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A Typology of Residents of Settlement in Urban Riverbank, Indonesia

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Abstract
Individual preferences regarding settlements are influenced by many factors. This study examines slum resident's preferences with the analysis conjoint with cluster analysis to identify groups of residents in similar housing preferences. This study also explores the relationship between the groups and demographic characteristics. We identify the settlement development for communities that are living in the Musi riverbank, Palembang, Indonesia. The city of Palembang experienced a rapid development. As is the case with most metropolitan cities in Indonesia, some of the urban areas also decline into slum areas, especially in riverside areas. It is useful to get their opinions and acceptance regarding settlements planning to succeed the implementation of planning. Data were collected using conjoint analysis, and residents were segmented using cluster analysis. The correspondence analysis is used to identify notable differences in character demography of each cluster. We found that residents could be segmented into four clusters. Each cluster has a different consideration of preference settlement with the distinguish demographic characteristics about attachment to the settlement, dependence on the river, and economic competence. It provides information for city planners and policymakers in planning more sustainable settlement development that is in keeping with each unique demographic characteristic. Hopefully, it can make development more effective and more responsive to the ecological needs of the settlement's residents.

Keywords: Resident Segmentation, Settlement preference, Conjoint Analysis, Riverbank settlement.

Introduction

As an archipelagic country, many Indonesia cities have grown on the water's edge, either on coastal or by river banks. Palembang is one of the metropolitan city that evolved on the river banks. Many rivers traverse in Palembang. The largest river is Musi. Musi river banks are low topography and always wet inundated by the river overflow. Living culture on the river banks has become part of the history of this city. The currently rapid population overcrowds the settlements in the river bank. Spontaneous development without planning undermines a balance the ecosystem services of the river bank. The improvement of river settlements will not only improve the quality of life of the community but will also rehabilitate the ecosystem services.

The ecosystem approach to sustainable development considers ecosystem service as a limit to human exploitation (Kay et al. 1999). The implementation of such a concept regarding wetland development emphasizes maintaining local context, conserving the uniqueness of the ecosystem, and expanding open green space. The challenges remain in maintaining local context, specifically concerning the balance of cultural, ecological and biological development aspects within specific spatial space (Vollmer et al. 2015). Planning should integrate wetlands as part of the townscape to make a unique environment (Alberti 2010). Settlements should be arranged so that it built land is saved through vertical and denser housing (Novotny et al. 2010). The area along the river edge should be retained as a buffer from the settlement area to the river. Moreover, it should facilitate the riparian area to function well in supplying good quality water, controlling the no construction water cycles, and maintaining diverse aquatic habitats (Boyer and Polasky 2004).

The sustainable development concept based on an ecological approach needs community acceptance for a successful implementation. Planning should be responsive to desires of the community and its ecological context (Scott et al. 2013). Knowledge of the segmentation provides more detail information for planners in determining the policy. Planners could know the most appropriate treatment according to the characteristics of the community according to their needs and desires. The cluster segmentation of the house is influenced by six factors of housing and neighbor attributes, i.e. quality ad comfort, trust and pride, access, outdoors, neighborhood, and activities (Gibler and

Tyvimaa 2014). Heterogeneity of the preferences can be explained partly by sociodemographic and human values (Nijënstein et al. 2015). Culture, ie gender, politics, religion, kinship, and social relations have significance as predictors of housing preferences (Jabareen 2005).

This article discusses the community acceptance of the concept of sustainable settlement in the riparian areas of the city of Palembang, Indonesia. The shift of cultures in the community there has caused environmental degradation within the area. Previously, houses in these settlements were built in adapted to the riparian ecosystem. Currently, the area is crowded with slum dwellings with community members come from diverse backgrounds with different needs and desires. Each of them has dissimilar preferred residential characteristics. The preferences of the community for a particular settlement can be used as the basis to formulate guidelines, criteria, and policy. The harmony between planning and community preference will ensure public support for such policy developments (Johnston et al. 2013).

We collected primary data using the conjoint analysis technique and created resident's segmentation using cluster analysis. Then, we used the correspondence analysis to determine a demographic characteristic of clusters. This research provides information for city planners and policy makers for planning settlements that are more in keeping with the characteristics of the community and its preferences. The responsive planning which balances human and ecological needs will result in more efficient implementations.

