Are we facing complex problems or complex solutions? A reflection on urban slum planning through the lens of complexity: A case of Indonesia

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Abstract. This study aims to reflect on urban slums planning and management through the lens of complexity theory by utilizing Indonesia as a case. This study employs a literature review to explore several problems and provide solutions as implemented in the Indonesian urban slums. The two key reflections were underlined. First, the given spatial solutions generate more complexity by its various type of programs and managements. Second, the root cause of the slums is poverty, despite unachieved by the given non-spatial solutions. This study suggests to refashion the planning approach in dealing with the slums problem to achieve SDGs particularly point 1 and 11, while adjusted to adapt with the COVID-19 situation.

1. Introduction
Humans have attempted to create inventions and innovations for higher level of humanity, reaching all fields of life, including urban neighborhood planning and management. However, as the development of new things, applied in an urban area, more problems thus emerged. Layered with major issues, such as urbanization and climate, the root of problems remains inconclusive [1]. These notions generate the problems experienced by the urban stakeholders. As a result, the concerned stakeholders attempt to search for novel ways by adopting several things, such as technologies, tools, and theoretical applications [2]. At first, the solutions were assumed to have an impact on a targeted problem. However, upon the implementation, the impacts of the solution are unknown, thereby generating similar or even further problems in urban neighborhood areas [1]. This phenomenon has thus presented complexity for the urban stakeholders.

In general, the essence of urban planning is to cope with problems by implementing solutions to achieve the ultimate goal in a specific timeframe [3]. Further with this notion, a modern planning practice (started around the post-war era) was initiated to deal with any complexities of the old (industrial) cities as a result of an organic development, forming an irregular street pattern and chaotic zones [4]. Another study Marshall [5] however pointed out that the modern planning practice tends to always reduce the complexity instead of utilizing it by developing an oversimplified technocratic approach, along with planned rules to plan and control the spatial quality of a city. This notion was firstly initiated as a movement led by Jane Jacobs back in 1961, represented by her great book entitled "The Death of Great American Cities". The most important message for urban (neighborhood) planning lies in a complex self-management system in which the modern planning approach has failed to manage [6].

This modern planning approach has been practiced by the Indonesian government to plan their cities by controlling the activity and zone of each city block by applying a rigid planning regulation. Due to
the comprehensive planning approach, the government however is unaware that the planning regulation could not represent the neighborhood area as a complex self-management system [7]. A building and neighborhood planning guideline was introduced by the government to construct a more mezzo-micro plan to deal with urban design at the neighborhood scale. Unfortunately, the plan also adopts a modern planning approach focusing on the development of urban design guidelines without considering the non-spatial aspects required by people in the neighborhood. As stated by Healey [8], simplified spatial-oriented planning cannot capture the social and environmental activities created by the people due to the city dynamic (and neighborhood within it). Therefore, the people as a community who have their notion regarding a good neighborhood has far from experienced the expected result of its implementation.

Thus, the urban planners have to manage with both complex realms, arising from the unknown aspects that fail to be captured, and the complex solutions from planning guidelines developed by the government and its implementation to the complex social system of the neighborhood area [7]. In addition, Batty and Marshall [9] argued that such tension in urban planning and management has encouraged the urban planners to deal with complex problems, offering an ordered approach resulting in simplified solutions, in which it is uncertain whether the solutions can be successful. Based on this condition, an urgency to reflect on the planning solutions is deemed pivotal for urban neighborhood.

This paper aims to reflect on the urban neighborhood planning through the lens of complexity theory by utilizing Indonesian urban neighborhood area as a case. To achieve the objective, the two research questions were formulated, as follows: (1) What are the complex problems and solutions regarding the spatial and non-spatial aspects of urban neighborhood planning in Indonesia? (2) What are the spatial and non-spatial complexities addressing the problems and solutions for the urban neighborhood planning in Indonesia? The result of these questions is further discussed in the global context situation by exploring the implication of this complexity to achieve the Sustainable Development Goals (SDGs), particularly Goal number 11: Sustainable City and Communities and also its linkage to the current COVID-19 pandemic situation.

