

Green Development through Built Form and Knowledge Community Environment in the Science City: A Lesson based on the Case Study of Cyberjaya, Malaysia and Tsukuba Science City, Japan

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ABSTRACT

This paper explains a way and lesson for green development through built form and knowledge community environment in the science city. A science city is known as a place for research and development activities, a science city involves the creation of new settlements, businesses, recreations, institutions, and cultural activities. This paper addresses place making, built form studies and a knowledge community planning. In addition, this paper emphasizes the comparative physical development between Cyberjaya, Malaysia and Tsukuba Science City, Japan describes how people perceive with their living and working environment. The result shows how sustainable development concept and design approach can be applied through the science city experience. The findings suggested some criteria of physical development such as green setting, built form, place making, and community environment.

1. INTRODUCTION

Green development is always associated with ecological concerns, energy efficiency, clean environment, low impact development and smart community. Recently, many countries have developed their own science city. The importance of place making has become a main consideration in developing a science city. The aim of this paper is to define the significance of physical planning and design development in the science city. This paper describes physical characters in science cities development from theoretical aspects and the case study of Cyberjaya in Malaysia and Tsukuba Science City in Japan. The main purpose of this paper is to illustrate the importance of physical settings and the place making in the science city development. In addition, the author conducted a questionnaire survey targeted the public opinions on the physical

setting in the science city and sense of memorable. A science city is referring to an urban property development which precisely aims to provide an amenable physical place for the commercialization of new ideas and knowledge resulting from research and development activities occurred within an urban context (Phillips and Yeung (2003). Science city models were based in extensive locations with high tech infrastructures, high tech industrial location and knowledge community environment. In these models the city offers spaces and infrastructures that would favor highly innovative activities as well as research and development.

2. RESEARCH METHODOLOGY

The approach of this study is based on exploratory and descriptive research. This study includes the existence of spatial elements that generate physical form in the science city based on the theory and background of science cities. In addition, two case studies were examined in this research, Cyberjaya in Malaysia and Tsukuba Science City in Japan. Case studies were selected in this research because it is a preferred strategy to explore a real situation of science cities in terms of their physical planning and design development. The survey investigates community environment in Cyberjaya and Tsukuba Science City about the relationship between physical environment and user needs. Participants were a random representative sample of science city's community. There are two sessions of questionnaire survey, firstly, the questionnaire about planning and design assessment of the science city and secondly, the questionnaire survey about sense of memorable of the place as well as a distinctive image. In the sense of memorable survey, the study examines physical qualities which relate to the attributes of identity and structure in the mental image by respondents.

3. CASE STUDY OF CYBERJAYA, MALAYSIA

Cyberjaya is the nucleus of the Malaysia Multimedia Super Corridor (MSC-Malaysia). The city is designed to equip businesses and corporations located with the latest Information Communications Technology (ICT). Cyberjaya is located approximately 50 kilometers from Kuala Lumpur, 10 kilometers from Kuala Lumpur International Airport and 5 kilometers from Putrajaya (Fig.1). It aims to be an "intelligent city" concerned to develop Malaysia's multimedia industry which complement to Putrajaya, a new federal government territory. In 2008, population in Cyberjaya for day-time consists of 37,000 people and for night-time 13,000 people. Total land development of Cyberjaya is approximately 2890 hectares. Land use planning in Cyberjaya can be divided into seven categories: residential (28.3%), enterprise (13.5%), commercial (4.2%), institutional (10.2%), mixed zone (3.8%), open spaces (5.8%), and infrastructure (34.2%). The land use distribution indicates two major developments in Cyberjaya consisting of residential zone and enterprise zone (Federal Department of Town and Country Planning, 2000). There are two main groups living and working in Cyberjaya: students and workers. The population rate in Cyberjaya is increasing from year 2007 (16,400 people) to year 2008 (18,700 people). Currently, there are many projects in Cyberjaya still under construction such as more office blocks, entertainments, enterprise and commercial blocks (Fig.1).