Methods

The Conjoint and Cluster Analysis for Segmenting respondents based on Preferences

This paper used conjoint analysis techniques for collecting data regarding respondents' preferences. Conjoint analysis is a popular marketing research method which measures the influence of the attributes in an individual decision-making regarding product choices and preferences (Louviere et al. 2000). In property market research, an individual considers and evaluates multiple characteristics such as location, typology or number and size of the room, construction material, and so on before choosing a house.

In this study, mapping the settlement preferences of the riverbank residents used conjoint analysis. Data from the conjoint analysis was further processed with cluster analysis. The focus of this study not only determines the importance of housing attributes and attribute levels but also finds the differentiating of preference of respondent from one the another. The procedure is common statistical designed to classify complex data sets with the purpose of grouping objects into clusters. The objects in one cluster have more things/characteristics in common than with the other clusters (Mooi and Sarstedt 2010).

The combined method of conjoint analysis and cluster analysis has been used in some studies. The analysis of heterogeneity preferences classifies respondents based on their preferences. This assessment provides in-depth knowledge for making more appropriate criteria for specific cases. This type of resident grouping is similar to market segmentation in marketing. Manufacturers usually separate consumers into groups of similar buyers. The goal is to create the right product that fits the characteristics and needs of the target group of buyers (Djokic et al. 2013) (Lonial et al. 2000). In our case_ this combined method results in resident segmentation based on settlement preference. By applying this analysis, it was possible to divide respondents into clusters; each cluster signifies a group/segment of respondents with similar settlement preferences.

This study was to apply correspondence analysis to identified specific profiles of each cluster that influences their housing preferences. It is used to profile clusters based on the respondents' sociodemographic and current settlement perceptions. Correspondence analysis explores data to estimate the relationship between categories of data without the need for haying a prior hypothesis about their specific influence on each other. One of the goals of correspondence analysis is to look at the relationship or proximity of a category in one variable to the categories of another variable (Greenacre 2007).

Design of the Residential Profiles

Previous studies regarding residential preference associated with water environment areas found five important attributes that used in this survey (Kauko et al. 2009) (Goetgeluk et al. 2005). The five attributes can be separated into two main components. The first is the building component, namely "residential type" and the second is the environment components, which includes "width of riverside open space", "riverside construction", "open space", and "riverside access" (Table 1). The survey instruments had been pre-selected in complied with this local study context.

The attributes consisted of two, three, and four levels. With five attributes and fifteen levels, the full-factorial experiments generated 216 possible combinations of settlement profile (=3x3x3x2x4). It was impractical for the

survey because subjects' cognitive and time limitation did not allow for the consideration of such a large number of profiles. Because of that, we created an orthogonal fraction factorial experimental design to make it more feasible for respondents to respond. It eliminated the occurrence of any two levels of different attributes that are uncorrelated and minimized cases of overlapping where attribute levels did not vary (Green and Srinivasan 1990). This orthogonal fraction factorial experiment resulted in 16 alternative combinations of settlement attributes.

Table 1 List of Attributes and Their Levels

Attributes	Level attributes
Residential type	1. Floating house 2. Stilt row house 3. Apartment
Width of riverside open space	1. <10 m 2. 10-20 m 3. 21-30 m 4. 30 >
River's edge Construction	1. No construction 2. Polder 3. Riverfront platform
Riverside Open space	1. Open green area 2. Wetland park 3. Playground
Riverside Access	1. River route 2. Promenade

