Understanding Unplanned Settlement Structure
As A Result Of Self-Organization In Jakarta

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Abstract: City design, as a continuous urban place transformation process, emphasizes the process rather than the product, therefore to understand the physical characteristic of a settlement should be based on an understanding of its formation process. The aim of this study is to discover and understand the features of those unplanned settlements, which have been created in an autonomous manner without any comprehensive planning. This study is intended for understanding the complex settlements structures as the result of self-organization mechanism. Through the mapping, organizing, and structuring of the settlement system elements, such as path system and land division system, using information extracted from maps, photographs and field survey in Kelurahan Petamburan village, the study reveals that there is a strong relationship between the path system and land division system with the hierarchy of socio-spatial units as the main determinant of unplanned settlement development. The pattern of the path network shows the importance of the neighborhood unit as socio-spatial unit that driven the settlement evolution. The neighborhood unit represents a closed socio-spatial unit with intact social and emotional relationships within its community, where effective self-organization mechanism takes place. Responding to the fact that there is segregation in urban settlement structures, due to relationship between the path - land division systems and the hierarchy of socio-spatial units, one approach to urban planning is reconfiguration or rescaling of the urban settlement and urban space hierarchy, as well as examining political roles and socio-spatial implications of various stakeholders with different interests.

Index Terms: hierarchy, land division system, neighborhood unit, path system, self-organization, socio-spatial unit, unplanned settlement

1. INTRODUCTION
City design should be understood as the formation process of physical settings for life in urban areas, could be called the art of creating places. In relation to the creation of urban places, the transformation of an urban environment become an urban place is actually a form of art, what we might call “civic art”. Civic art is the highest art form, which makes a big city unique and has a special meaning. Civic art represents social communication expression and its interpretation, as well as symbolism, imageability, memory, etc. [1] Civic art is an effort to create living spaces that occur continuously and evolves based on the values of society and culture or local wisdom. Civic art, Every human settlement refers to the region or space for habitation where human beings are involved in organized activities for human survival, in a form of multi-layered spatial system.[2] Whenever human beings create their settlement without any comprehensive plan, they allow their settlement to develop as a result of actions and reactions to satisfy their needs. Such a settlement has been created within the cultural and social constraints of its creators, external conditions constraints, and existing opportunities.[3] The development of such a complex settlement takes place in a form of processes in which individual and collective needs as well as non-articulated ideas and subconscious needs can be considered and satisfied, in addition to the logical aspects. [3] The interaction between private or individual and collective or communal interests produces a complex entity. The creation or development of such a settlement has not been specified in advance, but has evolved through the interaction of individual planning, collective or communal planning, and self-organization.[3] In the conventional sense, settlements which have evolved in this way are not planned. Their development process is clearly different from formal planning process, which are dominantly governed by rational considerations. which is a continuous place transformation process, emphasizes the process rather than the product, so that efforts to understand the physical characteristics of a settlement should be based on an understanding of the process of its formation. One form of an urban civic art is unplanned settlements. The actions of many development actors, in individual as well as in collective or communal way, which is not hierarchically or centrally controlled, gradually reach the limits of communication. In this situation, self-organization is inevitably needed. Self-organization appears by itself if the evolving settlement structures are not forced into a predefined structure or form by anybody, but rather evolves by itself as a synthesis of various factors. However, it can be assumed that the evolution of this unplanned settlements is based on an organization scheme or relationships scheme conditioned by cultural and social structures of their creators.[3], [4] Evolution of this unplanned settlements is governed by self-organization mechanism. Self-organization mechanism is the combination of various factors which lead to a new equilibrium formation.[3] Self-organization also means self-governance, which includes self-control, and self-regulation. It means a capacity or quality of dynamism within a system that does not need external control and governance to maintain order and stability, in case of occuring chaotic changes and challenges [5] The result of the above described development processes are complex settlement structures, which regarded as the representation of the physical or the material expression of a community living processes. Since the unplanned settlements have always been a part of urban settlements, integrating planned and unplanned settlements in managing sustainable urban development is inevitable. Therefore, the question that then arises is how the complex forms could be more easily understood and category based on its essential feature? The aim of this study is to discover and understand the properties and features of those unplanned settlements, which have been created in an autonomous manner without any comprehensive planning.
2 RESEARCH METHODOLOGY