3.1 Physical Development of Cyberjaya

The concept of balanced, harmonious relationship between 'Man and Nature' can be recognized from Landscape Master Plan for Cyberjaya. (Federal Town and Planning Department, 2000) Thirty percent of the entire Cyberjaya project is allocated for greenery and open spaces (Setia Haruman Sdn. Bhd., 2007). The City's 'Nature Zone' was described in terms of a therapeutic communion with nature. Thirty percent of each development is reserved plot for green spaces. Green areas in the master plan are classified into five categories: green areas, parks, buffer zones, retention ponds and sewerage systems. Urban blocks and plots at enterprise zone in Cyberjaya provide varieties of open spaces such as green at perimeter of plots, courtyards, islands, corridors and parking spaces (Fig.2). Most of the urban blocks at enterprise zone are multi massing, curvilinear circulation pattern and flexible interior spaces. Green spaces in Cyberjaya allowed building expansion for future changes. Replanting program has been applied to restore a natural character of the site (Fig.3). For example, replanting program for oil palm and other plant species has implemented at the site.

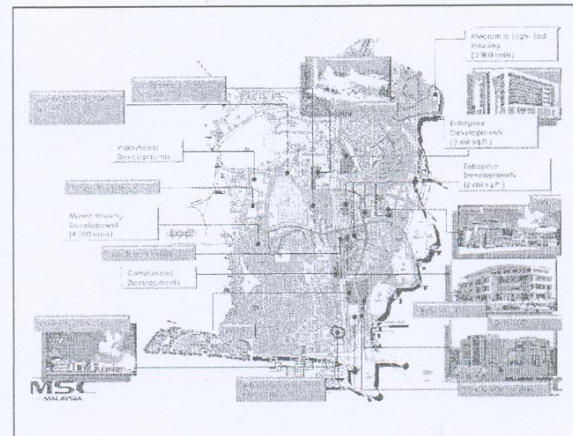


Fig.1 Overall development of Cyberjaya

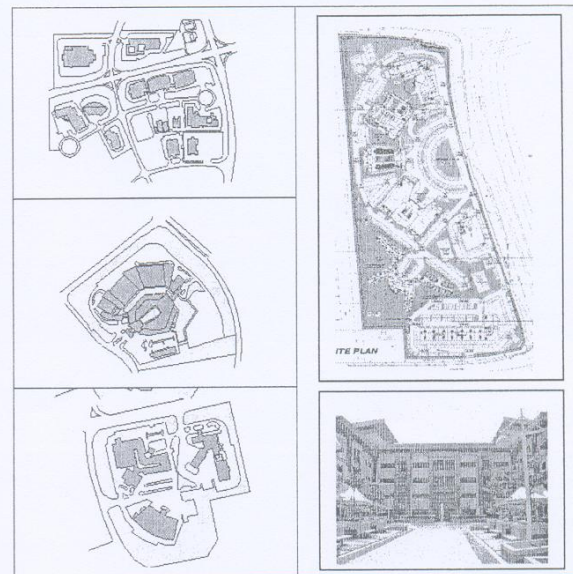


Fig. 2 Green approaches in physical environment of Cyberjaya: various types of open spaces



Fig.3 Replanting program to restore the existing landscape character

To achieve sustainable development, physical planning and design in Cyberjaya concerns on the desire to create a high quality of physical environment, protection of ecology, energy efficiency, smart infrastructure and healthy community.