Data collection

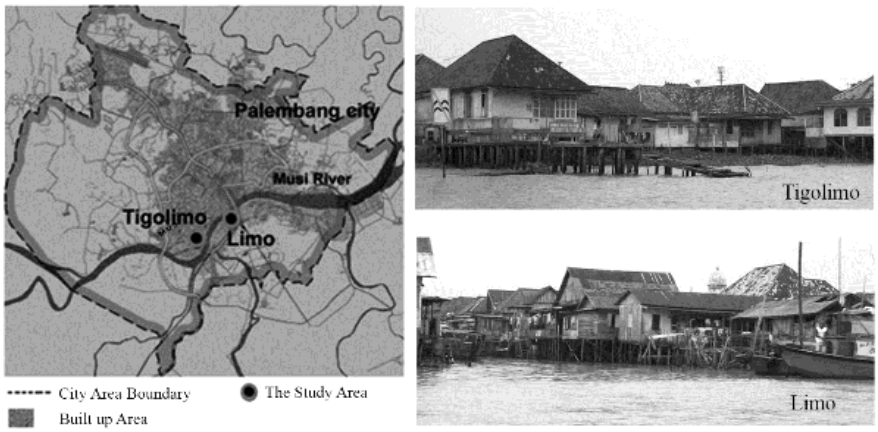

Fig.1. Map and picture of two settlements (Limo and Tigolimo) along the Musi river bank Palembang (Source: Google Maps)

The samples surveyed in two slum settlements: Limo and Tigolimo (Fig.1). In both of the sample areas, the riverbanks do not have man-made river walls. The settlements stretch to the river's edge. Most of the population in these areas are vulnerable to flooding. These riparian areas are also very dense with houses. Rapid development has led to there being almost no open public spaces. Any remaining open spaces are private properties. The extremely high population density of these settlements can be seen when measuring the distance between the houses which is less than two meters or even none. Although these small houses are detached buildings, they look like row houses. The houses in these areas are built on the typical wetland foundation using rafts or stilts, with eighty percent of the houses built on stilts. The raft houses are occupied by people whose jobs relate directly to the river, such as fishermen, boatmen, and floating traders. The floating traders use raft houses as stalls to sell oil and various boat. Slum dwellers of two settlements depend heavily on the river to support their daily needs such as transportation, household water needs, and livelihood. People can be seen along the river banks using boats for various activities. Small traditional boats equipped with motors are used to cross the river or navigate along the river banks, while larger boats transport commodities from production areas to city marketplaces. In contrast to the waterways, land access into this area is very limited. Many access roads are disconnected since they are narrow and winding, they can only be used as footpaths. Most people also rely on the river for bathing and washing, while some also use the river for household water. Although seventy percent of the houses in these areas receive city water services, this habit has not immediately changed. Community members use their riverside activities to interact with each other.

The respondents were limited to house owners living within 250 meters of the river edge, specifically residents who were a married couple, or eligible to make decisions about their housing. 306 respondents were obtained with a proportionate number for each area. Two sample was incomplete, so it could not be used for data analysis.

Trained field surveyors conducted door-to-door interviews. Each respondent answered the questionnaire within thirty minutes which included explanation time for instructive information. The interviews consisted of two distinct tasks: sociodemographic data followed by the stated preference questionnaire. Sociodemographic data included individual perception regarding house and settlement environment. The second part of the interview consisted of sixteen flashcards. Each card illustrated a residential profile. Interviewers explained the residential profile content one at a time and asked the respondents to rate the profile. The respondents rated them with values between one to ten which were then translated into numerical preference indicators in continuous data. Each respondent was asked to rank the attributes and explain the reason for their preference for each particular attribute to ensure consistency.

Results

Respondent Clusters based on Preference

Clustering analysis divided respondents into four clusters. The first cluster amounted to 88 people who had more similarity preferences to the second cluster with 51 members. The largest cluster was the third cluster totaling 127 people. The fourth cluster is totaling 38 people.

Cluster Characteristics

The result of correspondence analysis demonstrated characteristic differences between the four clusters (Table 2). There were six demographic profiles that statistically significant different among four clusters, that is job, income, tenure, living duration, house, and environment comfortability.

Member of cluster 1 have jobs as owners of boat rental businesses, boatmen or fishermen. The amount of this cluster income was equal to cluster 2 and cluster 3, ranging from one million IDR up to three million IDR. Most residents in this cluster have lived 16-30 years in this settlement. They felt comfortable with their house, but less so with the settlement environment.

Member cluster 2 had the similar characteristic jobs as member cluster 1. They both had jobs related to the prominent river living culture. Member Cluster 2 were traders at the traditional market that using boats to transport goods. Typically, they have done this job from one generation to another. They were long-time residents who felt comfortable living in this area. They had a good perception of house and settlement environment. It probably because most of them already had owned a house, although a few still rented a house.