2.1 Research Object and Analysis Unit
This research was conducted in “Kelurahan Petamburan” urban village in Jakarta, as a case study. Kelurahan Petamburan village is a settlement that is categorized as unplanned settlement, that has undergone a long process of place making evolution by diverse social communities independently. Place-making in this settlement can be understood as an effort of its inhabitants to create and transform their living spaces with the goal of strengthening social relation among people and the places they share.[6] Social relations or social interactions in a community are related to the use of space, which is identified as a territory[7]

Utilization or occupation and control of urban space by a community due to social interaction is the important cells that make up urban settlements, which cover a wide area. In a process-oriented settlement development or transformation, socio-spatial control approach has been the new subject for urban theory, because the physical focus is not sufficient to interpret unplanned settlement structure. [8] Based on the principle of socio-spatial control, the complex structure of spontaneous unplanned settlements can be understood through their spatial-differentiation representing different sizes of socio-spatial units. The existence of socio-spatial unit shows that the capability of community to create its living space is highly dependent on community resources that can be mobilized (financial, social, political, spatial) and the growth of interdependence in the community to protect their own environment as part of the city network. The efforts of community groups to control their living space collectively are an integral part of the self-empowerment process. Because the socio-spatial unit is an important element in understanding the characteristics of unplanned settlement structures, the unit of analysis or sample unit used in this study is the socio-spatial unit. The neighborhood unit (“RT” unit or “Rukun Tetangga” unit) is chosen as an analysis unit or sample unit with the consideration that in this unit individual and collective or communal planning and development processes occur as well as self-organization. The RT unit is a synthesis of informal community units formed by inhabitants and the "semi-formal" lowest units in the city administration structure. This neighborhood unit or “RT” unit represents the inextricable and overlapping relation of formal and informal community as well as top-down and bottom-up planning.

2.2 Research Variables
Settling means, basically, dividing the land into plots or sites and linking these sites by path. [3] Therefore, the physical form of a settlement, which actually comprises various elements, can be reduced to its elementary basic structure. The question about the features and characteristics of unplanned settlements can therefore be concentrated on two-dimensional structures formed by paths and two-dimensional sites or occupied land. Every socio spatial unit is seen as a connecting path system and a land division system. The connecting path system variables consist of overall path network pattern, such as path class hierarchy, path dimensions, number of path lanes, and nodes. Meanwhile the land division system variables consist of land utilization, shape and size of land units, and their relationship with “neighbors”. The composition of sites and their connecting path determine

the physical settlement structure formation, through the process of settlement evolution driven by various development actors (stakeholders) with their respective socio-spatial control characteristics.

2.3 Population and Sample
The population in this study is all neighborhood units or “RT” units in the Kelurahan Petamburan village. The sampling was done purposively with consideration of the diversity of building density within every “RT” unit. The number of samples used in this study are 27 neighborhood units. The number of samples is the total number of “RT” units (neighborhood unit) in the two “RW”s (community association as a community unit formed by a group of RT- units), which are chosen based on differences in building density (see fig. 1, 2, 3, 4). By including all “RT” units in each “RW” unit, it is hoped that the hierarchical characteristics of the socio-spatial units and their networks in forming the overall settlement structure can be studied. In 2017 Kelurahan Petamburan village consists of 11 “RWs” and 122 “RTs” [9] The population of Kelurahan Petamburan villages in 2018 is 42708 people [10] and the number of samples for interviews is around 100 people, besides several key informants for indepth interview.

2.4 Analysis Method
Through the mapping characterizing, organizing, and structuring of settlement structure elements in every analysis unit or neighborhood units, such as path system and land system, using information extracted from maps, photographs and field surveys in Kelurahan Petamburan village, the study can reveal properties and features of unplanned settlements. Information about the characteristics of the self- organization mechanism on various socio-spatial scales were extracted from various key informants, which consisted of competent individu or persons, communities, and institutions. Conclusions are drawn based on the categorization result and themes formulation of saturated information collected from those various informants.