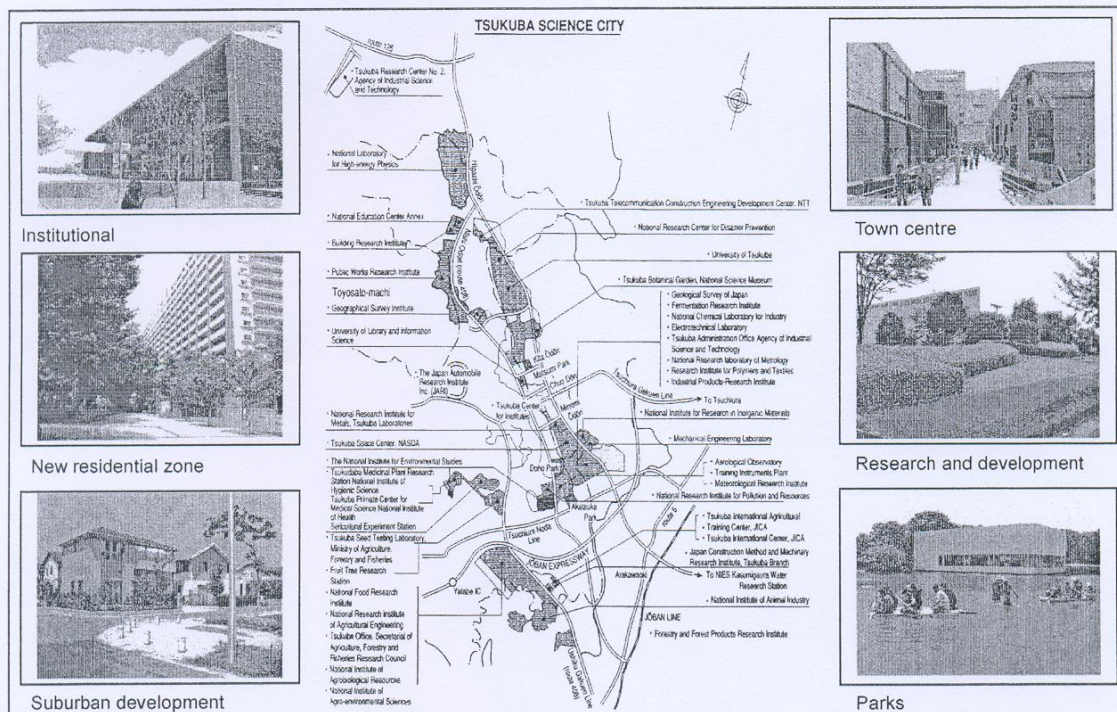


Fig.4 Tsukuba Science City and the built form: town centre, research and development district, institutional, parks and new residential areas

4. CASE STUDY of TSUKUBA SCIENCE CITY

Tsukuba Science City is the Japan's biggest national project undertaken in 1963. It has two purposes: to meet the need for high level R&D and improve higher education and to cope with overcrowded conditions in the Tokyo district. Under the Basic Plan for Science and Technology, Tsukuba Science City is outlined to be the core city to promote science and technology. The Basic Plan for Science and Technology promotes an active research exchange and joint study between public research and educational institutes and private research institutes. In addition transportation network such as Tsukuba Express connect Tokyo metropolitan to Tsukuba Science City and other new suburban areas. There are three major land uses in Tsukuba city planning: city centre zone (21%); residential zone (25%); and research and educational zone (54%). As an Eco-Life Model City, There are 6 types of spatial districts in Tsukuba Science City: collective government and public facilities, new urban residential area development project, land readjustment project, park project, suburban district and industrial parks. The distribution of zoning and land use patterns in Tsukuba Science City indicates the large proportion of research and education zone to enforce R&D activities (Urban renaissance Agency, 2007) (Fig.4).

For the population, in year 2008, day-time population in Tsukuba Science City is about 208,000 people and night-time is about 186,000 people (Tsukuba Science City Information, 2007). Fig.5 describes the daytime and night-time population from year 1985 to 2006. This figure describes that people in Tsukuba Science City are enjoying spend their time for working and living in Tsukuba Science City.

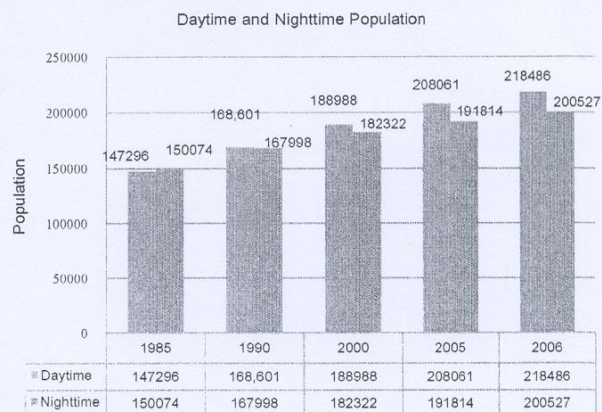


Fig. 5 Daytime and night-time population in Tsukuba Science City from 1985 to 2006