This paper consists of the six sections, this first section captures an introduction to the research problem, objective, and questions. Section two will elaborate the relevant theories to explain the reflection. The third section will describe the implemented method in conducting this research. Followed by section four which will elaborate the result of this research, and section five will explain the research findings and the correlation with the theories. Finally, a conclusion section will wrap important messages from this paper.

2. Theory

2.1. The complexity of the city

Complexity has been discussed in various scientific disciplines, such as in Physics, Biology, and Psychology to Sociology and Urban Planning [10,11]. From the planning view, there is no consensus towards the definition of the City Complexity and its planning practice. Even, planning scholars have a distinct opinion on whether complexity is regarded as a science or theory or it is just a mere fuzzy word [10], as the city itself is too complex when viewed only from a single conception [12]. From this condition, it seems that complexity presents a complex system. Apart from the no consensus of its definition and the different views, several scholars have defined complexity from their argument.

One pointed out that complexity refers to a system of “non-linear, adaptive, unpredictable but deterministic, dynamic, disordered but having order, integrative, interactive, and self-organizing” [13]. Before this definition, Batty [14] referred to the complexity as a higher-order phenomenon emerging from interactions and relationships among components within a system having a level of each component that represents dynamic processes and structures. Further, Johnson [15] applied the definitions to the city, navigating that the complexity of the city could be best described as the systems of systems. The city as a complex system presents a complex hierarchical spatial level of systems (from the upper ground, the surface, and underground) and spatial level of scales (micro, mezzo, and macro), in which each system interacts with each other dynamically. In this paper, this definition is utilized to express complexity within an urban neighborhood area, which consists of the hierarchical spatial level of systems and scales.
The hierarchical complex system within an urban neighborhood was further explored by Boeing [16], which offered key dimensions of complexity in urban design (see Table 1). There are five dimensions of complexity in urban design, which include: temporal, visual, spatial, scaling, and connectivity, in which each dimension and its interaction among others forms the complexity in an urban neighborhood.

### Table 1. Key Dimension of Complexity in Urban Design [16]

| Dimension | Remark | Examples |
|-----------|--------|----------|
| Temporal  | The change of processes & behavior over time; Unpredictability of human behavior & city futures | Traffic jams, Population growth & decline |
| Visual    | Human perception of the built environment’s visual coherence, scale, interest, order, legibility, & detail | Sense of enclosure, Building façades & signage, Human activity/vitality |
| Spatial   | Land patterns & grain, particularly in terms of diversity | Mixed land uses, Spatial distributions of urban form elements |
| Scaling   | The similarity of structure across multiple scales; fractal patterns | City area-perimeter growth size, Buildings of all sizes, Streets of all sizes |
| Connectivity | Cities’ & citizens’ network organization, connectedness, circulation | Destination accessibility, Street connectivity & permeability, Intersection types & density |

The aforementioned definitions of complexity only elaborate the spatial orientation in the complexity of the city. Whereas, there are non-spatial aspects that add the layer of complexity of the city, such as planning approach and governance. First, related to the planning approach, the complexity was identified as a form of self-management or self-organization, in which complexity emerges a shifting from top-down to bottom-up planning approach, static to dynamic process, maintaining equilibrium to iteratively deal with the non-equilibrium system [5,6,9,11,17]. However, shifting within the planning approach is overruled by modern technocratic planning [17], such as currently adopted by the Indonesian government.

Second, governance is related to the complexity of the city, acknowledged as self-governance [18], as a form of decision-making process led by the citizen or non-governmental actors to achieve a common goal, having the following [18]: (1) internal coordination and no external control, only a little intervention (2) collective movement (3) generated from a deliberative action to achieve common goals (4) predictable outcome (5) individual and collective engagement. Therefore, the governance aspect in the complexity of the city, could be characterized as a citizen and non-governmental bottom-up collective action in an area within a city, focusing on specific problem and solution as a common goal. This concept is in accordance with the governance model developed by [19].

