In such environments, neighbours know each other and take care of each other's children. However, the majority of the child respondents in Seksyen 3 Petaling Jaya do not felt secure or safe within their neighbourhood areas. This could be due to the fact that Seksyen 3 was very quiet and very low in density. This was also due to the lack of social interaction among the neighbours. From the questionnaires given, a majority of the residents claimed that they were not familiar with their close neighbours because most of the residents were not permanent residents but only rent the houses there. The young children do not felt secure walking alone within their neighbourhood because they fear of being kidnapped, were afraid of harassment, theft and also fear of being raped or murdered. As a consequence, children did not access community facilities and resources or spend time in public spaces. Owing to the fear of crimes, many parents did not allow their children to move beyond the pavement outside their houses. In terms of the availability of '*Rukun Tetangga*' unit in the neighbourhoods, only Seksyen 3 Petaling Jaya does have this unit. In Taman Samudera and Taman Sri Gombak, many of them claimed that they have never been in and were not aware of the existence of this unit. The establishment of this unit would be able to help the people in their objectives of fostering neighbourliness and unity. It was also to complement the job of the police in order to ensure the safety of the residents, particularly children, in the neighbourhood areas. And for children a safe environment was needed for their physical, emotional, and mental development. Table 4 summarizes the findings of this sector for the three neighbourhoods.

TABLE 4:
Summary of Findings for Sociology and Social Impact Aspects

Indicators	Taman Samudera		Taman Sri Gombak		Seksyen 3 Petaling Jaya	
	Findings	Score	Findings	Score	Findings	Score
Perception on the safety level of children in their neighbourhood area	68.0%	3	76.0%	3	28.0%	1
Perception on the safety of children in their homes and its surroundings	82.0%	3	92.0%	3	94.0%	3
Perception on the safety of children in their school and its surroundings	70.0%	3	79.0%	3	54.0%	2
Programs for children conducted in the neighbourhood	22.0%	1	21.0%	1	32.0%	2
Society's involvement in children's programs in the neighbourhood	4.0%	1	8.0%	1	8.0%	1

*Perceptions of residents towards their surrounding neighbours	72.0%	3	60.0%	3	48.0%	2
*Availability of 'Rukun-Tetangga' within the Neighbourhood	46.0%	2	56.0%	2	64.0%	3
(Total score) / (3 is the highest score x 7 indicators) x100	**76.2%**	**16**	**76.2%**	**16**	**66.7%**	**14**

* New indicators derived from the literature review

Transportation and Accessibility Sector

This sector was related to the safety of the children. It has been found in three study areas that children's walking and cycling to school showed a low percentage. This can be due to the longer distances to school and also due to the withdrawal of parental permission for children to be on the streets alone. Apart from that it could also be due to the highly car-based lifestyles of the residents in these neighbourhoods and low quality of public transport services. In Taman Samudera, the low percentage of students walking and cycling to school was due to the fact that most of the parents were concerned about their children's safety because their neighbourhood areas have not been provided with safe and connected pedestrian and bicycle routes. Children without parental supervision were seen walking dangerously and recklessly on the street. Table 5 summarizes the findings of this sector for the three neighbourhoods.

TABLE 5:
Summary of Findings for Transportation and Accessibility Aspects

Indicators	**Taman Samudera**		**Taman Sri Gombak**		**Seksyen 3 Petaling Jaya**	
	Findings	Score	Findings	Score	Findings	Score
Percentage of student walking to school / Number of school students	26.0%	1	28.0%	1	16.0%	1
Percentage of student cycling to school / Number of school students	12.0%	1	10.0%	1	10.0%	1
Percentage of student taking school buses/ Number of school students	34.0%	2	22.0%	1	32.0%	2
Percentage of student using private transportation/ Number of school students	24.0%	1	24.0%	1	30.0%	2
Percentage of student using public buses / Number of school students	4.0%	1	14.0%	1	12.0%	1

Provision of pedestrian ways and cycling lanes at school area	Observation	1	Observation	1	Observation	2
Provision of crossing areas/lanes at school	Observation	1	Observation	2	Observation	1
Provision of pedestrian ways and bicycle lanes to connect public ways	Observation	1	Observation	1	Observation	2
Maintenance of pedestrian ways and cycling lanes in school areas	Observation	1	Observation	1	Observation	1
Provision of signage along the road in neighbourhood areas	60.0%	3	75.0%	3	70.0%	3
(Total score) / (3 is the highest score x 10 indicators) x100	**43.3%**	**13**	**43.3%**	**13**	**53.3%**	**16**

ISSUES AND PROBLEMS IDENTIFIED FROM THE STUDY

From the findings and analyses that have been done, it has been found that none of the neighbourhoods have achieved the target of 'child-friendly environment'. The study areas were facing a number of problems and basically the problems were similar for each neighbourhood. Among the problems were those mostly related to the inadequacy of the provision of public facilities that meet the children's needs. Among the facilities were the provision of children's crossing areas, the public transportation's stops, public toilets, and public phones. On top of that, these facilities were not specifically designed to cater for children's needs. The public phones were built too high for children to reach. Public phones, however, should be built at an appropriate height for children's use and provided in areas frequented by children especially at schools for their safety and comfort. In terms of the provisions of public toilets, which were located mostly in public areas, they were still not up to standard and were not suitable for children's use. From observations, it has been found that the main issue of the public toilets in these three neighbourhoods was the low level of their cleanliness. Another issue was the issue of uncovered drains. It has been found that most of the drains within the neighbourhoods were not well covered and properly maintained, thus creating risks and hazards to young children.

Among other major problems that have been identified was the level of cleanliness especially in the public areas. Cleanliness was one of the most important aspects in determining the health and well-being of the children. In their everyday life, children regularly move in and between the spaces of the home, street and neighbourhood thus, having clean neighbourhoods is important

to ensure children's safety and good health. The declining number of children walking and cycling to school in these neighbourhoods has been well attested through the analysis that has been done. This was due to the lack of the safety features such as safe and connected pedestrian and bicycle lanes provided within the neighbourhoods' area. Many studies show that the propensity of the children to walk and cycle was significantly affected by how safe, enjoyable, convenient, and pleasurable the experience of walking and cycling was. Furthermore, the declining number of children walking and cycling to school was also due to longer distances to school and also due to the withdrawal of parental permission for children to be on the streets alone. Apart from that, the provision of children's crossing areas was also one of the major problems faced by these neighbourhoods. The provision of this facility was still inadequate especially in school areas and other areas frequented by children. As Bartlett (2002) acknowledges, school children, particularly young children, were more exposed to road accidents, as they cannot measure how fast the car was moving.

Apart from that the issues identified were the safety and security of residents within their neighbourhood areas. There were a number of young children who expressed their fear of harassment or abuse and as a consequence did not access community facilities and resources or spend time in public space. Parents were more likely to prioritise enhanced security and traffic safety. Owing to the fear of crimes, many parents did not allow their children to move beyond the pavement outside their house. This issue could be related to the perceptions of the residents towards their own neighbours. The sense of community must be enhanced in order to create a child-friendly environment for the children. The inadequacy of the provision of street lightings was also one of the problems identified in this study. Provision of better lighting was important in order to ensure the safety of the children especially during night time when children are likely gone out for night classes or tuition. Societal awareness of children's programme is still found lacking in these three neighbourhoods. This issue should be well addressed in order to create a child-friendly environment for children's mental, spiritual, and physical development. The absence of the '*Rukun Tetangga*' unit was also one of the issues faced. On the whole, from the issues and problems identified in this study, it can be concluded that the physical environment of a neighbourhood affects health and well-being both directly through the quality of housing and public space, and indirectly, through the impact on behaviour and the sense of community.

RECOMMENDATIONS

In order to create a child-friendly environment for children, especially for those aged 7 to 17 years old, several recommendations with regard to neighbourhoods were outlined. Recommendations on the neighbourhoods will be focused on three important aspects which are;

i) Residential areas;
ii) Open spaces and recreational parks; and
iii) Neighbourhood movement planning

Residential Areas

The residential area was a basis for community development. As children are part of the community, having well-planned, safe, and healthy residential areas will enhance the community transcendences. The residential area is the place children encounter each day. They need a safe housing environment in which to live, play, run errands, thus helping to develop their physical and mental growth. Since the three neighbourhoods did not achieve the target of the child-friendly environment, the following recommendations are, therefore, made;

i) Maintaining Good Levels of Cleanliness

Cleanliness was the most important aspect in determining the health of the residents, especially children. Although many of the residents of the study areas claimed that the frequency of the garbage collection system in the housing area is 3 times a week, from the observation done the cleanliness of the neighbourhoods was still at a lower level. Apart from relying on the local authorities, the residents should have the initiative to keep their neighbourhoods clean. Weekly voluntary work or '*Gotong-royong*' programmes could be one of the methods that can be carried out among the residents in order to keep their neighbourhoods clean and, thus help in a creating child-friendly environment. A well-managed garbage collection, handling and disposal facility and well-maintained and covered drains were important to help maintain children's health and safety. The efficient removal of garbage was important not only to prevent the breeding of certain disease vectors, but also to ensure that the surroundings of the neighbourhoods were safe and inviting for children's play.

ii) ***Improvement of Drains***

Uncovered and some broken drains will compromises the safety of children who usually to play near the area. Their safety was most concerned especially during the rainy season when the drains will be filled with water. In this case, the local authorities should take action to solve this problem by upgrading the present condition of the drains. The top parts of drains should be well covered to avoid accidents especially among children. Apart from that, the quality of the material used for the drain covers should be observed.

iii) ***Improvement of Signboards***

The design of signs and signboards must consider children's ability to read from afar. They should be clear enough to enable children to read and find their destinations easily. The provisions of signs must be enhanced in terms of their quantity as well as their quality. Children easily get lost even within their own housing areas, thus adequate signs must be provided. The authorities must also provide better materials for the signboards.

iv) ***Facilities For and Used By Children***

Children's crossings are hardly to be seen in the three case study areas. The provision of children's crossings such as zebra crossings and overhead bridges are so important, especially in school areas, in order to ensure the safety of the school children. Overhead bridges should be provided in areas with heavy traffic flow. Children should not be allowed to cross roads without using these crossings. In school areas, the provision of zebra crossings is a must and the school should be able to provide 'lollipop man' to help children cross the road safe and sound.

v) ***Better Lighting***

The provision of adequate lighting is important to ensure the safety and security of the children especially those who tend to go out at night for tuition class, to a friend's house, to buy groceries, and so forth. The inadequacy of this facility may compromise the safety of children especially, females. The females are most likely to be exposed to heinous crimes such as rape and murder.

vi) ***'Rukun Tetangga' Unit***

Blending *'Rukun Tetangga'* (RT) with the Neighbourhood Watch (NW) will be akin to killing two birds with one stone to bring more benefits to residents, especially to children. *'Rukun Tetangga'*

focuses on unity and fostering relationships among the people in the neighbourhood. The presence of the '*Rukun Tetangga*' would be able to help the people in their objectives of fostering neighbourliness and unity and thus have a positive impact on children's growth and well-being.

Open Space and Recreational Park

According to De Chiara, J., Julius, P., and Zelnik, M. (1995), every residential neighbourhood requires a range of facilities for both children and adults that are easily accessible to the living units. Open spaces are not only provided for specific recreational opportunities but also encourage healthy lifestyles and the potential for social contact. Generally, the provision of open space for children's recreational purposes in housing areas has a positive impact in helping children's development process. Thus it is crucial to provide a proper, comfortable and safe play area for children to play in. From the analysis done, it can be concluded that most of the children's playgrounds in the three neighbourhoods are still not up to the standard and should be improved in order to create a safe environment for children. Regarding to this, few recommendations has been made:

i) Suitable Location of Children's Playground

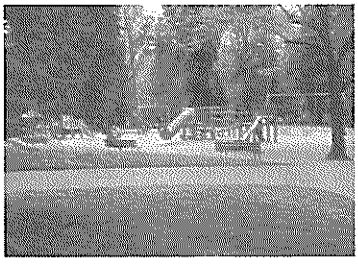
Local residents, particularly children and teenagers, should have the realistic option of walking or cycling to an appropriate range of open space facilities, and be able to walk between spaces on the green network. Apart from that, children's playgrounds should be located as close as possible because they are most frequently and intensively used by children who live in the immediate vicinity. The most appropriate distance for a children's playground should be within 5 minutes walk or 400 m actual distance of every home. The 400 m actual distance is based on general research showing that most young children travel less than that to play. The safety of the route is also important. Most young children are not allowed to cross main roads thus; the location of this playground must take these limits into account. Apart from that, the entire area should be enclosed and screened off from adjacent areas to prevent children from wandering around and to provide noise insulation for nearby living units.

ii) Variety of Spaces for Various Activities

Open space for children's recreational purposes should be designed in such a way that children could fully utilise and manipulate the

area and it serves the needs of both boys and girls of different ages. This is very important in developing their physical and mental growth. Variety of spaces in children's playground includes;

- Apparatus area for swings, slides, jungle gyms, and other equipment;
- Courts and fields for games such as basketball, softball, soccer, tennis, handball and volleyball;
- Open area for running, jumping, and informal play;
- Area for quite games such as checkers, chess, crafts, and hobbies;
- A shaded area for quite activities;
- Picnic areas; and
- Sitting area for parents to look after their children and for children to rest.