Fig.1 Part of the Kelurahan Petamburan village where RW 01 (Community association 01) and RW 03 as the sample entity of this study
as a result of the development process based on individual planning, collective or communal planning and self-organization, can be understood by identifying the character of the circulation path and the sites or occupied land. At the first sight, the structure of the settlement appears to be irregular. To be able to understand and describe this complex settlement structures, understanding how individual-planning, collective or communal planning and self-organization functions will be very helpful. Previous discussion revealed the importance of the community role with its socio-spatial control over its settlements in the process of development and transformation of unplanned settlements, through the process of individual-planning, collective or communal planning and self-organization. Therefore unplanned settlement structure have to be understood as socio spatial relations, within which territories, places, scales, and networks dimensions are interrelated.[11] In this case, the family units and community units with their socio-spatial territories are the main subject of their settlement development. In the context of the urban village of Kelurahan Petamburan, the most important community development unit is the “RT” unit or the Neighborhood unit. This social unit, which is actually more informal, plays an important role in daily life in Kelurahan Petamburan village, in which these social units regulate the mechanism of organizing social and development activities in an individual or family level as well as in community level. Almost all social and development activities are carried out by groups or community organizations, whose formation basically adheres to RT units. The RT unit is a social unit that is very “intact”, in which familial social relations among members of the community can be found. Most of the respondents, 82.6% defined the RT unit territory as their semi private residential environment. The territory of the RT unit is still divided into smaller groups (sub-groups), which usually consist of several houses. Individual planning, collective or community planning, and self-organization are carried out on several scales, in a hierarchical manner. The smallest or lowest scale is at the family level (house-unit) with its individual planning. Meanwhile collective or communal planning and self-organization are carried out by several families within the scope or scale of house-group (several house-units). On the RW scale, the smallest individual-planning unit is a house-group unit. Collective planning and self-organization are carried out by several house-groups within the scope of the RT unit. On the RW (community association) scale, the smallest self-planning unit is the RT unit. Collective planning and self-organization are carried out by all RT units within the RW unit. And so on up to the Kelurahan (village) Scale, as the lowest formal representation of the government. On the Kelurahan (village) scale, the smallest unit of self-planning is the RW unit. Collective planning and self-organization are carried out by all RW units within the Kelurahan unit. The hierarchy of the socio-spatial units shows clearly that the formal government administrative structure is a major consideration in the formation of the hierarchy of socio-spatial units structure and hierarchy of socio-spatial control. (fig. 5)
It can be recognized that the path classes are related to the scale of the socio-spatial control units of development actors (settlement structure forming agents), as shown in the fig. 5. What is also striking in the cursory observation is the large number of nodes (bends, intersections), which have consequences for the large number of path fragments. This large number of path fragments makes linking path networks seems "scattered" irregularly. However, this condition actually provides a high level of permeability of these unplanned settlements, where there are many choices to access a place or destination. The overall shape of the path network pattern is irregular, that causes the pattern geometrically not simple and easy to understand. But by describing unplanned forms in other ways, namely understanding the pattern of path networks through the process of self-planning, collective or communal planning and self-organization, a "regular" pattern can be identified or recognized. The hierarchical linking path patterns as a means for land division structures show consistently their correlation with the hierarchy of socio spatial units as the development agents. In relation to the objectives of settlement development actors participating in the mechanism of self-organization, the mechanism of self-organization can be grouped into three categories, namely: (1) self-organization by the powerful institutions for economic gains; (2) self-organization by local government authority with the disenfranchised for basic rights; and (3) self-organization by ordinary people for community interest.[17] These three self-organization categories have a reciprocal relationship with connecting or linking path network characteristics.

**TABLE 1**

<table>
<thead>
<tr>
<th>Unit Socio Spatial Scale</th>
<th>Self-Organization Mechanism</th>
<th>Self-Organization Categories</th>
<th>Characteristics Linking Path Network, Path Class/Width</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Border Internal Network</td>
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<tr>
<td>Family</td>
<td>Family individual-planning</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Houses Group</td>
<td>Families collective-planning</td>
<td>(3)</td>
<td>1 – 3 m</td>
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<tr>
<td></td>
<td>Houses Group self-organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT/ Neighborhood</td>
<td>Houses Group individual-planning</td>
<td>(3)</td>
<td>3 – 5 m 1 – 3 m</td>
</tr>
<tr>
<td></td>
<td>Houses Groups</td>
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<tr>
<td></td>
<td>Groups collective-planning</td>
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<tr>
<td></td>
<td>RT self-organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RW/ Community Association</td>
<td>RT individual-planning</td>
<td>(2)</td>
<td>5 – 7 m 1 – 3 m 3 – 5 m</td>
</tr>
<tr>
<td></td>
<td>RTs collective-planning</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>RW self-organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kelurahan/</td>
<td>RW individual</td>
<td>(2)</td>
<td>7 ≥ 10 1 – 3 m</td>
</tr>
</tbody>
</table>