#### 2.2. The urban neighborhood

The neighborhood concept was initially introduced by an American architect and planner, Clarence Perry, in 1929 to cope with the rising problems in automobile transportation, housing environment quality, social cohesion, and family safety [20,21]. Since then, the concept of the neighborhood was developed, with various definitions, characteristic criteria and scales introduced by several scholars [22], such as definition from Mumford [23], Keller [24], and Martin [25] (for a detailed definition analysis, see Perry [22] and Park and Rogers [26]. Even, both the urban planners and people in a neighborhood have a different perspective on defining a neighborhood area, as a basic planning unit in which people conduct personal and communal activities on a daily basis [27].

Comparing the definitions to the condition in Indonesia, neighborhood is spatially defined as an area within a city whose boundary is determined based on a certain function [28]. A neighborhood has different spatial and population sizes, therefore there is no single conception that can be adopted to define such term [26]. According to Indonesian National Standardization Agency [28], a neighborhood is equal with an administrative area, locally acknowledged as “Kelurahan” containing around 30,000 people, which, hierarchically, consists of elements such as hamlets or “RW” / “Kampung” (containing around 2,500 people) and “RT” (containing around 150-250 people).
For this paper, the neighborhood is particularly defined as a complex interaction of spatial and non-spatial aspects in an “RW”/”Kampung” scale containing around 2,500 people, in which the inhabitants could obtain their basic needs and social needs supported with good environmental quality fulfilling certain characteristics. Therefore, this paper will focus on: (1) the interaction between spatial and non-spatial aspects of an urban neighborhood; (2) the formal (planned residential area) and informal neighborhood (Urban Kampung); (3) the complexity in planning the neighborhood area. Regarding the formal and informal neighborhood, there are at least three typologies, comprising formal neighborhood (such as: gated community and planned residential area), informal non-slum neighborhood area (such as organic settlements in the inner city), and informal slum neighborhood area (such as slums and squatter settlements in riversides and railway sides [29,30].

3. Research method
A literature review was implemented to compile data related to the common problems and common solutions, emerging in an Indonesian urban neighborhood area. Furthermore, this paper additionally explored the common outcomes of the solution(s) implementation. A literature review refers to a process of data collection and synthesis of various previous studies for knowledge and theory development [31,32,33]. The three types of approaches were applied in a literature review, including: systematic, semi-systematic, and integrative. This paper particularly applied the integrative approach, aiming to synthesize previous studies, which include all online published texts conducted by performing a qualitative method and classification of aspects, and analyzed by using a coding technique.

The information was collected from both online official documents and online scientific publications from google and google scholars. Google scholars were utilized for this purpose as it accommodates wide arrays of sources ranging from scientific articles and official reports from the government, private consultants to civil society. Several keywords were applied to navigate the literature both in English and in Bahasa Indonesia (see Table 2). However, the navigation process presented a challenge as there was no firm meaning on the term such as "neighborhood" in Bahasa Indonesia. Additionally, it appears that the essential definition of the neighborhood is not adapted in the Indonesian planning system; thereby generating the misinterpretation in the result of this study. From around 52 documents gathered from the data collection, there were only the reviewed 43 documents. mostly contained information on problems and solutions related to the urban neighborhood slum area, due to inadequate information regarding the Indonesia urban neighborhood problems and solutions. The documents are generally dated between 2007 and 2020.

| Language      | Keyword(s)                                                                 | Remarks                        |
|---------------|---------------------------------------------------------------------------|--------------------------------|
| English       | “Problems in Indonesia neighborhood”                                      | Only 1 specific document emerged|
|               | “Problems in neighborhood planning implementation in Indonesia”           |                                |
| Bahasa Indonesia | “permasalahan lingkungan permukiman perkotaan di Indonesia”              | There are more than 50 documents gathered |
|               | (“urban settlement problem in Indonesia”)                                 |                                |
|               | “permasalahan penataan lingkungan permukiman di Indonesia”               |                                |
|               | (“neighbourhood arrangement problem in Indonesia”)                       |                                |