Variety of spaces at children's playgrounds

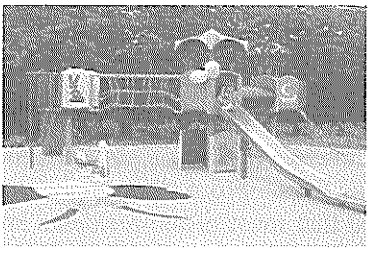
Provision of sitting or picnic area

iii) Safe and Suitable Play Equipment

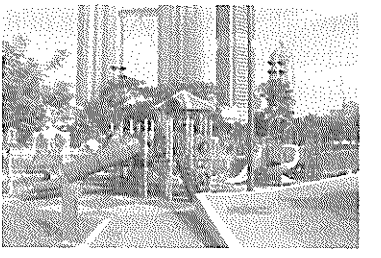
Children are sometimes exposed to accidents when playing in the playgrounds. Children's playground should be equipped with high quality of play equipments in order to ensure the safety of the children. It has been identified through observation that most of the playgrounds within the case study areas are still neglect the safety element for a safe children's playground. Thus few suggestions have been proposed:

- Broken equipments should be removed to avoid any fall off or other dangerous incidents from happening;
- Play equipment must be provided according to the different ages of children;

- Play equipment should be designed in structurally stable conditions. They must be arranged with appropriate distance from each other to avoid accident among children.
- Play equipment must be at least in two types of colour in order to attract children and increase their safety level;
- The provision of guardrail to ensure children's safety;
- Slides should not be more than 30 degree gradient to ensure that children's body can move in controllable speed; and
- "Fall Zone" area that surrounded the play equipments should be expanded to 1.2 m to ensure children's safety.



Fall zone surrounding the play equipments to ensure the children's safety



Stable play equipments to avoid any unintentionally accidents on children

*iv) **Maintain Good Level of Cleanliness at Children's Playgrounds***

Children's playgrounds and recreational parks should be well maintained in terms of their cleanliness. They should be clean enough in order to create a healthy environment for the users particularly the children. To achieve a high level of cleanliness, the authorities should give real teeth when assigning the responsible staff or workers to always ensure the cleanliness of the open spaces and parks. There should be consistent dates for inspection, proper schedule on the types of maintenance programmes and person in charge. The garbage collection should be done at least 3 times a week in order to maintain the cleanliness level of the open space for children's recreational use. Apart from that, the residents from these three neighbourhoods can take initiatives by organizing weekly *'voluntary community work'* for their neighbourhoods. This programme could help in fostering community development among the residents. Furthermore, high levels of cleanliness can also be achieved through the appropriate provision of garbage disposal within the playgrounds and parks. Signboards showing phrases like 'Keep This Area Clean' should be provided in order to create awareness among users, particularly the children.

v) ***Appropriate Landscape Design***

The landscape design of the open spaces must be taken into account in order to create an attractive, comfortable and conducive environment for children to enjoy. Good design of landscape elements will provide a better visual impact for the surrounding environment. However, the purpose of having trees is not only for the aesthetical value, but to provide shady areas for play activities during the daytime.

Neighbourhood Movement Planning

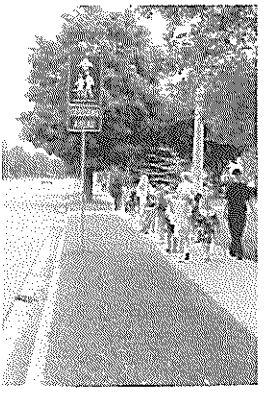
Network movement is one of the main components in a settlement as it connects various activities within the settlement itself. Vehicular traffic has to be sufficiently tamed so as to pose little threat in terms of accidents especially to children. Indeed, providing safe routes and movement for children is increasingly important in order to develop children's ability to be independent as well as to enhance children's lives. From the analysis of the three neighbourhoods, it can be concluded that most of the residents are not satisfied with the safety of their children in terms of the network system provided in their neighbourhood areas. Below are few recommendations that have been proposed based on the issues and problems which arise;

i) ***Safe and Connected Pedestrian Route***

Pedestrian activity is the livehood of the neighbourhood. Enabling easy and free pedestrian movement is, therefore, a very high priority. To ensure the safety of children when walking in the neighbourhoods, a numbers of measures should be taken into account:

- Pedestrian routes must be continuous, connected and as direct as possible in order to reduce distance to be walked and increase the pedestrian catchments of facilities;
- Green spaces should be linked to the network to allow for round walks, and where 'green routes' to major centers of activities such as children's playground;
- Pedestrians ways should be provided with good permeability whereby choices of routes filtering through an area allowing pedestrian especially the children to go which way they wanted to go;
- It is vital to provide easy, direct access to public transport facilities for the convenience of the children;

- Pedestrian routes should avoid steep hills, unnecessary barriers, steps or kerbs that might inhibit less agile people such as children in particular;
- Routes should be well lit and feel safe, without dark corners or featureless, unconnected sections that might be intimidating to children particularly;
- Pedestrian routes should be linked by convenient and safe crossings, with minimum diversion to meet children's need;
- Apply the concept of 'Safe Routes to School' at every neighbourhood in the country; and
- Provision of water cooler facility to encourage the children to walk.



Pedestrian route that linked by safe crossings for children's safety

Water cooler facility to encourage children to walk.

ii) Safe and Connected Bicycle Lanes

Ordinary streets throughout the neighbourhood should be managed for bicycle use, linking directly with the surrounding areas. This requires that vehicle traffic be 'calmed' in order to ensure the safety of users, especially children. To improve the present condition of the bicycle lanes in the three neighbourhoods, a few suggestions have been outlined:

- Separate lanes or paths should be provided especially in area with heavy or fast-moving traffic is unavoidable, in order to reduce accidents that likely to happen on children;
- Main bicycle routes should be as continues as possible, with few stops;
- Cycling paths should ensure easy gradients (normal maximum 6 percent), a smooth surface and protected from fumes;

- Cycling paths can share surfaces with pedestrians on segregated routes in order to ensure the safety of the children;

iii) Safe Crossings Areas for Children

The provision of children's crossings is very important to determine the safety of the children especially in school areas. Children's crossings must be well maintained in order to ensure the safety of the children. It should be clear enough to be seen by children for their safety and comfort. Without proper children's crossings, especially in school areas, it may create hazards and traffic accidents to children. Indicates the example of a well-maintained children's crossing provided in a school area.

TABLE 6:
Summary of Issues and Problems, and Recommendations

ISSUES AND PROBLEMS	RECOMMENDATIONS
Safety of Children	• Provision of safe and comfortable pedestrian walkways • Provision of safe and connected bicycle lanes/routes • Provision of children's crossings especially in school areas • Improvements of uncovered drains • Planning for suitable locations of children's playground • Provision of safe and suitable play equipment at children's playground • Appropriate locations of bus stops that are secure from traffic to avoid accidents
Security and Supervision of Children	• Provision of adequate lighting in neighbourhood areas • The availability of '*Rukun Tetangga*' unit in the neighbourhoods
Health of Children	• Maintaining the cleanliness level of the neighbourhoods and public areas • Maintain the cleanliness of the children's playground
Comfort of Children	• Provision of suitable and appropriate height of public phones, and other facilities for and used by children • Clean and comfortable public toilets
Mental and Physical enhancement	• Appropriate landscape design at children's playground • Provision of appropriate, suitable children's playground • Various spaces for various activities in children's playground • Programmes organised for children within the neighbourhoods

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THE EVALUATION OF BEACHES IN NORTHERN MALAYSIA

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Abstract

This paper reports on findings of an IRPA Long Term Research that among others, aims at ranking natural tourism resources found in the states of Penang, Kedah and Perlis. Selected tangible resources such as beaches and waterfalls were assessed using structured evaluation sheets. This paper discusses the methods and approaches utilized in assessing the products. Five evaluating factors that were used to determine product attractiveness and quality include transportation & accessibility, accommodation, facilities & infrastructure, tourist activities and physical features. The resulting quantitative rankings can assist tourism planners and marketers in planning and plotting potential tourist routes and developing more integrated regional tourism products.

Keywords: Tourism Products, Tourism Resources

INTRODUCTION

Natural resources are often the main products that attract tourists into destinations. Throughout the world, places like the Niagara Falls, the Great Lakes, Mount Everest and Mount Fuji have established themselves as the world's icons. Back here in Malaysia, areas like Cameron Highlands, Redang and Tioman Islands, Mulu Caves as well as Mount Kinabalu continue to rank highly in the mind of visitors as the must visit places in Malaysia. While the bulk of the international travelers in Malaysia spend most of their vacation in urban destinations like Kuala Lumpur, Penang and Malacca, a growing number of visitors venture into more remote, natural areas. In the domestic front, Malaysians in general, have begun to appreciate nature spots as their preferred locations for recreational and tourism activities. Beaches, especially, are flocked by local recreationists, especially during weekends and school holidays. In the islands of Langkawi, Penang, Tioman and Pangkor, beachfront hotels are preferred than those located in the urban areas. Due to this preference, beach hotels enjoy better average room occupation rate, thus charging higher rate than

the town hotels. The growing number of establishments and destinations that promote concepts like agro-tourism, nature-tourism or even archeo-tourism reflects the increasing interest in alternative tourism in Malaysia! This trend calls for a more integrated planning of natural resources. Past studies, such as those done by Abdul Aziz and Badaruddin (2002), revealed that states in Malaysia have abundant but hidden natural treasures that can be explored and conserved as great tourism products. Their study found that many potential natural resources in Southern Kelantan are not fully developed and various formerly successful attractions are left abandoned and unmanaged.

Tourism has become the second most important sector for the growth of the Malaysian economy. In 2003, tourism contributed over RM36 billion to the total economic revenue through foreign money exchange. Malaysia recorded an increased arrival of 13.3 million international tourists on the same year. Due to various promotion and campaign such as *'Malaysia...Truly Asia'* and *'Visit Malaysia Year'* that were publicized throughout the world, the country expects to enjoy an average of 4% increase in international tourist arrivals for the coming years until the year of 2020. At the same time, Malaysia also encourages domestic tourism through aggressive promotions such as *'Visit State Year'* and *'Cuti-Cuti Malaysia'* and hosting open houses, in order to induce local travel. Encouraging domestic travel is also a strategy to counter the impacts of global economic slowdown, due to events such as disease outbreak and war that affected the tourism sector. However, while domestic tourism is strongly encouraged, the quality of service and facilities at local attractions must also be upgraded. Potential products need to be explored, diversified and developed into quality products. These efforts aim to expand the tourist market so that it is capable to serve both local and international tourists with the uniqueness of our tourism resources.

TOURISM PRODUCTS

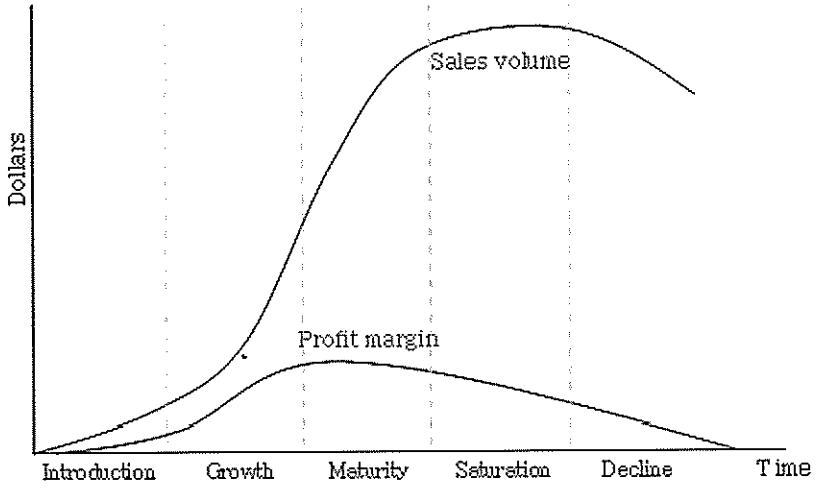
Literature has highlighted several concepts and definitions related to tourism products. According to Becherel and Vellas (1999), tourism products are service products of distinct attributes; namely intangible, perishable, supply inelastic, demand elastic, complementary, inseparable, homogeneous, high fixed costs and labor intensive. Mc Grath (1999) argues that tourism products can also be wide ranging, from tourist destination, transportation, hotel, food and beverages, travel operator to the natural or man-made attraction. Tourism products at best are often distinctive and differentiated (Booms and Bitner, 1980; Gilbert, 1991).