Source: Tsukuba Science City, Statistic Record 2007

4.1 Tsukuba Science City Built Form

Most of the buildings in Tsukuba City Centre are incorporated with 30% to 40% of green spaces and are linked with pedestrian connections and streets. The pedestrian and cycling lanes extend for a total of 48km throughout the city. This provides a good accessibility, legibility and permeability in Tsukuba City Centre. Another feature that characterizes the green spaces in Tsukuba Science City is a spinal greenway running across the length of the city. The spinal greenway runs into the city centre through urban zone and urban corridor links town centre and other districts. Hence, the pedestrian mall connects public spaces such as parks and squares, malls, Tsukuba Science and Technology Museum.

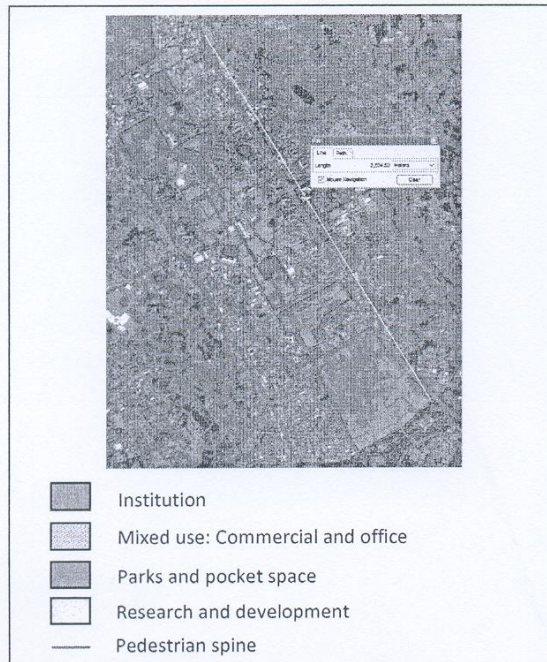


Fig.6 Green spinal across Tsukuba City Centre

Fig.6 indicates urban trails at Tsukuba City Centre recorded by Global Positioning System (GPS). The trail links various public spaces and urban components at Tsukuba City Centre. The 5 kilometers walkway across the Tsukuba City Centre creates a vibrant pedestrian and cycling movement and it is also functioned as a green corridor for natural zone. This spine creates city's central axis as well. In order to provide a creative environment, there are many urban decorations elements were located along the pedestrian ways such as sculptures, information signage, waterscapes, benches, lightings, soft landscapes such as trees and shrubs, etc. Series of pocket spaces such as small neighborhood parks and children playground areas become transition points and small nodes along the pedestrian networks.

5. COMPARATIVE QUESTIONNAIRE SURVEY, CYBERJAYA and TSUKUBA SCIENCE CITY

The research conducts a questionnaire survey on physical development in Cyberjaya and Tsukuba Science City. In Cyberjaya, questionnaires were distributed through walking interviews. Hundred forty eight respondents were interviewed. However in Tsukuba Science City, questionnaires were distributed through mail survey. The questionnaire was distributed randomly in the early June 2008 at the several districts including residential, commercial, offices, and other public areas. The questionnaire was placed inside the respondent's mailbox. In the first attempt, based on a hundred of set of questionnaires were distributed and we received 20% of responses by end of June 2008. The second attempt, we distributed on the early September 2008 with another hundred set of questionnaires and received 23% of responses by end of the month. The total numbers of responses in Tsukuba Science City are 43 of respondents. In this survey, public were asked to evaluate their satisfaction on physical environment of the park.