A content analysis was conducted to reveal the frequency of topics or themes (referred to the aspects) that emerge in the gathered literature [34]. In addition, this paper utilized an open coding technique assisted by Atlas.ti software to gather important words related to the research questions. The coding was conducted by dividing the content of the literature based on two divisions, which covered: problem (P) and solution. There were the 25 aspects generated in the problem category; whereas, in the solution category, there were 49 aspects generated with a different number of emergences. From the generated aspects, for the problem category, this paper solely applied the aspects, emerging for more than five times from all literature, as such number of emergences indicates data reliability to represent most problems in the observed field. For the solution category, this paper applied the aspects that emerged for more than one time from all literature. It is assumed that solution appearing more than one time in different documents offers more favorable solutions addressing the problems (see Table 3).
Table 3. Aspects Generated from Qualitative Data Analysis

| Category | Aspects |
|----------|---------|
| Problem  | 1. Lack of wastewater management  
2. Slum area  
3. Lack of clean water provision  
4. Lack of solid waste management |
| Solution | 1. Vertical housing development  
2. Community-based neighborhood development  
3. Collaboration between stakeholders  
4. Urban neighborhood regeneration  
5. 100-0-100 program  
6. Kota Tanpa Kumuh (KOTAKU) Program  
7. Neighborhood Upgrading and Shelter Sector project  
8. Law enforcement  
9. Resettlement program  
10. Sustainable development goals |
|          | 5. Lack of drainage utilities  
6. The high rate of poverty  
7. Lack of basic utilities and facilities  
8. Unhealthy neighborhood  
9. Illegal housing  
10. High disaster risk |

4. Result and discussion

The conducted literature review reveals that most online official documents and scientific publications discuss the topic of the urban slum area. This result reflects that most governments and scholars have focused more on the slum area than the informal non-slum area or the formal neighborhood area. This finding is sensible because the formal urban neighborhood area in Indonesia is generally well-planned and well-developed. Regarding the informal non-slum neighborhood area in Indonesia, several issues are required to be addressed, but this neighborhood is generally well provided with basic utilities and facilities. Issue emerging from the area lies in the social and economic condition and its support to the bigger area or the city [35]. Hence, this paper will focus more on the urban slum neighborhood area. This paper however does not focus on one specific city or slum area. Hence, an example of a certain case will be elaborated to support the result in accordance with the previous researches.

4.1. Complex Problems and Solutions in Spatial and Non-Spatial Planning

Spatial Problems and Solutions

The 7 spatial problems and 13 solutions that emerged from the analysis (see Table 4). Regarding the problems, most aspects refer to utilities of the neighborhood area, such as wastewater, clean water, solid waste, drainage, and other utilities and facilities that support, representing the lack of basic infrastructure in the area. The other problems relate to the unplanned area (the slums) and disaster risk as a consequence of the lack of basic infrastructure and low planning intervention. Regarding the solutions, several programs and approaches were conducted to cope with the problems over time. However, the 13 solutions had been similar, indicating the tendency to overlay each other in which complexity can be seen here.

Table 4. Spatial Problems and Solutions for Urban Slum Neighborhood Area

| Category  | Aspects |
|-----------|---------|
| Spatial Problems | 1. Lack of wastewater management  
2. Slum area  
3. Lack of clean water provision  
4. Lack of solid waste management  
5. Lack of drainage utilities  
6. Lack of basic utilities and facilities  
7. High disaster risk |
| Spatial Solutions | 1. Vertical housing development  
2. Urban neighborhood regeneration  
3. 100-0-100 program  
4. Kota Tanpa Kumuh (KOTAKU) Program  
8. Neighborhood-based Housing and Settlement Intervention program  
9. Property Development approach  
10. Slum and Squatter Improvement Program |

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Reflecting on the result, the list of the problem reveals the complexity regarding the physical development and the management of each component; thereby generating the difficulty to develop a proper underground utility network (such as wastewater, clean water, and drainage network) and to manage the utilities (such as, solid waste management). Consequently, the area becomes a slum, and is vulnerable to disaster. An example includes a slum area near the river (such as, Kampung Code in Yogyakarta) depicting a high risk and vulnerability to floods, landslides, and even epidemics such as malaria or dengue suffering from meeting the basic utilities. Hence, generating solutions to unpack the complexity in the basic infrastructure provision is deemed instrumental.