Members of Cluster 3 are residents who had lived comfortably in the area. They were homeowners and long-living residents. Most of them were the descendants of families who had lived for generations in this settlement. Their occupations no longer depend on the river. They were laborers or office workers.

Most of the members of cluster 4 had temporary jobs with uncertain income. Their jobs were traditional traders or do odd jobs. Some of them were a worker in the salted fish industry. Their income was the lowest among all the clusters. Almost all of them had not owned a house. They rented or lived with other families. They felt uncomfortable regarding their house and settlement environment.

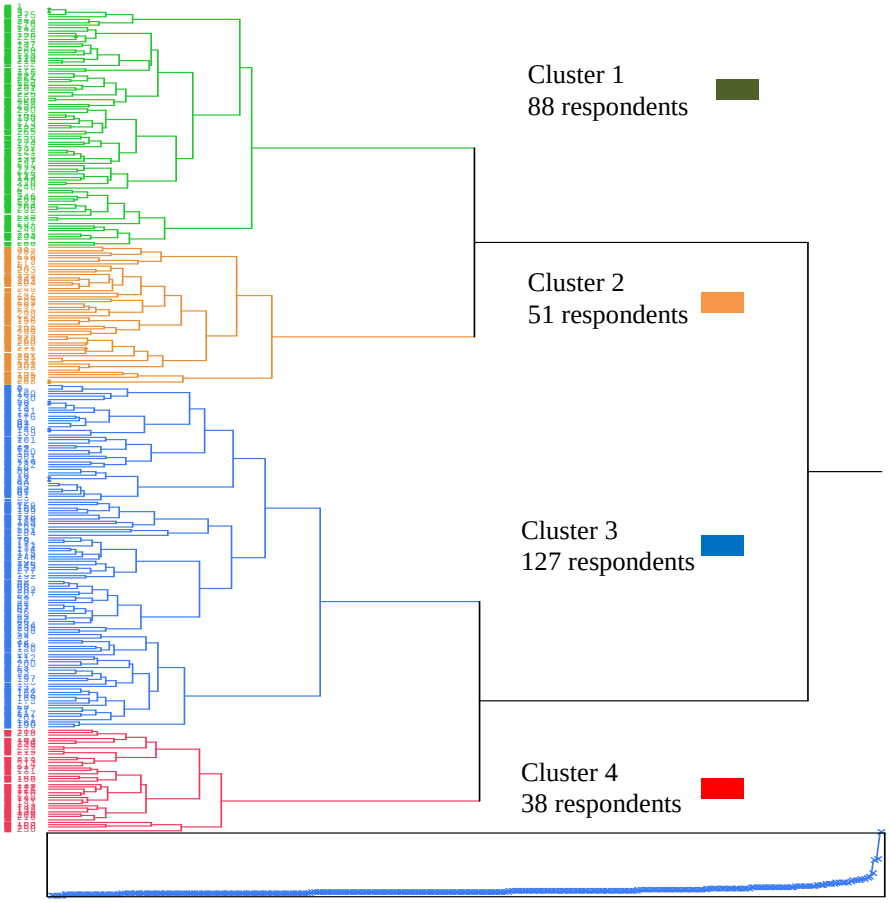

Figure 1 Results of clustering analysis

Table.2 Contingency analysis of the characteristic of the clusters

Characteristics	**Cluster**			
	1	**2**	**3**	**4**
Number person	88	51	127	38
Living duration	16-30 years	30-45 years	>45 years	< 15 years
Income	Rp 1.000.000, Rp 3.000.000,	Rp 1.000.000, Rp 3.000.000,	Rp 1.000.000, Rp 3.000.000,	<Rp 1.000.000,
Tenure	Most Renters or Owners	Most Owners or Renters	Owners	Living with others family or renters
Job	Boat driver and fishermen, small entrepreneur, others odd jobs	Local trader	Officer, Laborer	Small entrepreneur, others odd jobs
Perception of House comfortability	Comfort	Comfort	Comfort	Discomfort
Perception of Settlement environment comfortability	Discomfort	Comfort	Comfort	Discomfort