5.1 Questionnaire on Attractive of Physical Elements to provide a Favorable Environment in the Park

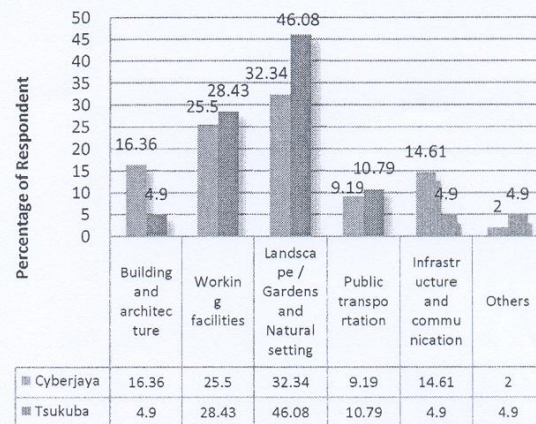


Fig.7. Comparative results between Cyberjaya and Tsukuba Science City based on respondents' opinion attractive physical elements in the park

Respondents were asked to select among six categories which reflected their opinions on physical elements providing a favorable environment to the park (Fig.7). The options given were:

- Building and architecture
- Working facilities
- Landscape, gardens and natural setting
- Public transportation system
- Infrastructure and communication
- Others

In Cyberjaya, 32% of respondents stated that landscapes, gardens and natural settings provide a favorable environment to the park. Twenty six percent of respondents reported that working facilities were contributed in developing a favorable environment of the park, followed by building and architecture (16%), and infrastructure and communication (15%). On the other hand, public transportation (9%) and other factors (2%) were not considered as significant elements. Based on respondents' opinion in Tsukuba Science City, 46% of respondents stated that landscapes, gardens and natural settings provide a favorable environment to the park. Twenty eight percent of respondents reported the working facilities involved in developing favorable environment of the park, subsequently followed by public transportation (11%). Other factors were not considered to be so significant according respondents' opinion such as building and architecture (5%), infrastructure and communication (5%) and other factors (5%). The results of both case studies indicate that landscape and gardens play an important role to provide a favorable environment to the park.

5.2 Sense of Memorable between Cyberjaya and Tsukuba Science City

This study describes the sense of memorable features in Cyberjaya and Tsukuba Science City. The questionnaire offers eight categories for the image analysis about sense of memorable in Cyberjaya and Tsukuba Science City. The eight categories were buildings, public spaces, streets, pedestrian and cycling lanes, public arts, parks and landscapes, natural setting and green areas, and activities. The questionnaire was divided into two parts: firstly, the memorable image and secondly, the memorable routes in Cyberjaya and Tsukuba Science City. The questionnaire was conducted into direct interviews at several public spaces. We interviewed 21 respondents in Cyberjaya and 22 respondents in Tsukuba Science City. Respondents were asked to give a score for each of the image: 5 for the most memorable, 4 for memorable, 3 for Neutral, 2 for less memorable and 1 for not memorable. In the second part of the questionnaire, respondents were asked to make a schematic diagram for the mental maps. The concept of a mental map referred to a person's personal point of view based on their experience in Cyberjaya and Tsukuba Science City. The study examines how the physical features create memorable elements as well as distinctive features to the local community and visitors in Cyberjaya and Tsukuba Science City.

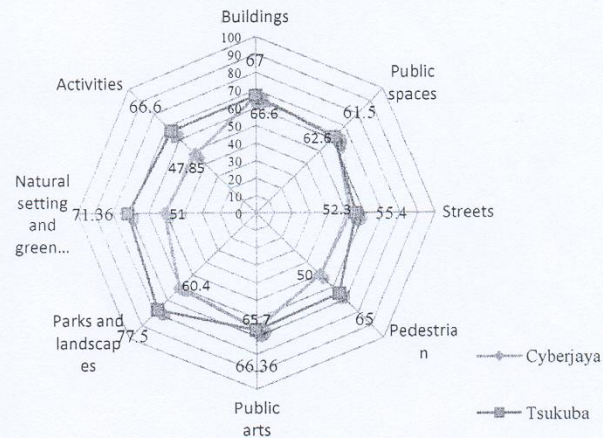


Fig.8. Result of survey in Tsukuba Science City and Cyberjaya based on the eight categories: Buildings, public spaces, pedestrian and cycling lanes, public arts, parks and landscapes, natural setting and green areas, and activities