3.2 Properties and Features of The Settlement Structure

The focus of self-organization, which regulates and coordinates individual planning and collective or communal planning, is to fulfill common needs such as the need for public space, especially related to accessibility or linking path system. Public spaces are spaces within the settlement area which are accessible to all people.[16] In relation to accessibility, public spaces in form of path and node usually build linking networks. In general, the linking network pattern in Kelurahan Petamburan village appears to be irregular, does not display rules of ordering system that are commonly recognized in planned settlements such as linear, grid, centralized, radial, etc. However, the path hierarchy, which can be identified by path class or path width, can still be identified.
The settlement vector is the area of the village, where theปาติภูมิ is bound by one road. Meanwhile the housepath can be found in the form of a path or intersection of 2 or more RT units. This entrance in the form of a T-junction never faces directly with the entrance of another RT unit. So it is almost impossible to find a 4-lane node or intersection that connects 2 or more RT units. This characteristic of entrances make every single RT unit closed and introverted, which certainly give a higher sense of security.

Each RT or neighborhood socio-spatial unit has an internal path network that connects one plot or building with the other as well as one house-group with the other house-groups within the RT unit.

The entire path network can be a composition of several path sections of 4 - 6 classes. Most RTs (67.7%) have a path network consisting of 5 path classes, 22.2% of RT units have 4 path classes, and a small portion (11.1%) of RT units have 6 path classes in them.

Path classes of RT unit, both peripheral path and internal path consist of: path class of ≥ 10 m, path class of 7 m, path class of 5 m, path class of 3 m, path class of 2-2.5 m, and path class of 1-1.5 m. RT units with 6 path classes have a paths of 1 m - ≥ 10 m wide. RT units with 5 path classes have path widths from 1 - 7 m.

Meanwhile RT units with 4 path classes have path widths of 1-5 m

Most of the internal path sections with 2 – 5 m wide are binding spaces for 2-9 lots or buildings, which are the result of mutual agreement among them. This group of buildings bound by one path section is referred to as a house-group unit within the scope of the RT unit. However, most of these house-groups consist of 5-7 building units. The more number of internal path sections in the RT unit, the smaller the number of buildings or plots in the house-group socio spatial unit. The settlement structure of this RT unit is basically formed from the combination of the internal path sections and the number of buildings that surround it.

These RT internal paths meet each other in the form of 2 lanes nodes (bends), 3 lanes nodes (T-nodes) and 4 lanes nodes (intersections). The number of nodes in one RT unit varies from 1 to 9 nodes. The type of node that dominates the RT’s internal network is the 3 lanes nodes or T-nodes, with more than 70% of the total number of nodes in the study area.

The large number of paths and nodes in a very dense RT unit (with an average building density of 72.88%) indicates that the number of alternative access with a distance as short as possible to one place becomes very important, which can help strengthen social relations among the community in an RT unit. In this case, distance corresponds to face-to-face relation and to density. [18]

Table 1 above shows the mechanism of self-organization (the interaction among individual planning, collective planning, and self-organization) that takes place, the category of self-organization according to the objectives of the development actors, and the characteristics of the connecting network in each socio-spatial unit scale. The characteristics of the connecting path network, which at the same time shows the characteristics of land division, are the main elements forming the unplanned settlement structure. Figure 1, 2, and 3 show the area of the kampung or village unit is restricted or bordered by a large road (7 - ≥ 10 m). RW or community association units are clearly restricted or bordered by environmental roads of 5 – 7 m wide, and most RT or neighborhood units are restricted or bordered by smaller neighborhood path of 3 - 5 m wide. Meanwhile the housegroup within the RT unit is marked by house-units covering a small section of path of 1 - 3 m wide, as a shared space that bound the mikro residential units. From the observation of settlement structure based on the pattern and dimension of the connecting or linking path network, it is clear that the RT or neighborhood socio-spatial unit, with house-groups inside, plays an important role in the process of building this unplanned settlement. The entire linking path network and land division of the Kecamatan Petamburan village is a combination of the linking path network and land division of each RT unit, which has the following characteristics (see Fig. 6):

Fig. 6. An example ‘RT’ or neighborhood unit as an analysis unit shows the characteristics of settlement structure consists of: peripheral path as unit boundary, hierarchical internal path network, multi access points from peripheral path, the form and configuration of occupied site or lots.