Medlik and Middleton (1973) further defined tourism products as all activities, services and benefits associated with tourism. Kotler (1984) echoed the view that tourism products involve anything worth marketing. Tourism products can be perceived at two levels: specific and total (Middleton, 1989). At the specific level, tourism product is seen as a single transaction of, say, a tour or an airline seat. On the other hand, tourism product at the total level encompasses the entire travel experience from start to finish. As tourism products comprise tangible and intangible elements, Jefferson and Lickorish (1988) argued the symbolic characteristics such as expectation and satisfaction should be included as tourism products. Levitt (1981) first presented a typology of tourism products, namely the core product (essential service); tangible product (actual service); and augmented product (a combination of tangible and value-added features). Lewis and Chamber (1989) further defined the typology of tourism products at the three levels; they are the formal product (what tourists believe they are buying); core product (what tourists actually buy); and augmented product (a combination of core product and value-added features).

Gunn (1994) further clearly identified tourism products as the major components on the supply side. Linkages between the components of attraction, promotion, information, transportation and services should be maintained and managed to receive visitors. Smith (1994) indicated good tourism products are the results of synergistic interactions between five key elements depicted in concentric circles. The progression of elements from the core to the shell is correlated with decreasing management control, increasing consumer involvement, increasing intangibility and declining empirical measures. Goeldner *et al* (2000) finally put forward a model of products life cycle consisting of five phases, namely introduction, growth, maturity, saturation ands decline (see Figure 1). Product life cycles have become much shorter due to changes in consumer lifestyles and emerging technologies.

Generally, tourist attractions can be categorized as natural assets or man-made. They include nature attractions, cultural attractions, events, recreational and entertainment attractions. Nature attraction as tourism resources is the focus of this article. Natural resource refers to undisturbed or uncontaminated natural sites comprising the basic elements of water, topography, flora, fauna and climate. Oceans and seas of tropical beaches constitute a major water-based tourism resource. Other water features such as freshwater lakes, waterfalls and hot springs are also popular outdoor recreational spots. Beaches and mountains

probably ranked as the top topographic venues for tourism activities (Weaver and Opperman, 2000).



Source: Goeldner et al (2000)

FIGURE 1: Product life cycle.

Goeldner *et al* (2000) asserted that natural attractions have become increasingly trendy amongst recreationists in many countries. The beauty of natural areas has appealed more to tourists in recent years (Valentine, 1992; Wight, 1996). Nature-base tourism is special interest tourism. Lucas (1984) referred to nature-based tourism as the enjoyment of natural areas and the observation of nature that entails low impact on the environment and is not labor intensive. Lascurain (1988) refined nature-based tourism as traveling to undisturbed or uncontaminated natural areas to study, admire and enjoy the scenery, fauna and flora, and cultural manifestations. It is important to ascertain the nature-based tourists in order to gauge their needs and requirements. Lindberg (1990) attempted to classify nature tourists into four categories: (1) hardcore; (2) dedicated; (3) mainstream; and (4) casual. Hardcore tourists are often scientific researchers, or members of educational or conservation tours. They are typically very highly educated Caucasian males. Dedicated nature tourists are usually professionals with steady incomes. They venture into protected areas to understand the local natural and cultural history. They are less demanding in their basic requirements (Boo, 1990). The mainstream tourists visit wildlife destinations as a regular trip. They may not be committed to the course of

nature and would expect relatively higher standards in food and accommodation. Finally, the casual nature tourists are people who visit nature as an itinerary of an extended trip. Both mainstream and casual nature tourists may not tolerate the crowding and basic amenities offered at some nature attractions.

TOURISM RESOURCE EVALUATION

Discussions on the concepts of tourism products and the categories of nature tourist lead to the task of evaluating the natural resources to develop viable tourism development plan in Malaysia. In Malaysia, tourism product development is much emphasized in the Eighth Malaysia Plan. A wide array of tourism products is available to accommodate all tourist interests and demands including (1) hill and island resort; (2) shopping destination; (3) thematic events; (4) sports and recreation tourism; (5) cruise tourism; (6) eco-tourism; (7) agro-tourism and home stay program; (8) cultural and heritage tourism; (9) education, student and health tourism; (10) meeting, incentives, conventions and exhibitions (MICE); and (11) theme parks. Several tools have been used to access and evaluate tourism products. The Delphi Method was utilized by Bauer (2001) to determine the preferred types of tourism in the Antarctic region; and by Nae and Yue (1999) to identify potential locations for national parks in Taiwan based on specific assessment criteria. Hudson's (1998) waterfall study was based on the economic and geographic theoretical frameworks of landscape resources as an attraction, recreation and tourism product. Prior to this, Piperoglou (1967) studied the physical, aesthetic and cultural significance of the Greek western coastal region and attempted a quantifiable ranking exercise for comparative evaluation.

RESEARCH METHODOLOGY

This research is organized into six methodology stages. In the first stage, preliminary studies and literature reviews on tourism were completed. The secondary data collection included information on tourism products, natural attractions, the role of nature in tourism development and the trend of nature-based tourism in Malaysia. The second stage intended to provide an inventory of tourist products identified within the research areas. Based on four different categories, the inventory was grouped into heritage, natural resource, rural resource and modern built attraction clusters. Stage three involved site selection and collection of primary data. The sites were selected based on the inventory of

tourism products identified through the groupings of the four categories mentioned above, while primary data was collected using observation and assessment method on the ground. The fourth stage included the synthesis between the data and the GIS database system in order to produce outputs. The fifth stage involved a discussion of the findings whereas the final stage presented the outcomes and recommendations.

Tourism Products Inventory

A product inventory encompasses established, new and potential tourism resources found within the study area of Kedah, Pulau Pinang, Perlis and Perak was collected. The products were selected from government reports such as the Structure Plans and Local Plans, brochures, websites, academic journals as well as words of mouth. Consequently, 329 resources were discovered within the study areas where 93 products were found in Pulau Pinang, 82 in Kedah, 26 in Perlis and 128 in Perak.

TABLE 1:
Tourism Resources in the Northern Region, Malaysia.

Resources	P. Pinang	Kedah	Perlis	Perak	Total
Natural	15	46	9	41	111
Heritage	62	11	5	58	136
Rural	4	2	1	5	12
Modern Attraction	9	14	3	13	39
Others	3	9	8	11	31
Total	**93**	**82**	**26**	**128**	**329**

As shown in Table 1, heritage resources in which Pulau Pinang and Perak are leading the packs dominate the Northern region. There are a total of 58 natural resources products in Perak whereas Pulau Pinang established 62 products around the state. The natural resources follow in second place with Kedah and Perak showing the highest counts with 41 and 46 respectively. While modern attractions and other types of resources can moderately be found in the study areas, rural resources have the least number of products within the four states. Other resources include major manmade locations like the Timah Tassoh Dam in Perlis. However, due to limitation of time and financial resources, the data collection exercise was also limited to only natural resources while abstaining the collection of heritage, modern attractions and rural data. The state of Perak was also omitted from the study for the same reason.

Evaluation Sheet

Another important exercise in the study is the design of the evaluation sheet to enable the collection of primary data in stage two. Questions, classifications and criteria used in the sheet were based on reviews on previous works by Gunn (1994), Baud-Bovy and Lawson (1998), Morgan (1999), Georgulas (1970), Abdul Aziz and Badaruddin (2002) and others. This research attempts to quantify elements that contribute to a major tourism product taking into consideration the fact that supporting infrastructures like parking spaces, food availability and information system are part and parcels of the product. The sheet contains 10 different sections namely:

Particular		*Details*
1. Resource Identification	-	Identification number, name, type and location
2. Transportation and Accessibility	-	Main road, entrance, transportation, parking
3. Accommodation	-	Type, distance, star rating, total room
4. Eating and Drinking	-	Number of establishments, distance, total seating
5. Communication	-	Hand phone coverage, number of facilities, distance
6. Tourist information Service	-	Number of services, availability of printed materials
7. Infrastructure	-	Availability and regularity of services
8. Type of Activities	-	Swimming, snorkeling, recreational fishing etc.
9. Other information on the resources	-	Beach length, water clarity, sand color etc.

Site Selection

Since there are thousands of tourism products within the areas, the study team was required to reduce the number of products for the purpose of assessment via careful selection and specific criteria. As a result, 13 site categories of natural resources based on ground accessibilities were identified. There are as listed below:

1. Island
2. Beach
3. Lake
4. River
5. Mountain
6. Hill
7. Cave
8. Waterfall
9. Sea Park
10. Recreational Forest
11. Forest Reserve
12. Hot Spring
13. Landscape and Scenery

The sites were evaluated using a mixed-method approach in which ground observation was supported by informal interviews with local tourism operators. The observation was designed to record the availability of public amenities, activities carried out by tourists, distances and photos on the nature and atmosphere of resources. Consequently, approximately 74% of the total products within the study areas were evaluated. Langkawi and Kedah recorded the highest percentages of completion with 83% and 87% respectively, while Perlis recorded the lowest with 44%. Variations in the outcomes are mainly due to unseen difficulties on the ground. For instance, many tourism resources in Perlis are located in the Taman Negeri (State Park) like Gua Wang Burma, Gunung Perlis, Tasik Meranti, Gunung Medan and Lata Kasih Waterfall. Visitors were actually required to obtain special permission from the authority in which the study team was unable to do.

Method of Assessment

Completed in three phases, the first involved the methods of storing and retrieving data while the second entailed data manipulation and analysis. The third phase described data output; that is, in the forms of reports and map reproductions.

Data Storage

Data collected from the ground survey is stored into a database system using Microsoft Access. Each data registered was uniquely differentiated by an ID No (or identification number) that identifies its name, location and category to enable the system to confirm the resource. Supportive secondary data was also used to ensure its precision. The total number of rooms in an accommodation facility was verified using the Accommodation Guide (Tourism Malaysia, 2002) while distances were measured from scaled maps. The database can further be extended into specific tables formed that are linked according to different levels and functions such as type of accommodation, transportation, sites etc.

Data Coding

The data was then coded into specific categories using simple guidelines. Each data was transformed into points based on certain justifications (Table 2). The coded data was further analyzed using mathematical calculations.

TABLE 2
Data justification.

Points	Distance from resource
5	0 – 100m
4	101 – 250m
3	251 – 500m
2	501 – 750m
1	751 – 1000m

Data Computation

After the coding process was completed, the data was computed using Microsoft Excel worksheet that performed mathematical scores (Figure 2). Scores from all tables stored in the database were combined into a single worksheet to obtain total score counts. The outcomes were ranked accordingly.

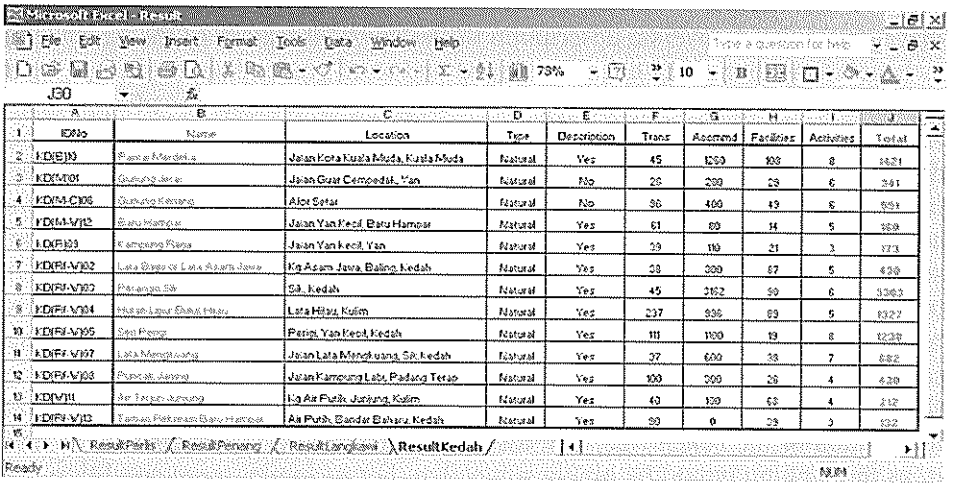


FIGURE 2: Data computation in MS Excel worksheet

The study team has considered five main criteria in determining the resource ranking. Each criterion was given equal weight based on its importance towards resource development (Table 3). The ranking was mainly based on transportation and accessibility, accommodation services, tourist facilities,

tourist activities and physical features. Finally, these rankings were incorporated with a GIS (Geographical Information System) to produce maps (of resources).

TABLE 3
Weight of Assessment.