Conjoint Analysis Result

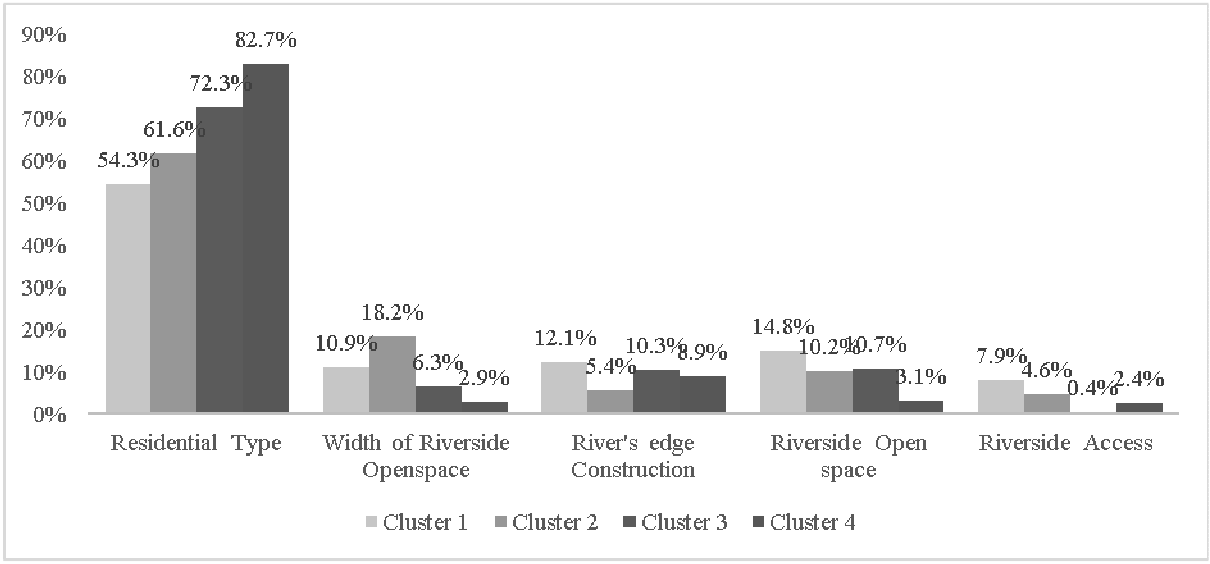

Fig. 1 Attribute Importance Score for each Cluster

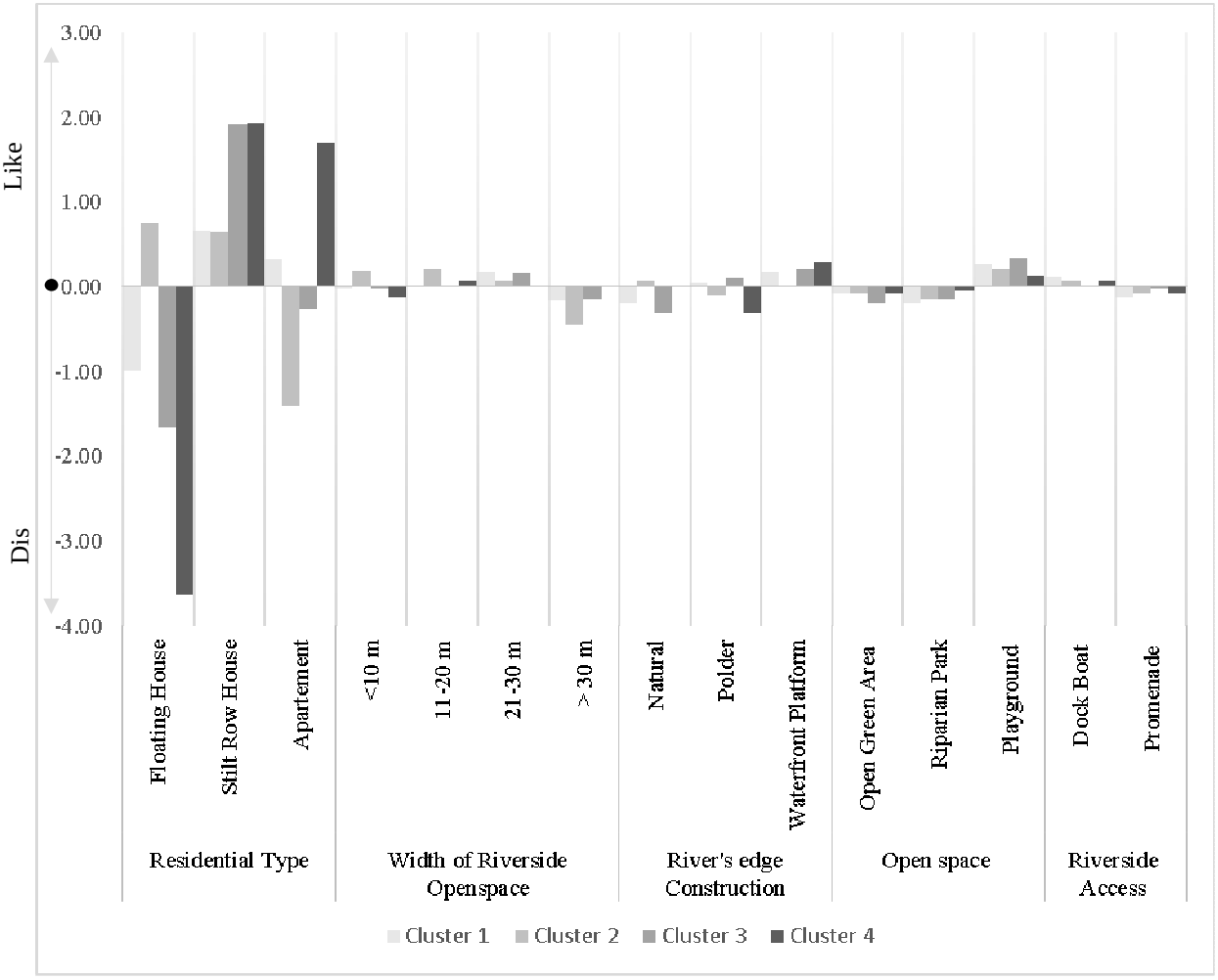

Fig. 2 Part-Worth Utility

The conjoint analysis is constructed by the utility function. The utility function describes the contribution of attributes that influence the overall utility of settlement alternatives. A number that describes percentage influence of the attribute on individual preference for the settlement alternative is called attribute importance score. The attribute importance score is the calculation of the range of the part worth utility between the most and the least preferred attribute level. The part worth utility explains the individual desire for particular the attribute level. While the part-worth utilities can be interpreted as the contribution of the attribute level to the overall utility from the mean overall utility. The explanation of part worth utility shows the positive and negative directions. A positive part-worth utility means that the presence of the attribute level in a residential alternative increases the total utility; consequently, a negative part-worth utility decreases the overall utility. The greatest value of the part worth utility is regarded as the most preferred attribute levels, while the smallest value showed the least favored attribute level (Jansen 2011).

Figure I describe the level of attribute importance score regarding the preferences of each cluster. It shows that “residential type” was the most important attribute for all clusters. This attribute scored more than 50% of all the total attention. However, the clusters had a different ranking order regarding the next attributes. Cluster 1 and cluster 3 had a similar of ranking attributes. Their next important attribute was “open space”, followed by “riverside construction” and “width of riverside open space”. The least important attribute was “riverside access”. On the other hand, cluster 2 considered “width of riverside open space” as the second important attribute. The third and fourth attributes were “open space” and “riverside construction”. Just like the others, “riverside access” was the least attribute. Meanwhile, cluster 4 choose “riverside construction” as their second important attribute. Their third and fourth important attributes were “open space” and “width of riverside open space”. “Riverside access” only received little considerations.

Cluster I, cluster 3, and cluster 4 made " stilt row house" their favorite residential type. Cluster 2 preferred "floating house" to "the stilt row house". It contracted to all other clusters that very much disliked "floating house". While

cluster 2 and cluster 3 objected to "apartment", cluster 1 tended to receive apartments to be built in their settlement. Cluster 4 even like this residential type as a solution for improvement building in this settlement.