References

- Each RT unit has a peripheral path network, which separates one RT unit from another RT unit. This peripheral path builds the border, that represent a bounded solidarity or filters for self-contained bodies.[17]
- There are many alternative access in to the RT or neighborhood territory from the periphery path (RT territory border line). The number of access paths ranges from 2 - 11 entry points, with an average of each RT unit having 6 entry points. This shows that the high level of accessibility in to RT unit territory is very important.
- All entry points in to RT unit territory are in the form of 3 lanes nodes. This entrance in the form of a T-junction never faces directly with the entrance of another RT unit. So it is almost impossible to find a 4-lane node or intersection that connects 2 or more RT units. This characteristic of entrances make every single RT unit closed and introverted, which certainly give a higher sense of security.
- Each RT or neighborhood socio-spatial unit has an internal path network that connects one plot or house or building with the other as well as one house-group with the other house-groups within the RT unit.
- The entire path network can be a composition of several path sections of 4 - 6 classes. Most RTs (67.7%) have a path network consisting of 5 path classes, 22.2% of RT units have 4 path classes, and a small portion (11.1%) of RT units have 6 path classes in them.
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- The large number of paths and nodes in a very dense RT unit (with an average building density of 72.88%) indicates that the number of alternative access with a distance as short as possible to one place becomes very important, which can help strengthen social relations among the community in an RT unit. In this case, distance corresponds to face-to-face relation and to density. [18]
Most of the land use in the village of Kelurahan Petamburan (more than 80%) is in the form of a residential area. Less than 20% of the land is occupied for office and service functions (along city highways), religious and educational facilities.

Although the plots or occupied lands are square and rectangular, overall appear to have an irregular arrangement. However, if we look closely at each RT unit, it can be seen that the characteristics of the plot or building composition in each RT unit vary according to the level of order, ranging from regular, semi-regular and irregular. The higher the level of building density in each RT unit, the arrangement of plots or buildings tends to be more organized.

Occupied lands size varies greatly, which can be grouped into 7 categories, namely: category of 0-40 sqm, 40-80 sqm, 80-120 sqm, 120-160 sqm, 160-240 sqm, 240-320 sqm, and category of > 320 sqm. Most of the land plots in each RT are of 0 - 160 sqm, with 2 - 6 house units (2 - 6 tenement doors) on every single plot.

The building density in each RT unit ranges from 53.08 - 90.93%, with an average building density of each RT of 72.88%. Most RT units (63%) have building density of 60% - 70%.

The number of internal path sections and nodes seems to correlate with the main function of land and the amount of plots/buildings in each RT unit. RT units which are dominated by residential functions and relatively large number of lots / buildings, have relatively more internal paths and nodes.

The findings of this research confirm that local knowledge of the unplanned settlements inhabitants has specific spatiality and play the important role in spatial strategy-making. This understanding about specific spatiality of local knowledge in unplanned settlement structure formation is important to develop interactions between communities and policy makers. Beside the understanding about specific spatiality of local knowledge, various manifestations of self-organization based on diverse objectives of different development actors leads to managing interactions between formal and informal planning or between top down and bottom up planning approaches. The result of this study has also confirmed that socio-spatial patterns are the backbone of unplanned settlements regeneration. Therefore mapping, structuring, and analyzing the socio-spatial patterns as the most important part of unplanned settlement structural network will guide the regeneration strategies of an participatory urban project. This participatory urban project also means a transformative socio-spatial planning, which enable resourceful communities in producing better places. Development strategies must be sought to improve resourcefulness of the community, which means that the community capacity to use their resources effectively and efficiently must be improve. The concept of bordering socio-spatial unit, which is non-finalizable processes, must be understood as constantly creating, confirming, and challenging of socio-spatial distinction. Borders with social institutions or socio-spatial unit in it, must be constantly created, re-created and maintained as a means of negotiating in context of place making proces within a complex everyday life. Based on this concept of bordering socio-spatial unit, one approach to urban planning is reconfiguration or rescaling of the urban settlement and urban space hierarchy, as well as examining political roles and socio-spatial implications of various stakeholder with different interests

The unplanned settlement structures (path systems, land division systems, and building densities) must be understood and described based on the process of settlement evolution that occurs through individual planning, collective planning, and self-organization mechanism. It can be concluded that there is a relationship between the connecting or linking system with the hierarchy of socio-spatial units as the main actors of unplanned settlement development. The path network pattern shows the importance of the neighborhood unit as socio-spatial unit that driven the settlement evolution. The neighborhood unit represent a closed socio-spatial unit with intact social and emotional relationships within its community, where effective self-organization mechanism takes place. Responding to the fact that there is segregation in urban settlement structures, due to the concept of bordering socio-spatial unit, one approach to urban planning is reconfiguration or rescaling of the urban settlement and urban space hierarchy, as well as examining political roles and socio-spatial implications of various stakeholder.

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REFERENCES


Relation. Trialog 100, pp. 24-35, 2009