The proposed solutions aim to unpack the complexity, thereby generating a new complexity through various types of programs, management, networks, administration, tools, communication, and approaches. For instance, a vertical housing development program is proposed to offer a solution in vanishing the slum, further transformed into a well-planned and high-density area. However, there are new problems emerge, such as the community’s reluctance to move to the new housing, the affordability, the administrative issues, and the social-cultural issues. Therefore, the solutions merely transform the spatial problems into the non-spatial problems.

**Non-Spatial Problems and Solutions**

There are the 3 non-spatial problems and 8 solutions that emerged from the analysis (see Table 5). Regarding the problems, the most highlighted aspect lies in the high rate of poverty as a fundamental reason for the emergence of the slum neighborhood area, hindering the community or resident to afford a healthy neighborhood with legal housing. Therefore, it is assumed that these non-spatial problems became the root of both spatial and other non-spatial problems. For instance, rural people who urbanize to a city tend to have a low income, only covering the rent of a cheap house in undesirable area, such as in the slums. If they succeeded and got a higher income, they will tend to leave the area. Yet, if they failed the urbanization process, generating only the low income, they will tend to stay and even expand the slums by building a house to accommodate their family size.

Regarding the solutions, various programs and approaches were conducted to cope with the problems over time. However, most of the programs have not addressed the root of the poverty problem. Most solutions tend to give a specific intervention (such as community-based neighborhood development, collaboration, law enforcement, affordable housing, and land-related programs). Yet, other solutions have been perceived to be too broad and general (such as: sustainable development goals and new urban agenda). The proposed solutions seem to be failed to address the root problems, since the government fails to navigate the root cause. Consequently, it adds other complexities in intervening the urban slum neighborhood area.

**Table 5. Non-Spatial Problems and Solutions for Urban Slum Neighborhood Area**

| Category               | Aspects                                      |
|------------------------|----------------------------------------------|
| Non-Spatial Problems   | 1. The high rate of poverty                  |
|                        | 2. Unhealthy neighborhood                    |
| Non-Spatial Solutions  | 1. Community-based neighborhood development  |
|                        | 2. Collaboration between stakeholders        |
|                        | 3. Law enforcement                           |
|                        | 4. Sustainable development goals             |
|                        | 5. Affordable housing program                |
|                        | 6. Guide land development                    |
|                        | 7. Land consolidation                        |
|                        | 8. New urban agenda                          |

4.2. Complexities in Urban Neighborhood Planning

**Complexities in Spatial Planning**

This study refers to Boeing [16], affirming that complexity in neighborhood spatial planning is observed in the four aspects, which comprise: temporal, spatial, scaling, and connectivity. In addition, the discussion of this section will be based on these five aspects to reflect on the spatial planning complexity.
both in the presented problems and the proposed solutions (see Figure 1). First, the complexity in the temporal aspect emerges in all spatial solutions to cope with the spatial problems, in which most of the programs indicate a certain timeframe, highly dependent on the authority/expert/facilitator. Hence upon the program completion, there is no guarantee that the spatial intervention is properly continued and maintained by the inhabitants, as Boeing stated that the neighborhood frequently faces a change of process and unpredictable human behavior over time. Second, the complexity in spatial aspect is demonstrated in the problems, such as: lack of basic utilities (such as clean water, wastewater, drainage, and solid waste infrastructures) and different facilities (such as: small shops and open space). These basic utilities and facilities have presented a challenge to be properly provided, developed, and managed in a slum area because the current built area has a complex structure. Third, the complexity in the scaling aspect emerges on the configuration of the slum area, connecting to both smaller scale (such as: on-site sanitation and communal space) and larger scale (such as: rivers, city-regional networks, and economic activities). Therefore, such realm indicates that the complexity of the hierarchical system [15] is required for an integrated and comprehensive system of intervention. Finally, complexity in the connectivity aspect is depicted by the accessibility of inhabitants in accessing wider streets (such as: local and secondary city roads). Thus, this becomes complex as most urban slum neighborhood areas do not have a well-developed route and clear street configuration.