Criteria	Weight (%)
Transportation/Accessibility	20
Accommodation	20
Facilities	20
Activities	20
Physical features	20
Total	**100**

THE RESULT

The natural resources evaluated comprises of 13 categories. However, this paper reports result of only one of the categories, namely, beaches. Overall, the study analyzed 18 beaches along the northern states of Malaysia. Eleven beaches are in Langkawi, six beaches in Penang and one in mainland Kedah. Information obtained for each beach covers 5 main sections: physical features, accessibility, accommodation, public facilities and tourist activities. The general information that was recorded covers a description of the physical feature of the beach such as beach formation, length, color of sand and sand grade, degree of slope main vegetation type, known danger to swimmers and source of pollution. Accessibility was assessed based on available modes of transport for the public, distance of the beach from the nearest main road, airport and other transportation hubs as well as parking facilities available. For the accommodation section, the information recorded includes the number of rooms, star ratting as well as distance from the beach. Information under the section of tourist facilities included the availability of eating and drinking establishments, hand-phone coverage, amenities as well as infrastructure provided. The final section covers availability of tourist activities, which include, activities such as fishing, swimming and gliding. Although information collected regarding the description of the beach was very useful, in some cases, it was difficult to rank it, as the ranking would be highly subjective. For example, wave condition that is strong would be favorable to surfers but such a condition would not be generally appreciated by leisure swimmers especially those who worry about the safety of their children. Therefore, the final ranking of the beaches only included characteristics that can be accessed objectively. The final ranking of all the 18 beaches was made up of the five categories: transportation,

accommodation, facilities, activities and physical features. It was decided that each category should be weighted equally as giving different weights create other problems (DeVellis, 1991).

Table 4 below illustrates the breakdown of marks given for all the beaches based on the 5 categories accessed. The Ferringhi Beach, which is located in the northern part of Penang Island, had the highest overall mark with a score of 72.35 out of 100%. The total score was contributed by 11.13% for transportation, 19.12% for accommodation, 18.80% for facilities, 9.6% for tourist activities and 13.60% for physical features. The highest ranking for Ferringhi Beach was made possible especially due to its excellent accommodation facilities (which was ranked highest), tourist facilities (also ranked highest) as well as good transport facilities (ranked third out of eighteen). Tanjung Bungah, also in Penang, came out second in the ranking with a total score of 41.74%. The overall mark comprises of 17.47% for transportation, 6.12% for accommodation, 0.55% for facilities, 5.60% for activities and 12.00% for physical features. The notable outstanding quality of Tanjung Bungah is its excellent transportation facilities (ranked highest) as well as accommodation (ranked third out of thirteen).

It is also notable that the ranking system used for this assessment showed a huge gap between the marks obtained for Feringghi Beach compared to second ranked Tanjung Bungah Beach and the rest. The high score for Feringghi Beach was actually inflated due to extremely high scores for number of accommodations available as well as public facilities. The third ranked beach is in Langkawi Island and subsequently, beaches that were ranked between fourth and seventh were also from this famous tourist destination. Pantai Tengah, which is third in the ranking scored favorably in terms of activities (10.40%), accommodation (6.59%) and scored 7.40% for facilities (second highest for this category). The total score for this beach is 38.99%.

The fourth ranked beach is Pantai Teluk Burau, which obtained a total score of 36.90%. The excellent quality of Pantai Teluk Burau is its activities, which scored highest among the 18 beaches (14.40%) as well as public facilities (ranked fifth). Pantai Cenang, ranked overall fifth, with a total score of 34.66% came out second in the physical feature category with a score of 12.80%. The secluded Pantai Datai, famous for its luxurious resort: The Andaman and The Datai, Langkawi boast excellent physical feature qualities but their exclusivity (in the form of low number of accommodation) and secluded location (in the form of distance from airport) scored poorly in the ranking. The overall ranking for Pantai Datai was sixth, with a total score of 34.47%.

It is important to note that the overall ranking of the beaches was based on the parameters set by the research team. It only gives a general impression and that by setting the parameters differently (i.e. parameters can be set according to specific requirements), the rankings would give a different outcome.

TABLE 4
Ranking of beaches in Northern Malaysia

Ranking	Name	Transportation 20%	Accommodation 20%	Facilities 20%	Activities 20%	Physical Features 20%	Total 100%
1	Ferringhi Beach	**11,13**	**19,21**	**18,80**	**9,60**	**13,60**	72,35
2	Tanjung Bungah Beach	**17,47**	**6,12**	0,55	5,60	**12,00**	41,74
3	Pantai Tengah	2,60	**6,59**	**7,40**	**10,40**	**12,00**	38,99
4	Pantai Teluk Burau	2,20	4,50	**4,60**	**14,40**	11,20	36,90
5	Pantai Cenang	2,60	5,86	3,80	9,60	**12,80**	34,66
6	Pantai Datai	1,67	4,60	1,80	**12,80**	**13,60**	34,47
7	Pantai Kok	7,20	0,18	3,95	**12,00**	9,60	32,93
8	Miami Beach	7,87	3,78	1,55	4,00	**13,60**	30,80
9	Pantai Teluk Baru	4,60	0,92	2,30	**10,40**	11,20	29,42
10	Shamrock Beach	**11,07**	0,02	1,40	3,20	**12,80**	28,49
11	Pantai Tanjung Rhu	2,20	3,60	2,45	**12,00**	8,00	28,25
12	Pantai Teluk Yu	5,87	0,01	3,60	7,20	11,20	27,88
13	Pantai Merdeka	3,00	0,23	**5,40**	6,40	**12,00**	27,03
14	Teluk Bahang Beach	7,67	0,00	0,75	5,60	**12,00**	26,02
15	Pantai Batu Hampar	2,93	2,78	1,75	7,20	11,20	25,87
16	Pantai Pasir Tengkorak	2,07	0,06	1,40	8,00	**12,00**	23,53

17	Pasir Panjang Beach	2,80	0,00	0,95	4,00	**12,80**	20,55
18	Pantai Pasir Hitam	1,53	0,02	**5,00**	4,80	8,80	20,16

Note: High scores in bold.

In addition, in most cases, the information would be very useful if examined individually, based on the sub category. For instance, those who are more interested in activities for tourists should focus more on what is provided as an indicator for visits. The information collected is also flexible in the sense that a ranking can be done to tailor suit different purposes. For example, ranking of physical features to suit surfers would be different compared to a ranking of features for families with children. Therefore, the information collected from this research, in the form of a database, would be especially useful for tourists and tourist operators.

It is important to note that this study has several limitations. Although it attempts to be comprehensive, it does not cover all available locations. In some instances, a site was not evaluated because no clearance was obtained from the authorities involved. In addition, some methods of data collection were based on crude assessments rather than a scientific approach (due to lack of resources and expertise). In addition, the assessments were also conducted based on one individual visit per site and that information on physical features (such as wind speed, clarity of water) might not be reflected accurately.

CONCLUDING REMARKS

This exploratory approach intends to evaluate the quality and attractiveness of natural resources that can abundantly be found in the three northern states of Peninsular Malaysia. By using a systematic evaluation technique and ranking, the result is further plotted into GIS maps which help portray the relationships between the resources. This research attempts to assist planners and decision makers to develop the resources accordingly and also pave the way for further evaluation in other parts of Malaysia as well.

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URBAN LAND USE CHANGE AND THE LANGAT BASIN ECOSYSTEM HEALTH

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Abstract

The paper discusses over four decades of urban land use changes in the Langat River Basin in response to rapid development impulses that flowed from the more developed Klang Valley where Kuala Lumpur, the Malaysian capital city is situated. It proceeds to look into the impact of those changes on the ecosystem health of the basin. Federal development policies, strategies, programs and activities have transformed the basin from an industrial agricultural basin into an urbanized area. Being contiguous to the Klang Valley, the basin rose over the decades to be a choice location for not only foreign direct investment to produce manufactured products for export but also services and educational. The paper also discusses the status of the Langat Basin ecosystem health. The change to the land use has indeed impacted on the basin ecosystem health. Using GIS, land use changes in the basin over the decades were analysed to reveal the persistent direction of change. It is clear that the trend of land use change in the Langat Basin is the conversion from one type of land use to developing urbanised and full urban areas. What is implied by the changes are indicators that can be derived to show the sustainability of the ecosystem in the Langat Basin such as river flood, mud flood, land slide, etc.

Key words: Langat River Basin, Ecosystem Health, Land Use, GIS,

INTRODUCTION

This paper perceives that economic, social and administrative driving forces have impacted on the Langat Basin land use. Land uses change continually from 1970 to 2001 that in turn impact on the basin ecosystem health. The ecosystem health concept is defined and impacts of the land use change will be summerised. Though far from clear, the ecosystem health is still a useful integrating concept to bring together man, culture and the environment. In this paper, land use is used as an illustration to discuss the status of the Langat Basin ecosystem health.

ISSUES RELATED TO LAND USE CHANGE

Meaning of Land Use

At the outset, land use change needs to be clarified. "*Land use* involves both the manner in which the biophysical attributes of the land are manipulated and the intent underlying that manipulation – the purpose for which the land is used" (Turner *et al.* 1995, 20). In a similar vein, Meyer (1995) states that "*land use* is the way in which, and the purpose for which, human beings employ the land and its resources (Meyer 1995, 25 cited in Moser 1996, 247). Briefly, *land use* "denotes the human employment of land" (Turner and Meyer 1994, 5). Skole (1994) expands further and states that "*Land use* itself is the human employment of a land-cover type, the means by which human activity appropriates the results of net primary production (NPP) as determined by a complex of socio-economic factors" (Skole 1994, 438). Finally, FAO (1995) states that "*land use* concerns the function or purpose for which the land is used by the local human population and can be defined as the human activities which are directly related to land, making use of its resources or having an impact on them" (FAO 1995, 21).

The description of land use, at a given spatial level and for a given area, usually involves specifying the mix of land use types, the particular pattern of these land use types, the area extent and intensity of use associated with each type and the land tenure status (Bourne 1982, Skole 1994). More detailed natural and physical characteristics are recorded for each land use type for a complete description of land use (see, for example, Chapin and Kaiser 1979 for the case of urban land use studies; Meyer and Turner 1994 for regional and higher level studies).

However, both in the case of land cover as well as of land use, the meaning and conceptualization of change is much broader. In the case of land cover change, the relevant literature distinguishes between two types of change: conversion and modification (Turner et al. 1995, 22; Skole 1994, 438). Land cover conversion involves a change from one cover type to another. Land cover modification involves alterations of structure or function without a wholesale change from one type to another; it could involve changes in productivity, biomass, or phenology (Skole 1994, 438). Land cover changes are the results of natural processes such as climatic variations, volcanic eruptions, changes in river channels or the sea level, etc. However, most of the land cover changes of the present and the recent past are due to human actions – i.e. to uses of land for production or settlement (Turner et al. 1995, 27). More specifically, Meyer and Turner (1996) suggest that "Land use (both deliberately and inadvertently)

alters land cover in three ways: converting the land cover, or changing it to a qualitatively different state; modifying it, or quantitatively changing its condition without full conversion; and maintaining it in its condition against natural agents of change" (Meyer and Turner 1996, 238).

Similarly, land use change may involve either (a) *conversion* from one type of use to another – i.e. changes in the mix and pattern of land uses in an area or (b) *modification* of a certain type of land use. Modification of a particular land use may involve changes in the intensity of this use as well as alterations of its characteristic qualities/attributes – such as changes from low-income to high-income residential areas (the buildings remaining physically and quantitatively unaltered), changes of suburban forests from their natural state to recreation uses (the area of land staying unchanged), and so on. In the case of agricultural land use, Jones and Clark (1997) provide a qualitative typology of land use changes: intensification, extensification, marginalization, and abandonment (Jones and Clark 1997, 26-27).

The magnitude of land use change varies with time period being examined as well as with the geographical area. Population change is used as a proxy measure of changes in the area of human settlements especially in urban areas. These latter changes are difficult to assess unambiguously as they are haunted by definitional and data problems (Douglas 1994). The impacts of these environmental problems are serious both in the short and in the long term. In the short term, food security, human vulnerability, health and safety are at stake; in the longer term, the viability of earth is being threatened.

Land use change is driven by a variety of forces, which relate differently to one another in different spatial and temporal settings. Holistic theories of land use change need to draw on a variety of theories relating to the drivers of this change, first, to offer realistic and meaningful accounts of land use change, second, to provide rigorous theoretical bases for modeling this change, and, third, to guide action in problem solving (i.e. planning) situations. More importantly, however, this blending and synthesising of theories – if it is ever achieved - may dissolve the present thematic boundaries (industrial change, spatial change, institutional change, etc.) and reveal a unified theory, a meta-theory of change.