The attribute of “width of riverside open space” is a transition space between the settlement and the river. Almost every cluster had a different preference regarding this attribute. However, cluster 1 and cluster 3 had similar preferences regarding this attribute. Their utility increased for "<10 m" to " 21-30 m" and decreased for ">30 m". They liked the width of riverside open space which was around 21-30 m. It means that they only could accept the width in less than 31 m. It indicated they support a longer distance than the current conditions. Most of the current houses were vulnerable to flooding. The results preference of cluster 2 showed a very high interest in this attribute. Cluster 2 preferred "11-20 m" as the most favorable option. This utility only slightly differs from "<10 m". Their settlement utility decreases for "21-30 m" to "> 30 m" width of riverside open space. Cluster 2 wanted the houses closer to the river. They considered a distance that under 20 m as ideal width. Meanwhile, cluster 4 has an indifferent preference about “width of riverside open space”. It was indicated by the part worth utility for all attribute levels which tend to be zero (.0,12, 0,08, 0,02 and 0,02).

Preference of "riverbank construction" is related to the alternative barriers that to control flood overflow of the river in this area but could obstruct the physical and the view to the banks of the river. This attribute received the attention from cluster 1, cluster 3 and cluster 4. Cluster 4 even put this attribute as the second of settlement attribute that influenced the preference. Three clusters clearly preferred "riverfront platform" which provides an elevated and flood-free terrace on the riverfront. If clusters 1 and cluster 3 did not like "no construction" river edge, so cluster 4 more disliked polder. "No construction" is a river edge option with no structural boundaries, while "polder" provides a more safety settlement from flooding but blocked the view to the river. It implied that all of them wanted a settlement that is not overly disturbed by the river overflow but still easy to access with open views towards the river. Meanwhile, cluster 2 did not pay any attention to this attribute.

"Riverside open space" received significant attention from three clusters: cluster 1, cluster 2 and cluster 3. All the clusters preferred "playground" as their most favorable open space. It is the type of open space are intended to accommodate a public activity. For the least favorable option, clusters 1 and cluster 2 most disliked "wetland park" and cluster 3 most disliked "open green area". It was contrary to cluster 4 who uninterested in this attribute. Their utilities for the attribute levels of "riverside open" space were almost same value. "Green open space" and "wetland park" were less attractive attributes. "Green open space" refers to an open space with grass, shrubs, and other riverbank vegetation without trees. It is an effectively transitional area for water recycling and flooding absorption. As the type of vegetation is low-lying, it does not obstruct views of the river. While the park is the open space that planted with diverse vegetations, includes trees. It provides shade for the settlements. However, the thick vegetation blocks the view of the river. Both options are purposeful to keep open space in undeveloped areas and free from public activities that would interfere ecosystem services.

The unique characteristic of settlements in riverbank areas is their accessibility from land and water. However, very few residents expressed interest in this attribute. Almost all clusters did not make particular mention regarding riverside access. It is concluded from the part-worth utility to "riverside access" that was not statistically significant. Only Cluster I put " riverside access" to a significant preference. They prefer "river route" rather than "promenade".

Discussion

The results of data processing show that people's preference for building components is very high, but not so with attention to the components of the environment. Apparently, for the community, the building is a component of settlements that are directly related to the comfort in living and daily activities, while the environmental component only as a supporter to get the comfort.

Each cluster has a different level of awareness of environmental quality. The four characteristics demografi that influence the resident's attention to the settlement environment are living duration, tenure, the perception of the settlement, and the dependent to the river. The built environment shapes the individual's subjective perceptions of that environment that would increase the place attachment. Housing quality and ownership modestly increase place attachment. The involvement of the environmental resources may enhance the place attachment. Attachment to the place felt by the residents that have long living duration. Long-term residence substantially increases sentimental ties to a locale with memories. Living in long duration in the settlement may create the bond that increases local social ties (Crowe 2010). Attachment to the place is also identified from the comforts of their present occupancy and neighborhood environment. The stronger the bonding of the place, the more it raises the awareness of the environment. Communities tied to places are usually socio-cultural feel as part of the resident community (Lee and Guest 1983).

Place identity, place dependence, and significant perceptions have a direct positive effect of attention to behavior and their environmental impacts (White et al. 2008).