Figure 1. Spatial Complexity and the Intersection between Spatial Problems and Solutions

Complexities in Non-Spatial Planning
Based on the theoretical framework elaborated in section 2, the complexity in non-spatial planning is observed in two aspects, comprising planning approach and governance (see Figure 4). First, related to the planning approach, it is obvious that the problems emerge from the people (the bottom), whereas the solutions are generated from the government or other stakeholders (the top). Yet, the top-down solution fails in addressing the root problem within the neighborhood area. Similarly, the government and other stakeholders are less empathetic with the local inhabitant’s issues and needs. Even if they accommodate the opinions of the local inhabitants, not all aspirations are implemented in the program, confirming the reason on why the generated solutions fail to address the root cause of the non-spatial planning aspect, such as poverty. However, poverty is also acknowledged as a complex problem causing the emergence of urban slum areas and other indirect things to urban slum neighborhood areas (such as: less educated inhabitants and less access to the financial facility). The problem is solvable in these complex systems by applying a more bottom-up approach, such as self-organization [17], co-creation [37], social innovation [38], or tactical urbanism [39] for the urban slum neighborhood area. In this way, a more specific solution to address the root cause of the non-spatial planning category could be generated, instead of frequently proposing the top-down solutions. This is because the approaches are implemented by involving the local inhabitants at the core during the planning, the implementation and the maintenance process.

Second, related to governance, there are various stakeholders (both government and non-government) collaborated in the slum area to provide the solution. Unfortunately, they do not coordinate with each other, therefore the generated solutions often overlap and are not effective. Reflecting on the identified solutions in Table 5, it is apparent that the government is unaware when dealing with a complex system, lacking a practical strategy to deal with the complexity by merely utilizing a bottom-up approach [18]. Furthermore, reflecting on this situation to the governance model of Newman [19], it could be argued that the current urban slum neighborhood area in Indonesia is planned under a hierarchical governance model. This model only fits with the characteristic of top-down solutions and
procedures with a strong role of bureaucracy or established institutions in solving the problems. This phenomenon thus contradicts with the governance model to cope with a complex system, which is the self-governance model that builds on a bottom-up initiation and empowerment with cooperation among the non-government actors.

![Diagram](image)

**Figure 2.** Non-Spatial Complexity and the Intersection between Spatial Problems and Solutions

### 4.3. Concluding Remarks

**The complexity of Urban Slum Neighborhood Planning**

Complexity in urban slum neighborhood area was initialized from the non-spatial category, in which most inhabitants had low income leading to poverty and the inability of people who migrated to the city to either rent or buy a proper house within the city. Slums indicated prominent evidence of this condition, spatially located in an undesirable area, and lack of basic utilities and facilities leading to a higher risk of disaster (such as: fire and flood) and unhealthy environment (such as: low quality of air circulation and hygiene). These problems thus create a complex system by influencing each element (the non-spatial to the spatial elements, and vice versa), generating the back and forth of "wicked problems" in the interplay of certain and uncertain situations, stimulated by human behavior leading to dynamic process [16,40].