Meaning of Ecosystem Health

As land use change will affect an ecosystem health, there is need to explore the concepts of the ecosystem health in some details. The term ecosystem health has been hotly debated in the literature (Jamieson, 1995; Lackey, 1995;

Rapport, 1995a; Wicklum and Davies, 1995; Callicott and Mumford, 1997; Simberloff, 1998; Rapport, 1995a,b) defines the states of the ecosystem health as the absence of signs of ecosystem distress, an ecosystem's ability to recover with speed and completeness (resilience), and/or a lack of risks or threats pressuring the ecosystem composition, structure, and/or function.

"Ecosystem health is the state of dynamic equilibrium between producers and consumers ensuring the optimum livelihood of all inhabitants in the unit. Human well-being should be a part of the harmony between all the other living beings in the ecosystem. The health concept should not be based solely on human health alone; otherwise, it will infringe on the life of other inhabitants of the ecology."

There is now evidence that many human dominated ecosystems, including various biophysical systems at regional and global levels, have become highly stressed and dysfunctional (Vitousek et al., 1997). The services provided by these ecosystems such as maintenance of ground and surface water supplies, balance of atmospheric gasses and reduction soil erosion etc. are extremely important to human welfare, but now they are losing, step by step. So fostering the practice of ecosystem health has never been more critical than at the present time. Ecosystem health is a major organizing paradigm for protecting and sustaining the quality of the environment and our own well-being, also as the foundational concept for developing new ways of assessing and managing environmental resources. Though concepts and theories related to ecosystem health approach are rapidly emerging, practical examples of the utility and result of this approach are critically important in understanding its application to real-life issues. Ecosystem health is not meant to be prescriptive in terms of method; the approach is as much a way of thinking as a precise way of doing things. However, owing to the complexity of ecosystems, it is not an easy task to find suitable ecological indicators to measure ecosystem health (Xu et al., 1999). Many researchers have proposed different definitions (Rapport, 1989; Norton, 1991; Costanza, 1992; Ulanowicz, 1992) and various indicators (Costanza, 1992; Jorgensen, 1995a,b). Costanza (1992) proposed an overall ecosystem health index. HI = $V \times O \times R$. Where V is system vigor index, O is the system organization index; and R is the resilience index. Plainly, different indicators cover different aspects of ecosystem health. It may be necessary to apply several indicators simultaneously to get a sufficient image of the health or integrity of an ecosystem (Jorgensen, 1997).

In a word, as an integrative organizing principle, ecosystem health goes far beyond the boundaries of stress ecology, a field that concerns itself with the strictly biophysical aspects of the problem. It explicitly takes into account the wider territory of socioeconomic, human health, legal, and policy aspects. Of course, no one model can be expected to accomplish all of these goals at once,

but practical evaluations of changes in ecosystem health must draw upon all of these dimensions (Rapport, 1995).

In this article we use the ecosystem health to show the current status of the ecosystem, measured from the changes in land use especially in urban area. This article shows that the ecosystem health is a useful integrative concept.

URBAN LAND USE CHANGE IN THE LANGAT BASIN 1974 - 2001

Urban land use change is to illustrate the use of ecosystem health in the Langat Basin. Developed/urban areas showed tremendous changes from the 1970s. Data from Table 1 highlighted the changes of developed areas/urban areas. In 1974 the developed areas (urban areas) size areas were calculated at 7,022.79 ha or 2.34 %, which then increased to 28,194.24 ha or 8.77 % in 1988 remaining the same in 1991 at 28,510.70 ha or 8.86 %. In 1996 developed/urban areas increased to 30,968.31 ha or 9.55 % and then increased tremendously to 51,502.80 ha or 14.94 % of the entire Basin in 2001. It can be seen that the major changes in Langat Basin were the growth of urban areas, which caused a major impact to the natural ecosystem. In 1974, urban areas stood at 2,009.97 ha or 0.69 %, which then increased to 3,670.56 ha or 1.25 % in 1981. This trend shows rapid growth in 1996 based on land cover classifications using Landsat TM, with urban areas increasing rapidly from about 21,007.85 ha to 23,017.80 ha in 1996 and further increasing 17,621.40 ha to 40,639.20 ha or 13.86 % of the total land use in 2000. This increased doubled within five years, and almost 20 times of the figures in 1974.

The Langat Basin ecosystem has and is undergoing rapid changes. In the 1960s and 1970s much of its original lowland dipterocarp and peat swamp forests were lost through conversion to agricultural plantations, tin mining areas and human settlements (Wong, 1974). More recently, its natural areas have come under increasing pressure from rapid urbanization and industrialization, particularly the development of the administrative centre, Putrajaya which was given the status of Federal Territory, the development of Cyberjaya to link with the Multimedia Super Corridor that stretches from Kuala Lumpur, and the zoning of new industrial areas which has since overtaken agricultural activities. This has given rise to employment opportunities and infrastructure development, hence the rapid growth in urbanisation and industrial development.

The land use change from 1996 to 2001 is interesting to analyse due to the development of new administrative centre located at Putrajaya (formerly known as Prang Besar) and Cyber Jaya. In 1996, the agricultural activities shown decline from 176,640.00 to 164,841.00 hectares in 2001, while the shrubland showing to increase from 7,950.51 to 10,863.60 hectares and developed areas increase tremendously from 23,017.80 in 1996 to 40,639.20 hectares in 2001. The changes from agricultural to developed area will give an impact to ecology and socio-economic of the basin and Selangor as a whole.

The conversion from one land use to another type of land use give different impacts to the ecosystem. The focus of this paper is on the conversion from other type of land use to the developed area or bareland/shrubland that believed will caused the higher negative impact to the ecosystem such as mud flood, land slide, etc. Within three decades, the changes from agriculture area to developed areas were the highest changes (295,026,300 hectare) compared to the other conversions. The reasons behind this changes was the availability of the agriculture land and suitable to be developed for urban areas. The peat swamp and mangrove areas especially in Kuala Langat district also converted to the developed areas such as housing estates and industrial area. The development of the Putrajaya and Cyber Jaya in Sepang district shows the higher changes from agriculture to developed area.

Driving Forces to the Langat Basin Land Use Changes

Land use changes and trends of that change in the Langat Basin were directed and influenced by, policies and strategies legislated by Federal and State Governments. There are also other factors that influence the land use changes in the Basin such as the process of urbanization. The Federal and State governments see globalisation as a challenge to enable Malaysia competes at the global level. The Langat Basin has been chosen as one of the major areas for economic growth as well as preparing for urbanization. This is true as Kuala Lumpur International Airport, West Port, the MSC and Putrajaya are located in the Basin. These infrastructure and facilities have been developed to attract foreign investors and thereby building capacity to compete at global level in terms of trade and technology development. Land use changes in the Langat Basin is significantly influenced by policies legislated by the Federal and State Governments. The New Economic Policy and the successive Malaysian five year plans have been the key policies and with strategies and programs that drive the land use patterns in the basin.

TABLE 1:
Land use/Land cover Change in Langat Basin 1974-2001 in hectares

	1974	%	1981	%	1988	%	1991	%	1996	%	2001	%
FOREST	127831.3	43.57	121509.39	41.42	88920.96	30.32	87652.44	29.89	80571.22	27.47	70702.63	24.11
Hill Dipterocarp	46,822.6	15.96	45,966.80	15.67	46,566.30	15.88	49,097.40	16.74	47643.10	16.24	43864.10	14.96
Peat swamp	46,603.2	15.89	43,879.90	14.96	20,190.00	6.88	17,542.40	5.98	12571.90	4.29	7894.53	2.69
Lowland Dipterocarp	5,757.10	1.96	4,563.99	1.56	2,372.13	0.81	1,809.54	0.62	1514.52	0.52	1207.80	0.41
Mangrove	28,648.4	9.77	27,098.70	9.24	19,792.53	6.75	19,203.10	6.55	18841.70	6.42	17736.20	6.05
DEVELOPED AREA	7022.79	2.34	7601.49	2.53	28194.42	8.77	28510.70	8.86	30968.31	9.55	51502.80	14.94
Shrubland	5,012.82	1.71	3,930.93	1.34	6,658.92	2.27	10,312.70	3.52	7950.51	2.71	10863.60	3.70
Developed Area	2,009.97	0.69	3,670.56	1.25	21,535.50	7.34	18,198.00	6.21	23017.80	7.85	40639.20	13.86
AGRICULTURE		52.92		54.79		57.97		58.21		60.22		56.21
Agriculture	155,249	52.92	160,733.0	54.79	170,016.0	57.97	170,705.0	58.21	176640.0	60.22	164841.0	56.21
WATER										1.75		2.12
Water Bodies	3,267.27	1.11	3,496.59	1.19	6,170.13	2.10	6,401.52	2.18	5132.52	1.75	6207.12	2.12
TOTAL AREA	293370.36	100.0	293340.47	100.0	293301.51	100.0	293269.66	100.0	293312.05	100.0	293253	100.0

Source: Shaharudin et. al 2004

New Economic Policy (1970 – 1990) and the Five Year Malaysian Plans

The First Malaysia Plan was introduced in 1966 for the country's planning from 1966 to 1970. This was a continuation from the two previous Malayan Plans, which were introduced after Independence in 1957. The first three plans focused upon the administrative and financial aspects for the structuring of a newly independent country. However, after the racial riots in 1969, the government had begun to realise that economic planning was to be explicitly based on social criteria. Its emphasis was on:

'Rapid socio-economic development, in which all Malaysians have the opportunity, the right, and the responsibility to participate and share equitability and embark upon a long-term development strategy designed to meet the over-riding need for national unity' (Malaysia, 1973).

Thus, with this, the New Economic Policy (NEP) was introduced in 1970 and incorporated into the Second Malaysia Plan (RMK2) (1971 – 1975). The NEP is felt to have been the major driving force of land use changes in Malaysia (Sulong and Katiman Rostam, 1987). This policy, which was introduced in mid-1970's had two main objectives, the eradication of poverty regardless of race, and the restructuring of the Malaysian society so as to reduce the identification of employment with race and location within the context of an expanding economy (Malaysia, 1973). Therefore, the formulation and adoption of regional development was used as a strategy for national development to reduce disparities between regions. The emphasis from purely sectoral based planning in earlier plans was changed to comprehensive regional planning as a mean for economic development. This is to ensure that a balance is achieved between rural development and urban development efforts.

In Second Malaysian Plan, under NEP, Outline Perspective Plan (OPP), urban and regional planning development policies were introduced. These policies were necessary to drive development in rural and other growth centres. These decentralisation and integrated rural development began to take shape in Banting, Telok Panglima Garang, Nilai, Batu 9 and Batu 11 Cheras, Kajang and Semenyih. Agriculture activities were identified to raise income levels and to create a dynamic economic and social environment for rural areas (Malaysia, 1973). RMK2 focused on the acceleration of the expansion and modernisation of the agricultural sectors and employment opportunities, extensive land development and improvement. This can be seen through the government's efforts in establishing agricultural institutions at the state and Federal level such as FELDA, FELCRA, RRI and MARDI. This is to provide a more effective channel for marketing services, credit and research results, to farmers in order to

increase productivity and make them more commercially viable. The intensification of agricultural activities paid off as this sector provided about one half of the total employment, with 96,000 jobs and land development contributing about 65,000 jobs.

However, the Third Malaysia Plan's (RMK3) (1976–1980) regional development had played a greater role in the formation of national development. Its objectives were to redress economic and structural imbalance among the regions within the country and ensuring that regional development contributes towards the national goals for economic development. The NEP was used to accelerate rate of growth of less developed regions, exploit full potential of human and physical resources of these areas, and ensure an equitable distribution of basic services and amenities. Thus, the need to develop existing urban centres and establish new townships to achieve these objectives began. RMK 3 also emphasized on industrial development, particularly in less developed states (Malaysia 1979) and still continuing focus on agricultural development.

The decade of the 1970s and 1980s was a period of implementation of NEP. At the same time the emphasis was given to industrialization in Malaysia. The factors influencing the changes of land use and land cover are:

a) Industrial urbanisation which brought large numbers of rural youths to the urban areas, working in factory environments.
b) Increased public sector workforce opening up access to urbanisation for the rural population

The Third Malaysia Plan was a landmark in national development policy which opened up a floodgate of opportunities for rural population. Selangor state embarked on a large scale development plan attempting not only to guide but to change the path of development – that consciously included rural population in its development agenda. It was during this period that the mass urbanisation took place. For the first time job opportunities in the form of new factory employment became available. The state also increased its public services jobs, attracting number of rural population to urban fringe areas.