Based on the result, a mental image selected by the respondents was produced in and Cyberjaya Tsukuba Science City (Fig.9). Fig.8. describes the most memorable features in Tsukuba Science City were the park and landscape which received 77.5%. The second memorable features selected by the respondent were the natural setting and green areas (71.36%). Then it was followed by buildings (67%), public arts (66.36%), activities (66.6%), pedestrian and cycling lanes (65%), and public spaces (61.5%). Streets with 55.45% were not so significant image in the Tsukuba Science City. However in Cyberjaya the most memorable features were building characters which received 66.6%. The second memorable features selected by the respondent were public arts (65.7%). Then it was followed by public spaces (62.6%), parks and landscapes (60.4%). Streets (52.3%), pedestrian (50%), and activities (47.85%) were not so significant memorable in Cyberjaya.

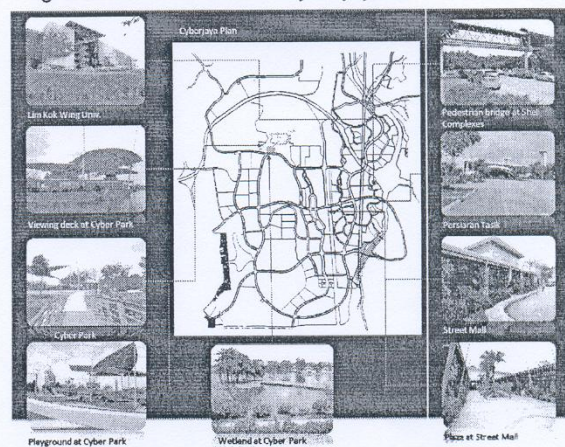


Diagram A: The most memorable images in Cyberjaya

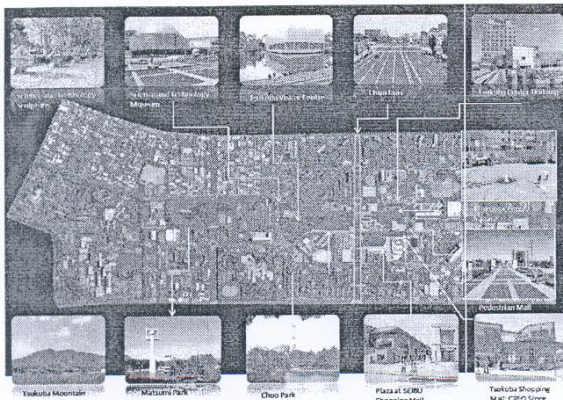


Diagram B: The most memorable images in Tsukuba Science City

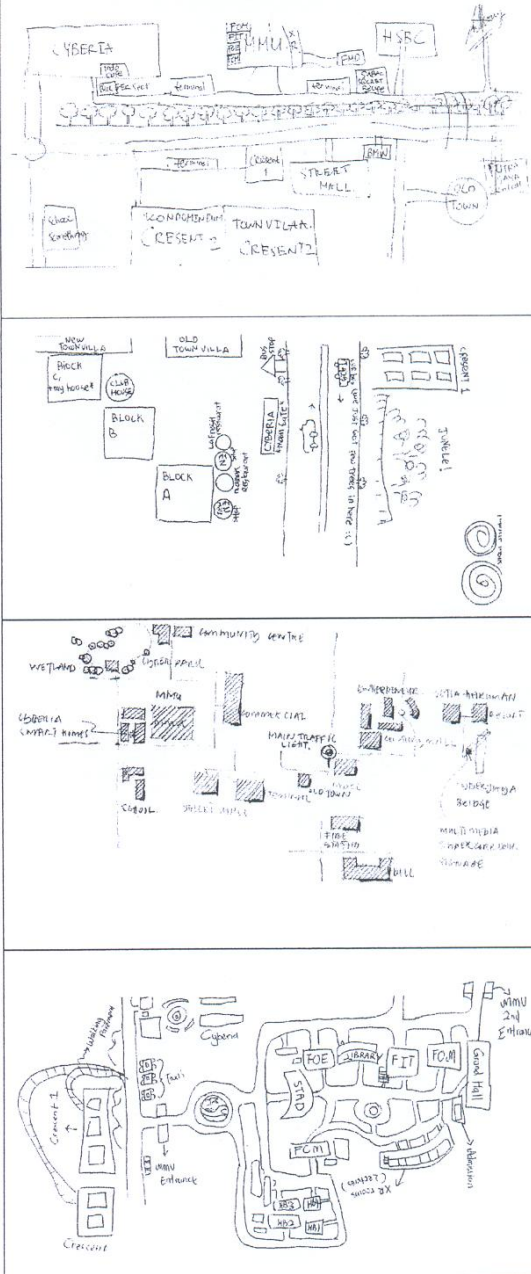
Fig.9. Diagram A. and Diagram B. describe the most memorable images were selected by the respondents in Cyberjaya and Tsukuba Science City.