Upon observing such complex spatial and non-spatial problems, mostly, the government endeavors a huge part to generate solutions to deal with the problems. However, the situation creates a more complex issue, in terms of program types. For example, from 1969 to 2014, in total, the Indonesian central government has executed at least 8 grand programs for intervening urban slum neighborhood area with different names and approaches [41,42], yet there are slums in most of the Indonesian cities (such as in Jakarta, Yogyakarta, Kendari, Malang, and Surabaya). This finding is in line with prior studies by Bathari, Limba, and Mustafa [43] pointing out that most of the government programs created the confusion among the field executors and inhabitants, due to the overlapping programs between the central, provincial, and city government with a different kind of governance and actors involved in transforming the provided solutions into new problems, thereby arising to the complex non-spatial system. It seems that a top-down solution creates a fuzziness in the implementation process, hence it fails to address the root problems, which is poverty, yet they focus more on the spatial-related interventions that do not focus on the root cause (such as community-based development and law enforcement). All in all, it reveals that both complex problems and complex solutions within urban neighborhood planning are inevitable, further circulating a complex hierarchical system and spatial scale levels.

These root problems and complexities have thus to be urgently noted by the decision-makers, when intending to achieve the slum dwellers indicator in SDG 11. United Nations [44] stated that 24% or world urban population reside in slum areas. The highest slum dweller is in low-income countries within Eastern and South-Eastern Asia, Central and Southern Asia, and also sub-Saharan Africa [44]. Therefore, policies and strategies developed by all agencies in the countries (Central Government, Local Government, International NGOs, and Local NGOs) should not solely focus on the provision of utilities but more on increasing the urban slum inhabitant’s income. It means that the policies and strategies to achieve the SDG goal 1 of No Poverty, have to be focused on the urban slum inhabitants, while, at the same time, the city authority should provide the affordable housings for affected slum dwellers. By doing so, it is feasible that the interventions towards urban slum neighborhood area will cover the achievement of both SDG goal 1 and SDG goal 11.
Planning with no Plan: Towards Self-Organization Neighborhood Planning

The complexity of urban slum neighborhood planning encourages an urgency to refashion the approach towards dealing with complex slum problems. This condition has been simply explained by an argument stated by Friedmann [10] that planning in a dynamic and rapid changing system in low-income and middle-income countries is similar to “walking in a dark path”, especially related to establishing a database as the main source of planning and creating a low margin of error in data analysis. Instead of reducing the complexity and making the simplistic approach, planning would be wiser to embrace the complexity and to identify the benefit in generating the proper planning approach, thereby preventing a new problem and a complexity [5]. As in such a complex system, the urban planners would barely observe the whole system, the effects of their intervention (positive and negative impacts of the solutions), and the optimal condition of the future (the overall outcome of the plan implementation). Recognizing the benefit of complexity would feasibly create a more effective plan [5]. The benefits of complexity are perceptual richness (complexity invites various perceptions for the people), functional capacity (complexity enables more chance to increase the function of a city element), and the added value of synergy (complexity allows the opportunity to add more synergy among city elements and benefit the people) [5].

By understanding the complexity and its benefit for urban neighborhood planning and management, this paper suggests that urban planner has to readily to plan without a plan, meaning that they would be forced to not develop a simple plan, alike the traditional or modern planning (such as in creating zoning, codes, and masterplan). Instead, they have to adapt to the reality in the field and start to work with the local inhabitants in a “blank canvas” (leaving their notions on the best plan that the urban neighborhood might have). In this way, the planning approach will shift from top-down to bottom-up, or, in the context of complexity, self-organization or other similar approach to a more reliable and effective means [17]. In the context of urban slum neighborhood management, the self-organization is potential to be conducted by encouraging the government and its planners as a facilitator opening local inhabitants’ visions on the root problems, by collectively generating and implementing concrete solutions [45]. Additionally, it has to be noted that this approach will only work if there are no other interventions to the area (such as another program from the central government, private consultant, or NGO). It has to be a single activity that is collectively conducted by multiple actors, yet the local inhabitants themselves will choose their future paths. As Friedmann [10] stated that the inhabitants basically could appropriately organize their neighborhood without depending on intervention from the outside, the only required thing lies in an awareness of the root problem, which is lack of prosperity.