National Urbanisation Policy

Until today there has been no comprehensive and official policy on urbanisation *perse*. However, strategies and approaches use in order to achieve the NEP objectives, urban development can and have been considered as an urbanisation policy. This policy promotes the development growth centres that are arranged in a network of high-density urban centres, with different types of township in

terms of size and roles. To achieve these objectives, strategies have been planned and identified as follows:

a. To assure balanced urban development in term of physical development, ethnic participation and efficient resources management.

b. To enhance urbanisation process in rural areas through participation of land development scheme settlers and community in-situ in urban economic activities as well as small industrial activities.

c. To assure well planned development in existing urban growth centres, taking into account of local requirements. Structure plan for main centres and local plan for smaller growth centres have been prepared. These plans should serve as guidance for development and to enhance efficiency of development plans in urban areas.

d. To introduce the concept of urbanising the rural areas through aggregating adjacent small villages to become small towns or rural development centres, where the industries, business and commercial agriculture could be put in place.

In support of this and to assure that development of the existing towns and growth centres are well structured, the government introduced the "Structure Plan" and "Local Plan" through the Town and Country Planning Act 1976. The entire districts of the Basin's towns and the Multimedia Super Corridor (MSC) have their own structure plans and local plans.

Moreover these concepts were the basis for the physical planning stage, which were used for zoning and dividing areas for each land use category. These were supported by guidelines as follows:

i. Development Planning Report (LPP) guidelines.
ii. Housing guidelines.
iii. Commercial guidelines.
iv. Industry guidelines.
v. Hill Area Development guidelines
vi. Local Area Development Plan.

The new township strategy was adopted, as it was concomitant with the development of industrial estates to provide social and urban facilities such as housing, essential services and various amenities for industrial workers and their dependant). Areas such as the District of Hulu Langat were earmarked to

be the newly developed areas or towns. Through this strategy, the town of Kajang in Hulu Langat grew rapidly to meet the demand for urban services arising from increasing rural wealth due to the upturn in development and supported the spill over from the Klang Valley.

National Industrial Policy

Since 1970's the government has emphasized on the development and growth of industrial sector for sustaining economic growth and creating job to achieve the NEP objectives. However, these industries were export-oriented and used large number of workers. In the 1980's, the government started a program which encouraged the development of heavy industries. This was to boost the industrial development and to assure the sustainability of economic growth as well as to increase the country's capability to compete at the global level. Therefore, in 1986 The National Industrial Policy (NIP) was put in place to show the government efforts towards industrialisation. NIP enhanced the industrialisation process and helped the industrial sector becoming the main engine for Malaysian economic and national growth. The objectives of the industrial policy were:

a. To make the manufacturing industry sector as the catalyst of national industrialisation development.
b. To encourage full utilisation of national natural resources.
c. To enhance local technology research and development (R&D) as the basis to develop Malaysia as industrialised country.

To achieve these objectives strategies and plans had been identified. The Industrial Master Plan, (IMP) and IMP2 were the main documents used to drive the development of industry in Malaysia.

In terms of land use change in the Langat Basin, the industrialisation policy and its strategies focused on that enhanced existing industrial areas and developed new industrial estates in areas with the required infrastructures such as highways, roads and utilities. This strategy helped to reduce cost of development of industrial estates. Until 1997, this strategy had opened 30 industrial estates in the Langat Basin. With the modernisation of the industrial sector and the government's effort to diversify the existing industries towards developing high tech and information technology industries, more industrial estates were to be developed. The MSC was to play the major role for this industry, and it will have a significant impact to the Langat Basin in the future.

Global multinational corporations turned to the rural areas for workers resulting in commuting and firming specific urbanisation. Rural gentrification where rural population composition shifted to a higher urban based population residing in rural areas whereby;

a) Role of state and its repositioning within the context of Multi National Cooperation (MNC)
b) Reaction and response by the people – involvement and distancing
c) The macro to micro perspective
d) A study on how people negotiate space

From the information gained in the study of land use and land cover pattern changes, it is apparent that the primary driving forces are economic and socio-political development in the country that affects the Basin. While spatial sciences would place elements such as distance and accessibility, as well as agglomeration and other locational variables as crucial, the role of the government (and with it the social driving forces) cannot be downplayed. Literature in development studies have identified that the patterns of development in Southeast Asia as being led and initiated, rather than a private sector endeavour supported or approved by the state (Hoogvelt, 1977). The case in point is the development of Cyberjaya, Kuala Lumpur International Airport (KLIA) and the Federal Territory of Putrajaya. This also includes the Multimedia Super Corridor (MSC), a 15 kilometer by 50 kilometer area stretching from Putrajaya to the Kuala Lumpur city centre specifically at the KLIA in Sepang. In visiting the early parts of the MSC, Cyberjaya what is apparent is a very subdued vision of development. Single storey resort style developments belie its targeted goal. Passing through the oil palm plantation reveals a way to the digital black gold (the investors wish), the site for the headquarters of the Multimedia Development Corporation, built in less than five months depicting a resort style living. Visually, it seems to fit the surroundings, though the feeling of an amphitheatre is felt, but the clearing of the jungle is clear. There are elements of the Indonesian and the Japanese architecture and landscaping, but the suitability to the surrounding is questionable.

After the official launching of KLIA, Putrajaya and Cyberjaya, the entire MSC project took off, and is expected to create impacts unrivalled before in the Langat Basin. KLIA, the new international airport sits on a 25,000 acre parcel spanning two mukims, Labu and Sepang has created an access hub in what were previously plantations. Putrajaya, the new federal administrative centre proposed as early as 1993 on a 10, 847 acres land in Mukim Dengkil has now transformed the area into a post-modern complex of government agencies, and soon-to-be-completed housing projects.

Together with the Cyberjaya intelligent city project, these efforts are capable of turning the entire region into a new city - as was attempted in Brasilia, during a much earlier time. Being identified as the hub of computer and multimedia technology, the structure plan projected some 570,000 population for the whole Structure Plan area 250,000 are expected to be within Putrajaya, another 240,000 in the incorporated area and the remaining 80,000 on Malay reserve lands (Anon, 1995). The Structure Plan also envisioned 127,000 jobs to be generated with 76,000 from the public sector and 58,900 from the private sector. Much of this perhaps will be jobs diverting from existing areas. It is also estimated that about 116,000 units of housing will be required to house the new population. To add to this expected boom is the development of nearby Airport City at Bandar Baru Salak Tinggi, targeted not only to take over from Sepang as the District Administrative Centre but also as an urban centre with industries and new institutions.

Apart from this, the Sepang Formula 1 Circuit built four years ago, adjacent to KLIA, very much active, has had a strong impact on the environment, particularly to the land use and land cover change, and to the people in the Langat Basin. Other development projects expected to impact on the Langat Basin ecosystem include;

a) The development of the central link highway connecting Kuala Lumpur with KLIA and the KL-Seremban highway.
b) The Development of the South Kelang Valley highway
c) The proposed highway between Kuala Lumpur, Putrajaya and KLIA.
d) The development of the Express Rail Link connecting Kuala Lumpur, Putrajaya and KLIA.
e) The connecting system for the Light Rail Transit between Bukit Jalil and Putrajaya. The proposed coastal alternative route for Klang - Bukit Kemandul - Sepang - Lukut - Port Dickson - Tanjung Agas - Linggi - Melaka. The Bukit Nanas, Port Dickson waste disposal site.

The other primary driving force for land use change is the strong growth of construction industry in the early 1990s, which was linked to the urbanisation process, which up to the economic downturn of the late 80's and 90's had a major influence on driving investors to look for developable land. The Langat Basin, previously an agricultural region, provided the much needed asset. Conducive government policies and support of construction projects allowed the fast conversion of agricultural land.

Implications of Land Cover Change to the Langat Basin Ecosystem Health

The reason for looking at urban growth as an ecosystem process is that the physical environment either man-made or natural is part of the elements that make up the urban scene. The intrinsic as well as the stated definition of urbanization and development thus takes into consideration the well being, growth and 'welfare' of the environment. By making environment as part of the equation defining the advancement of urbanization, the process of urbanization itself cannot be separated from the working of the environment. In this manner, environment cannot be totally static and neither can urbanization be void of environmental concerns. There is then needs to be a redefinition of environmental and urbanization concerns. Questions are then placed on more established ideas of conservationism and preservationism. It will also develop new challenges for ideas of environmental ethics which in the Malaysian case may differ from current Western ideas. Within the context of urban growth as an ecosystem process, one can then evaluate the imbalance within the system, and prepare plans for future sustainable urbanization.

Among the more evident problems created by unbalanced rapid urban growth which will have impacts on the quality of urban life and ecosystem are:

- Proliferation of squatter settlements
- Housing and sanitation
- Traffic congestion
- Environment quality
- Unemployment and underemployment
- Social and moral crisis; the rise of counter-culture
- Urban without urban
- Poverty and marginal groups

The relationship between man and nature for the past thousands years has created and impacted on the society itself. The stresses that exist as a product from the relationship can be shown by multidimensional evident such as flood, mud flood, landslide, criminal cases, drugs, and vector-borne disease such as dengue, cholera, asthma cases and others. In the Langat Basin, the evidents are taken as manifestation of the stress that is experienced by the society. The vector-bourne diseases were found at Hulu Langat district (Shaharudin Idrus et. al, 2000); the asthma cases in places closed to the Klang Valley (Shaharudin and Mazrura, 2000). All showing the consequences of the land use changes in the basin.

With regards to the above issues which emanate from urban growth, priority on policies on urban management should be given due consideration with particular emphasis on housing, traffic congestion, environmental quality (water, air and noise), and local participation in managing the urbanization process. Certainly all these negativities are problematic. But the urban areas in the basin can still sustain themselves. More people are attracted to come and stay to earn their living. From this point of view, the ecosystem health of the basin is still in good shape, well above the tolerant level of the urbanites. In short, from basin life sustenance view, the basin is healthy.

CONCLUSION

The changes of urban land use in Langat Basin for the past four decades shows the conversion from other type of land use to the urban land use which cannot be converted to the original land use in turn. The changes have generated much negativity to the people in the basin. Yet those negativities should not be interpreted as a downward trend to the basin ecosystem health. In sum, the basin is still attractive to industries, allied activities and people. At any time, one sector may be under stress but at other times it may revert to its former stature following ameliorative action of the administrative action. The ecosystem health concept is a useful integrating concept to bring together man, culture and the environment.

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APPLICATION OF LAND USE APPROACHES IN CONTROLLING INDUSTRIAL WASTEWATER DISCHARGE INTO RIVERS

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Abstract

In Malaysia, water pollution is one of the major environmental problems facing the society at present, especially river water pollution. Despite their importance, especially as supply of water for consumption, rivers are continually being polluted by human. One of the main contributors to river water pollution in Malaysia is effluent (wastewater) discharge from industries. At present many of the measures exercised by various government agencies to control industry-related river water pollution centre on the use of non-land use approaches such as enforcement of legislation and use of technology. However, the use of non-land use approaches is not without its own shortcomings. Hence, this paper aims to provide some insights into the possibility of using land use approaches to achieve the same result, which is controlling industry-related river water pollution.

Keywords: Land use Approaches, Water Quality, River Pollution.

INTRODUCTION

Water is a precious environmental resource. To sustain life, living organism requires water. In fact, human would survive longer without food than without water. The major issues related to the use of water by humans are water quantity and quality. Water in quantities is necessary for the support of modern societies, but water of good quality is needed to allow for its consumption by the same societies. In Malaysia, water pollution is one of the major environmental problems, especially river water pollution. Rivers have always been the focus of growth and progress of societies in Malaysia, historically and presently. Rivers, like the Malacca River, Klang River, Muar River, had played a major role in the growth of important towns and cities in the past. Malacca River was the busiest trading zone during the Sultanate era, Klang River was the origin of Kuala Lumpur, the capitol city of Malaysia, and Muar River gave rise to Bandar Maharani (later Muar), former capitol of Johor. More recently, Putrajaya, the country fabulous federal administration centre, has also been developed with

river as its focus. Rivers are also the main source of water supply for consumption in Malaysia. Presently, there are close to 350 (Legal Research Board, 1992), if not more, potable water intakes all over the country, pumping in river water for processing and supplying clean water for consumption to more than 20 million of the population.

Malaysian River Water Quality

Despite their importance, rivers are continually being polluted by human. In Malaysia, Department of Environment (DOE) reports that prior to 1999, river water quality in the country is degrading steadily over the previous few years with the number of effluent-related pollution of river water remains high (DOE, 1999). However, monitoring results for the year 2001 have shown improvements in terms of Malaysian river water quality (DOE, 2001). DOE has conducted river water quality monitoring since 1978. The main objective of the exercise is to establish the status of water quality, to detect water quality changes and to identify sources of pollution (DOE, 2001). In 2001, out of the 120 river basins monitored, 60 basins (50%) have been identified as clean, 47 (39%) slightly polluted, and 13 (11%) polluted (refer Figure 1). Similar monitoring in the previous year indicates that 34 river basins were clean, 74 slightly polluted, and 12 polluted (DOE, 2001). Comparing the results of both years, it seems like there has been a marked improvement in water quality of those river basins, especially in terms of the increase in the number of clean river basins and the reduction in the number of slightly polluted river basins. However, one may argue that the improvement may not be that significant since the considerable increase in the number of clean river basins was largely attributed by '*...the fact that the 26 river basins that became clean (WQI > 81) were already* ***marginally*** *in the slightly polluted category (WQI 76-80) over the past several years.*'(DOE, 2001, p.33). By the same token, one may argue that the number of polluted river basins actually increased from 12 basins in year 2000 to 13 in year 2003.