The result describes that the physical setting in the Tsukuba Science City provides more elements that are creating sense of memorable to the communities and visitors compared with the physical setting in Cyberjaya. The percentage of each element in Tsukuba Science City is higher than that of each element in Cyberjaya. For example the highest element that creates sense of memorable in Tsukuba Science City is the park and landscape category (77.5%) whereas the highest element that creates sense of memorable in Cyberjaya is the buildings category (66.6%). Hence, this result indicates that the most significant elements that create sense of memorable in Tsukuba Science City is the parks and landscapes category, on the other hand, in Cyberjaya buildings plays an important element to create sense of memorable. As a place for living and working, it is important to the science city development to provide a good mental map by the community.

5.3 Mental Mapping Survey

In order to assess a sense of memorable in the science city, a survey on mental mapping by the respondent in Cyberjaya and Tsukuba Science City was investigated. Twenty respondents in Cyberjaya and Tsukuba Science City were interviewed. The result from this survey has described that the most popular elements in the mental maps drawn by the respondents are the public spaces such as malls, streets, restaurants, pedestrians and open spaces such as parks and squares. Fig. 10 and Fig. 11 describe mental maps were produced by respondents in Cyberjaya and Tsukuba Science City.

Fig.10 Mental maps by Respondents in Cyberjaya



Eight drawings from the respondents in Cyberjaya were analyzed. The result indicates that 6 out of 8 drawings show places such as Cyberpark, Street Mall, Cyberia (smart housing), Cyberjaya terminal and Multimedia University are amongst popular elements appeared in the respondent's drawing. Most of the features are located at Persiaran Multimedia, central road at enterprise zone of Cyberjaya. Persiaran Multimedia also is appeared in each drawing.

Tsukuba Science City, Japan provide a distinctive of physical characters through their physical elements and their built form. Cyberjaya and Tsukuba Science City have demonstrated a concern over sustainable development from their physical characters, community environments, movements and connections and landscape and gardens. In short, Cyberjaya and Tsukuba Science City create a human friendly environment providing a balance by taking people needs into considerations, and ensuring an attractive and healthy place to lives and works in the science city development. The provision of landscape and gardens, pedestrian connections, building styles are amongst the important elements to provide a high quality environment in the park.

Fourthly, an overview of the survey results reveals that some physical features in the science city have contributed to the sustainable development and place making of the city such as building and architectural styles, landscape and gardens as well as townscapes.

Finally, the physical characters and high quality of place making in the science city need to be incorporated significantly into a spatial master planning. The importance of physical characters and their built form will improve spaces, activities, movement patterns, and sense of place which further create an enjoyable experience and livable communities in the park. In new development, spatial planning should be more responsible to provide high quality spaces, attractive and enjoyable environment to the park, well- designed public spaces, safe streets environment and to present greater opportunities for walking and cycling to become the norm for local movements or travels. In addition, there are various occupants in the science city such as students, professional workers and non professional workers. Every group of community needs different types of facilities and environment. The physical environment of science city will change from time to time. It is depending on the objective and purpose of the science city. Significantly, nowadays, science cities offer a lot of opportunities for a new living, learning and working environment.

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