This approach is also in line with the current COVID-19 pandemic situation, in which over 90% of COVID-19 cases are in urban areas [46,47]. During this situation, the city government tends to focus their programs on handling the COVID-19, thereby ignoring the quality of life of the slum area inhabitants. For example, in 2020, the City of Yogyakarta focus their programs on the healthcare system, COVID-19 tracing, educational system, macroeconomy, and social security system. Hence, the government does not have resources to focus on the urban neighborhood quality, especially the slum area. Moreover, it is more threatening for the urban slums inhabitants as the area usually has a high density with low hygiene [48]. In this situation, a self-organization approach is regarded to be more effective than a top-down approach, as it gives room for the inhabitants to manage their daily problems and necessities during the pandemic situation, facilitated by the urban planners. Therefore, the government is required to develop a program that can accommodate the local inhabitant’s aspirations.

5. Conclusion

This paper aims to reflect urban neighborhood planning through the lens of complexity theory by identifying various complex problems and solutions that emerged in the spatial and non-spatial aspects of Indonesian urban neighborhood and various spatial and non-spatial complexities that emerged in the problems solutions. At first, the term urban neighborhood was stated in general, based on the three typologies, including formal, informal non-slums, and informal slums neighborhood areas. However, the literature review reveals that most official and scientific literature were focusing more on the urban slum neighborhood area, which tends to have significant problems and solution interventions both for
spatial and non-spatial categories. Hence, this paper highlights more attention to the complexity of the urban slum neighborhood area.

Upon addressing to the first research question, it reveals that, in the problem category, there are the 25 generated aspects, whereas, in the solution category, there are the 49 generated aspects with a different number of emergences. From that number, there are 7 problems and 13 solutions in the spatial category. In this category, the prominent problem lies in the lack of basic utilities and facilities (such as, clean water, wastewater, and solid waste infrastructure). Meanwhile, the most prominent solution is a vertical housing development. Whereas, there are the 3 non-spatial problems and 8 solutions. In this category, the prominent problem is poverty (in low-income inhabitants); while the most prominent solution is community-based neighborhood development.

Upon addressing the second research question, there are at least two reflections that have to be underlined. Firstly, the given spatial solutions mostly want to unpack the complexity of the lack of basic infrastructure, yet it makes a new complexity by its various type of programs, management, networks, administration, tools, communication, and approaches. Second, the root cause of the slums comes from the non-spatial category, which is poverty. However, most of the given solutions fails to address the issue. Instead, most solutions tend to give either specific intervention or too general policy. It seems to become the main reason why many solutions fail to increase the quality of urban slums. As most of the solutions are based on a top-down approach, it is claimed that the governments (central, provincial, and city governments) do not see the root cause, and this is one of the complexities in planning intervention. Additionally, it reveals that we face complex problems and complex solutions within urban neighborhood planning. Both create a complex hierarchical system and a complex level of scales. By taking this result, governments in low-income and middle-income countries can achieve both SDG 1 and SDG 11 in parallel, as the government will also need to develop policies and strategies to increase urban slum inhabitant’s income while managing the slum area.

In sum, to make planning part of the solution and not to add more problems, there is an urgency to refashion the planning approach towards dealing with complex slums problems. Planning would be wiser to embrace the complexity by considering that the whole system of the neighborhood and its interaction to the city and region remains inconclusive in a complex system. Therefore, urban planners are encouraged to recognize the benefit of complexity for a more effective urban neighborhood plan, generated with the appropriate planning approach. It is suggested that urban planner has to be ready to plan without a plan, by developing a simple plan such as in traditional or modern planning by adapting with the condition of inhabitants as a "blank canvas" as the best plan. Hence, the planning approach will shift from top-down to bottom-up, implementing a self-organization approach. In the context of urban slum neighborhood planning, the self-organization is feasible to be conducted by positioning the government and the urban planners as facilitator, opening inhabitants’ visions on the root problems and collectively generating and implementing concrete solutions. Therefore, planning is inevitable part of the solutions and the citizen of the city. This approach is more effective to be adopted in the COVID-19 situation, in which the inhabitants could list their daily problems and needs collectively fulfilled by the government.

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