Sources of Malaysian River Water Pollution

In terms of Malaysian river water pollution, the main sources are from sewage, industries, and earthworks and land clearing (DOE, 2001). Figure 2 below shows that 33% of the river basins were polluted by suspended solids resulting from land clearing and earthworks activities, 20% polluted by ammoniacal nitrogen from sewage that included livestock farming and domestic sewage, and 18% polluted by biochemical oxygen demand from sewage, and agro-based and manufacturing industries.

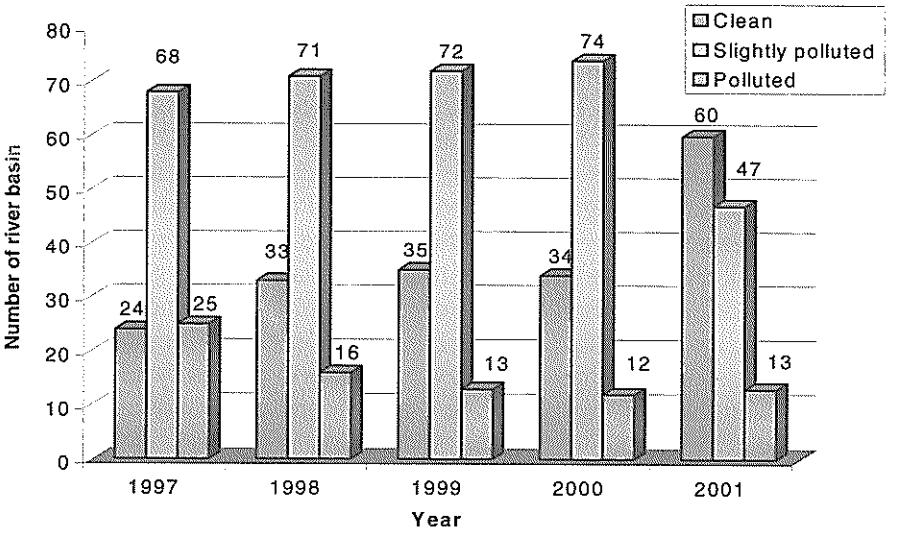

FIGURE 1: Water Quality of Malaysian River Basins, 1997-2001
Source: Adapted from DOE, 2001

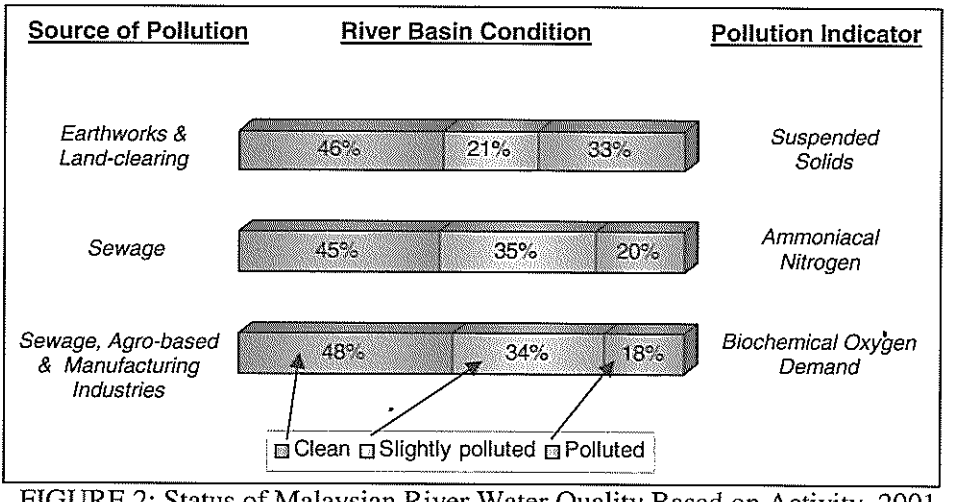

FIGURE 2: Status of Malaysian River Water Quality Based on Activity, 2001
Source: Adapted from DOE, 2001

SCOPE OF THE STUDY

Earlier discussion has identified several sources of river water pollution in Malaysia. Industrial activity has also been identified as among the biggest contributors to the problem. Figure 2 earlier indicates that in 2001, 52% of Malaysian river basins were polluted by biochemical oxygen demand from activities related to sewage, agro-based industries and manufacturing industries. The general consensus is prevention is better than cure. Thus, in order to control river water pollution resulting from industrial wastewater discharge, obviously, the best thing to do is to control the source of the pollution. Hence, this paper focuses its discussions on using land use approaches in controlling the problem of industrial wastewater discharge into rivers. It is also necessary to note here that all discussions within this paper are purely based on Malaysian context, unless specified otherwise.

Method of Study

A questionnaire survey was conducted on selected sample consisting of built environment professionals who have experiences in town planning related works. These can be in the form of development plan study, physical plan preparation and environmental planning and management. Altogether, a total of 67 samples were selected for the purpose of this study. Out of the 67 respondents, 28 were those working in the field of town planning, 19 in environment, 12 in design and 8 in engineering. Those working in design are basically architects or landscape architects. Due to unavoidable constraints, sample selection has been limited to Klang Valley only. Data collected through the survey was later coded and keyed in into statistical computer software - SPSS 10.0 for Windows. Analyses on the data were also carried out using the same software.

NON-LANDUSE APPROACHES IN CONTROLLING INDUSTRIAL WASTEWATER DISCHARGE INTO RIVERS

Presently, non-land use approaches have found widespread application in efforts to mitigate the problem of industrial wastewater discharge into rivers. The main benefit of this type of approaches is that their implementation is direct, site-specific, and straightforward. This chapter will briefly look at three of the non-land use approaches commonly adopted – namely legislative approach, end-of-pipe approach, and pollution reduction approach.

Legislative Approach

Rules and regulations are possibly the most widely used measure in mitigating pollution resulting from industrial wastewater discharge. The amount and composition of pollutants in wastewater discharge is subjected to limits as stipulated by regulations. In Malaysia, the Third Schedule of the Environmental Quality (Sewage & Industrial Effluents) Regulations, 1979 (a subsidiary legislation to the Environmental Quality Act (Amendment), 1974) specifies the parameter limits of industrial wastewater discharge. The limits are categorised into two – Standard A and Standard B. Standard A is applicable to wastewater discharge upstream of potable water intake, while Standard B is for downstream discharge (Legal Research Board, 1992). The regulation is being widely imposed throughout the country and helps to reduce river water pollution resulting from industrial wastewater discharge.

End-of-pipe Approach

Apart from rules and regulations, end-of-pipe solution is also commonly adopted in controlling industrial wastewater discharge. End-of-pipe solution refers to the treatment of wastewater prior to discharge where wastewater is being treated using either physical processes, chemical processes, biological processes or combination of the three, in order to reduce the amount of pollutants in the wastewater. The use of suitable and proper treatment processes enable industries to achieve compliance with the regulation requirements in terms of wastewater discharge.

Pollution Reduction Approach

Pollution reduction refers to measures adopted in order to reduce pollution through several techniques as listed below.

i. Reduce the amount of pollutants resulting from the production processes such as by replacing hazardous input material with non-hazardous one, or changing the output composition. Replacing paint coating of the final product with longer lasting plastic coating is one of the many examples where changes in product composition can help to reduce pollution.
ii. Reduce the volume of wastewater through employing good management practices. For example, the practice of minimising the amount of water use for household tasks (such as cleaning of equipment and machinery) means less wastewater generated.

Reduce the volume of wastewater that need to be collected and treated through recycling and reuse of the wastewater. One of the common

iii. Practices among industries are to reuse wastewater in production process and also to use wastewater for other purposes in treatment process. For instance, acidic wastewater from one industry can be collected and transported to another industry with alkaline wastewater for neutralisation purposes.

Weaknesses of Non-Land use Approaches

There are several inherent weaknesses of the legislative approach which might affect its effectiveness in mitigating river water pollution resulting from industrial wastewater discharge. A case in point would be the comprehensiveness, or lack of it, of the Third Schedule of the Environmental Quality (Sewage& Industrial Effluents) Regulations, 1979. The list of parameter limits of the Third Schedule is not comprehensive and excludes parameters such as herbicides, pesticides, nitrate nitrogen, radioactive material, and total organic carbon.

Another main weakness of the legislative approach lies in its enforcement. Level of ground enforcement is questionable due to lack of manpower. The management and enforcement of the regulation fall under the responsibility of DOE. However, with a mere workforce of 586 for the whole of Peninsular Malaysia (DOE, 1998), it is arguable that DOE is capable to carry out effective enforcement of the regulations in order to curtail non-compliance discharges.

End-of-pipe approach relies heavily on technological capability to treat wastewater, and consequently, reduce its pollutants loading. The same can be said with regard to pollution reduction approach. The technology to treat wastewater, unfortunately, does not come cheap. Its installation, operation, and maintenance generally require hefty investments from the industries, and accordingly, a burden to small and medium scale industries. As a result, many of these industries opted not install wastewater treatment system and rather discharge their wastewater untreated.

Survey Findings

Based on the survey, it was found that all respondents agreed that river water pollution resulting from industrial wastewater discharge is a major problem. Additionally, many of them (80.6%) believe that the existing regulation is ineffective in controlling the problem. Only 13.4% said otherwise, but quoting

poor regulation enforcement as the reason for the problem. 6.0% of the respondents gave no answer since they were not aware that there is such regulation that control industrial wastewater discharge into rivers.

LAND USE APPROACHES IN CONTROLLING INDUSTRIAL WASTEWATER DISCHARGE INTO RIVERS

Earlier discussion has highlighted that, despite their ability to mitigate river water pollution resulting from industrial wastewater discharge, the non-land use approaches have their own shortcomings, and this was reflected in the high percentage of polluted and slightly polluted river basins by industrial effluent-related pollutant (refer Figure 2). Seemingly, more has to be done in order to mitigate river water pollution resulting from industrial wastewater discharge.

Due to the imperfection of the commonly adopted non-land use approaches, it is worth to consider how land use approaches can assist in mitigating river water pollution resulting from industrial wastewater discharge. The advantages of such strategy are that, besides being reactive and proactive in nature, it also represents a multi-pronged solution to the problem. The development of river reserve, for instance, does not only help to mitigate river water pollution, but also beautify the area and enable its use for other purposes such as recreational.

The following part of this paper will briefly discuss three of the many land use approaches that have the most potential in mitigating river water pollution resulting from industrial wastewater discharge. These approaches are development of river reserve, development of river corridor, and development of planned industrial area.

Development of River Reserve

From Malaysian context, river reserve can be defined as strips of land on both side of the river banks which have been gazetted by State Authority for the purpose of river reserve under the Section 62 of the National Land Code 1965 (Act 56). By being gazetted as reserve, understandably, the land belongs to the State and for public purposes. The minimum width of river reserve recommended by the Department of Irrigation and Drainage Malaysia (DID) is as in Table 1 below. Figure 3 provides a cross-section of a typical recommended river reserve.

TABLE 1:
Minimum Width Requirement of River Reserve

Width of water channel	**Minimum reserve requirement (m)**
> 40 metres	50 metres
20 – 40 metres	40 metres
10 – 20 metres	20 metres
5 – 10 metres	10 metres
< 5 metres	5 metres

Source: DID, undated.

Application

The designation of river reserve is multi-purpose, including serving as buffer for river erosion, acting as flood plain, providing access for river maintenance, and allowing for Future River widening and straightening works. However, the interest of this paper is solely on its use for river beautification and recreation. Presently, only a handful of river reserves have been developed by DID, State Authorities, or local authorities for such purposes. As a result, most river reserves are being left idle, unattended and unfriendly to any recreational use by the public. Without public attendance along river reserves, industries are relatively unfettered in discharging murky wastewater, which does not comply with regulation standards, into rivers. To the authorities, monitoring non-compliance industrial wastewater discharge is also difficult because the only way to monitor is through river patrol. However, dense shrubs and undergrowth, which covered the unattended river reserves, can easily conceal industries' discharge conduits.