The dependence on river is indicated by the intensity of the residents doing the river activity either in the daily activities or the livelihoods associated with the ecosystem. Dependence to the river is more than just a dependence on the river to meet every day needs, but the comfort of setting in the ecosystem. For example, some residents do the habit of washing and bathing on the banks of the river not because of unavailability of infrastructure in their houses. Their existence and linkage with the river will blend with the environment and provide a positive reciprocal effect. Type of occupations that dependence on the rivers raises resident's awareness regarding the quality of the riparian settlement. Dependence on the place is related to an alternative that is perceived can underpin behavior (Jorgensen and Stedman 2001). It referred that cluster 1 and cluster 2 gave a balanced attention to the building and the environmental component. Contrarily to cluster 3 and cluster 4 which had jobs that are not dependent on the river. Their preferences attentions were more primarily on the quality of the building.

Cluster 1 consisted of moderate living duration. Their occupations are the mix of the depend and no depend on the river. This cluster preferences of settlement improvement represent options that tend to be a transition from a river-oriented culture to a land-oriented culture. Cluster 1 requires a settlement in adequate distance from the river. Distance in 30 m from river edge can be an option to meet the needs. Besides that, they accept an apartment type. Their preferences are beneficial ecologically because it can save development land and provide more natural land for ecosystem service needs.

Cluster 2 depent to river because many of them have jobs that are connected to the river. This cluster has the community attachment too. They feel comfortable living in this settlement. Their presence on the banks of the river is symbiotic and mutual need with local ecosystems. Their jobs require proximity to the river bank. They also give positive attention to the quality of environment. The settlement improvements for them could be planned by modified the house type which is more land-efficient. It aims to reduce land cover to create more open space and more soft structure for ecological planning.

Cluster 3 has strong place attachment, but less dependent on the river. Member of cluster 3 are the residents who no longer depend on the river. Their lifestyle, including jobs and daily activities, have shifted to a land-oriented lifestyle. However, cluster 3 still consider the three other attributes ("width of riverside open space", "river's edge construction", and "open space"). These residents feel like a part of the river community. Although their settlement preferences show a shift in orientation, but their length living duration makes them familiar with the riverside ecosystem. An apartment type is unusual house types are clearly rejected by cluster 3. Although they require the convenience of the flood but an improvement by building polder is not preferred. Polder is uncommon construction in this area. The settlement that improves the infrastructure in suitability with river culture living by mimicking the performances of the ecosystem will be easily accepted.

Cluster 4 gave almost all their preference attention to "residential type" and only "river's edge construction" is the environmental component that received the significant attention. Members of cluster 4 are not native-born residents. They have lived less than 15 years in this settlement. Their income is low with non-permanent jobs. Perceptions of the condition of the house and the environment are uncomfortable. They do not feel like a part of the community. It is inferred from their indifference to "open space" attribute. Only cluster 4 who does not pay attention to the need for communal open space. It can be concluded their preference settlement only focus on getting a decent home. Cluster 4 has settlement preferences that are very concerned about the quality of dwelling and less attention to environmental quality. It indicates that living in the riverbank is not a priority for their settlement preferences. They rented houses in the settlement in riverbanks because it provides a cheap and strategies location to the city center. The observation on these settlements showed that condition of most of the rental housing is very bad. The houses have inadequate air and lighting, prone to flooding, and were not equipped with clean water services. They can be identified as migrants, based on the short duration of their living in this settlement, the type of jobs they have (mostly odd jobs), as well as their low-income and housing status (renting instead of owning). Also, they do not feel comfortable with their housing or their settlements.

Based on the characteristics of each cluster, we car the four clusters as: Cluster l as 'transition community", Cluster 2 as "riverbank community", cluster 3 as "land oriented community" and Cluster 4 "migrant". Settlement planning needs to get acceptance from the community. Their characters and preferences are informed in the planning process of settlement improvement.

Conclusion

The segmentation communities based on their settlement preference based on riverbank residents and associated with socio-demographic characteristics gives more detailed information in making more appropriate designs that will suit the unique characteristics of the residents. The planning can be designed specifically to target a particular resident segment. The planners can modify development concepts according to the characteristics of certain communities which will increase their acceptance of new development plans. The segmentation procedure is very useful for urban planning, especially in areas which have sensitive environmental issues and complicated urban problems. Planners can modify attributes and trade-off planning components while taking into account the costs as well as the benefits of public acceptance. Planning should respond to residents preferences, and also be sensitive to the impact of planning on the local environment, including recognising underlying cultural values.

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