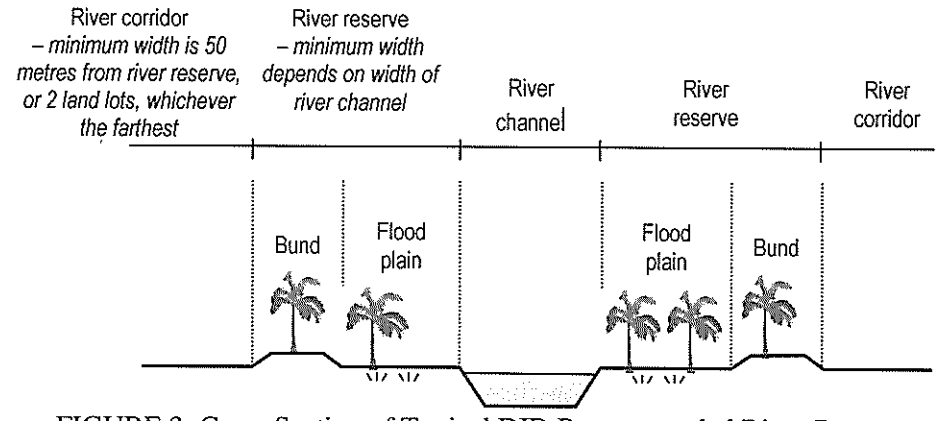

FIGURE 3: Cross Section of Typical DID Recommended River Reserve
Source: Adapted from DID, undated

Development of river reserves for recreational activities can attract the public into the area. While no permanent building is allowed, recreational facilities such as sports fields and courts, children playgrounds, jogging paths, and cycling paths, can be developed within river reserves for public use. This approach, apart from beautifies rivers and provides recreational areas for the public, also exposes any activity of industries illegally discharging non-compliance wastewater into rivers. Since more people are using river reserves, any murky and polluted industrial wastewater discharge can be easily spotted by the users, who, in turn, would complain to the authorities or the media. Acting on complaints by the public and reports by the media, the authorities could then easily locate the source of the pollution and enforce appropriate penalty on the polluters.

Weaknesses

As aforementioned, development of river reserves not only beautify rivers and provide recreational areas for the public, but it also help to control river pollution resulting from industrial wastewater discharge. This measure relies on the public to notify authorities or media upon spotting industrial discharges that they think may not comply with the regulation standards. This is easy enough if the pollutants loading of the discharge are represented by the colour of the discharge. For example, wastewater with high oil and grease loading would produce a blackish discharge, and therefore easily identified. However, many other pollutants loading in wastewater is not represented by the colour of the discharge. Wastewater which is highly polluted with certain heavy metals, for instance, can still have a clear discharge. The same goes to wastewater with

high temperature. Although toxic or hazardous, this wastewater is still clear in appearance and, to the public, it might not be a cause of concern.

Survey Findings

In terms of application, 77.6% of respondents replied that they have used river reserve development approach in their previous work, and out of this, 75% of the respondents have experience using the approach specifically to control the problem of industrial wastewater discharge into rivers. A high number (76.1%) of respondents also perceived this approach as being effective in controlling the problem, with only 22.4% of respondents replied otherwise. 1.5% did not answer. Despite its perceived effectiveness and widespread used among the respondents, more than half (55.2%) of the respondents replied that the approach is difficult to implement. 38.8% replied that it is quite difficult to implement the approach, 11.9% very difficult, and 4.5% impossible to implement. Nevertheless, 70.1% respondents expressed their interest to use, or continue using, the approach in the future for the purpose of controlling the problem of industrial wastewater discharge into rivers.

Development of River Corridor

DID identifies river corridor as areas outside river reserves, but within fifty metres or two land lots, whichever the farthest, from river reserve (Figure 3). In utilising the concept of river corridor to control industrial wastewater discharge into rivers, there are two approaches that can be adopted by local planning authorities – to restrict or prohibit industrial activities within river corridor, or to provide incentives to attract non-industrial development within river corridor. Although both approaches lead to the same result, the implementation of one is markedly different from the other. The former is stick and the latter is carrot.

Application

Development of river corridor in controlling industrial wastewater discharge into rivers relies on the exploitation of planning approval mechanism in the planning system. To illustrate, say, a local authority, in efforts to protect a river from being polluted by industrial wastewater discharges, embarks on a policy of industry-free river corridor. Implementing this policy would mean no planning permission would be granted by the local authority to any application for industrial development within the river corridor. At the same time, existing industries operating within the river corridor would also be denied to renew

their operating licence, and therefore, have to operate somewhere else, outside of the river corridor.

On the other hand, instead of applying outright prohibition on industrial activities within the river corridor, the local authority could instead opted for a softer approach. The local authority may decide to provide incentives to attract development, other than industrial, into the river corridor. For example, a higher plot ratio or a bigger plinth area will be allowed for non-industrial development within the river corridor, or planning application for such development will be subjected to a fast approval process at discounted planning fees. Apart from the incentives, the local authority may also decide to increase the fees for licence renewal for existing industries operating within the river corridor. The incentives provided by the local authority, coupled with the increase in licence renewal fees, would make it more profitable to developers/land owners to develop their land within the river corridor, including existing industrial premises, with non-industrial development.

Weaknesses

The softer, or carrot, approach of providing incentives to non-industrial development within river corridor does not guarantee an industrial-free river corridor, especially when it involves existing industries. This approach is more effective in attracting non-industrial development into the river corridor but might not be able to influence existing industries to relocate their operations to other areas outside of the corridor. In reality, the decision for an industry to relocate its operation is not solely governed by the amount of licence renewal fees or profitability of developing the premise with non-industrial development. Various other factors, like availability of workers, easy accessibility for material and product transportation, and economies of scale, also play an important role in any relocation decision.

The stick approach, on the other hand, seems to be able to guarantee an industrial-free river corridor. However, the rigid nature of the approach is usually not favoured by the local politicians since it will reduce their popularity. Fierce lobbying by industry owners might also help to influence local politicians to not adopt such an approach.

Another aspect, which has to be looked into, is the minimum width requirement for river corridor. The existing minimum width requirement of fifty metres or two land lots from river reserve is rather small. It is still possible for an industry operating, say, one hundred metre (width of river corridor plus maximum width

of river reserve) away from river to channel its wastewater direct into the river via underground pipe or even open conduit. The minimum distance of river corridor should ensure that it is impossible or very costly for industry operating immediately outside of river corridor to discharge wastewater direct into the river. Additionally, the minimum river corridor width must also ensure that any seepage from industry does not reach the river before it being diluted or neutralised.

Survey Findings

Most of the respondents (68.7%) agreed that it is difficult to implement river corridor development approach in controlling the problem of industrial wastewater discharge into rivers. This is reflected in the low number (52.2%) of those who replied that they had used the approach in their previous work. Nevertheless, whenever this approach was used, most of them (82%) have been for the purpose of controlling problem of industrial discharge into rivers. The low number of its use may also be because of this approach is relatively new in the field of environmental management as compared to, say, development of river reserve approach. In fact, many of the respondents requested further elaboration on what this approach is all about and how it works. Despite being relatively new, a high number (73.1%) of respondents (after provided with brief explanation on how the approach works) perceived this approach as effective in controlling the problem of industrial wastewater discharge into rivers. Only 25.4% of respondents replied otherwise, and 1.5% did not answer. A chi-square analysis also indicates that there is no significance between the variables of having experience in using this approach in previous work and the perceived effectiveness of the approach. This is reflected in the high number (68.7%) of respondents whom expressed their interest to use, or continue using, the approach in controlling the problem in the future.

Development of Planned Industrial Area

Development of planned industrial area revolves around locating industrial activities in purposely-planned locations, and favourably away from high-density areas (such as urban and residential areas). In Malaysia, apart from providing premises for new industries, development of planned industrial area is also used by local authorities as a mean to provide premises in industry relocation exercise. It has been a popular solution to problems like urban congestion caused by heavy vehicle transporting input material to, and product from, industrial premises; noise and air pollution within residential and

commercial area as a result of industrial activities; and water pollution as a result of industrial wastewater discharges.

Application

Locating industrial activities away from rivers can significantly help to reduce river pollution resulting from industrial wastewater discharge. In implementing this approach, a site, away from rivers and high-density areas would be designated as a planned industrial area by the local authority. Basic infrastructure such as road, drainage, water supply, and electricity supply would be provided in the area. To ensure economy of scale, the type of industries to be developed in a planned industrial area may be restricted, but the scale of the industries varies. To illustrate, say, a planned industrial area is restricted to automotive industries. In such industrial areas, there would normally be a few anchor industries developed, with the rest acting as supporting industries. The anchor industries would be involved in the production of engine, chassis moulding, and vehicle assembly. The supporting industries, on the other hand, would be involved in making components to be supplied to the anchor industries.

Another approach to development of a planned industrial area would be to restrict the scale of industries within the area. A popular approach in Malaysia is to develop a planned industrial area which is restricted to small and medium scale industries. The argument for such an approach is that the small and medium scale industries are among the main contributors to water pollution. Operating at the lower end of the scale, it is argued that these industries could not afford to install the hi-tech and expensive wastewater treatment system. As a result, many of these industries discharge their wastewater untreated. The economy of scale achieved by locating them all in one place would enable a centrally operated treatment system to be installed in the area to treat the industries wastewater. The cost of installing and maintaining the central wastewater treatment system could be shared among them.

Weaknesses

As mentioned previously, the development of a planned industrial area can be used in relocating existing industries away from the riverside in order to protect the river from industrial wastewater discharge. Nevertheless, this approach is not free from problems. Perhaps the most prevalent one is the unwillingness of existing industries to relocate their operations into the planned industrial area.

In a highly urbanised area, the local authority might also face with the problem of finding suitable site to be developed as planned industrial area. Locating such development close to urban area would usually invite strong protest from the surrounding population, while remote location would reduce its attractiveness to the industries.

Survey Findings

A high number (73.1%) of respondents replied that they have experience using the development of planned industrial area approach in their previous work. Out of this, 98.0% have been for the purpose of controlling the problem of industrial wastewater discharge into rivers. In terms of effectiveness, 94.0% of respondents perceived the approach as being effective in controlling the problem. Only 4.5% of respondents replied otherwise, and 1.5% did not answer. In terms of implementation, the general perception is that the approach is relatively difficult to implement, with only 46.3% of respondents replied otherwise. 34.3% perceived the approach as quite difficult to implement, 17.9% very difficult, and 1.5% impossible to implement, with many quoted that finding suitable location as one of the main difficulties in implementing this approach. Despite the perceived difficulties of its implementation, still 92.5% of the respondents expressed their interest to use, or continue using the approach in the future.

CONCLUSION

This study has been helpful in understanding the perception among the built environment professionals involved in the survey on the application of non-land use, as well as land use, approaches in controlling river water pollution resulting from industrial wastewater discharge. The main findings of the study can be summarised as below.

i. All of the surveyed professionals agreed that river water pollution resulting from industrial wastewater discharge is a major problem.
ii. A high number of the surveyed professionals perceived that the regulation is not effective in controlling the problem of industrial wastewater discharge into rivers.
iii. A high number of the surveyed professionals perceived that the land use approaches identified in this study as effective measures in controlling the problem of industrial wastewater discharge into rivers.
iv. A high number of the surveyed professionals perceived that these land use approaches are difficult to implement.

v. A high number of the surveyed professionals are interested in using, or will continue using, these land use approaches in controlling the problem of industrial wastewater discharge into rivers.

In conclusion, it has to be noted here that the aim of this study is not to determine which approach (land use or non-land use) is the best in controlling the problem of industrial wastewater discharge into rivers. Instead, it is to introduce several of the approaches that can be, and have been, used in controlling the problem, and to suggest that there may be a need for employing these various approaches in a more strategic way in controlling the problem. As can be seen from earlier discussion, no one approach is not without its weakness, but all of them posses different strengths that can help in controlling the problem. Therefore, the way forward would be to exploit the strength of the approaches and at the same time to overcome their weakness. With all the approaches being employed strategically, their impacts in controlling the problem would be monumental. Among the various approaches that can be applied in controlling the problem of industrial wastewater discharge into rivers are the land use approaches. As can be seen from the findings of this study, incorporating land use approaches in controlling the problem of industrial wastewater discharge into rivers can be beneficial. The perceived effectiveness of the approaches makes them popular among the professionals surveyed. Furthermore, the need to incorporate these approaches in controlling the problem is even more pressing with the regulation being perceived as ineffective. In addition, a high number of respondents also expressed interest to use, or continue using, the land use approaches in the future despite the general perception that implementation of the approaches is difficult. In the case of river corridor development approach, apart from being perceived to be difficult to implement, it is also relatively new to many of the respondents. Nevertheless, many of them perceived it as being effective and many are interested to use, or continue using, the approach in the future. This may be due to the increase in awareness among the respondents that a more strategic approach is required in controlling the problem of industrial wastewater discharge into rivers. Relying on one approach may not be effective in controlling the problem. But strategic combination of various approaches might be able to bring about better results.

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