

Implementation of Smart Co-Housing Concept in Middle-Aged Adult Community in Indonesia

Try Ramadhan¹, Dindha Nirmalasari², Mutiara Ningrum², Beatrice² and Heince Andre Maahury²

¹ Architecture Program, Faculty of Civil Technology and Planning (FTSP), Universitas Kebangsaan

² Master Program in Architecture, School of Architecture, Planning and Policy Development (SAPPK), Institut Teknologi Bandung

Email : tryyramadhan@gmail.com

ABSTRACT : The population of productive age will reach 70% in 2020-2030, while the remaining 30% is unproductive population (under 15 years and above 65 years). The increasing number of population will affect on increasing housing needs, whereas if viewed from the availability of land, it will be difficult to realize a private housing that will required land is large enough for each family. When faced with other phenomena, the productive age composition is filled by a year old aged of 35-60 years and dominated by a millennials generation. This generation is very open and accustomed to the use of technology in daily life. The proximity of millennial generation with technology will revolutionize the way of human life, especially how to settle to influence the growth of housing and urban in indonesia. Therefore, with regard to the problem of increasing housing needs due to the explosion of population in Indonesia, if faced with demands of technological demand as a lifestyle of millennials, the concept of 'smart co-housing' which is the concept of a decent and integrated residential housing that can consist of several families. Smart co-housing contains two concepts of house concept, which are smart house and shared house. Smart house is a concept of houses that apply technology application and directed into the eco-friendly housing because there is control of energy consumption. Meanwhile, house sharing is a residential concept combining of multiple families with the sharing of private and public spaces as a communal spaces. This research uses a descriptive method that examines the concept of smart co-housing to make a description of the concept systematically later compared to similar phenomena that have occurred in other countries (comparative study) to determine the potential and challenge of the implications of this housing concept in Indonesia. The results of this study indicate that the smart co-housing concept can be applied in Indonesia as a solution of increasing housing needs for millennials in middle adulthood, in terms of economic, social, and environmental aspects.

Keywords : Demographic bonuses, co-housing, middle-aged adult, smart housing

1. INTRODUCTION

A demographic bonus is a condition when the composition of the population with a productive age (15-65 years) reaches the maximum point, compared with non-productive age (0-14 years and above 65 years). Population projection data shows that the demographic bonus in Indonesia is expected to occur in the time span from 2020 to 2035 (Jati, 2015, Geo, 2012). According to the projection of population conducted by Central Statistics agency, the number of Indonesian population in 2025 will be 273.2 million. In the same period of productive age, 15-64 years of age increased from 66.6 percent to 68.7 percent and for seniors, those aged 65 and above rose from 4.9 percent to 8.1 percent. This arrangement resulted in a dependency ratio falling from 50.1 percent in 2005 to 45.6 percent in 2025 (Badan Pusat Statistik Indonesia, 2013 & Badan Pusat Statistik, 2012).

The productive age composition is filled by the age of about 35-40 years old and ending around 60 years of age, that age is characterized by the physical and mental changes (Jahja, 2012). Middle aged was filled by a generation called millennials (Shahreza, 2017). Adult characteristics at this age generally have a family with a certain number of children who need shelter to settle. This generation is very open and accustomed to the use of technology in daily life.

The development of Information and Communication Technology (ICT) in Indonesia is driving people to live practically and efficiently as community needs can be accessed with smartphones that have revolutionized the way of human life from socializing, ways learning, how to work, how to do business and how to settle so that it affects the growth of housing and urban in Indonesia (Damanik, 2016). The development also reform the operational process from conventional to digital, mobile and virtual, so it can help effectively improve the quality of human life and indirectly require human to use it in

various activities. The role of technology if applied and used appropriately, which is very important in Indonesia that is moving towards information or community-based knowledge (Ngafifi, 2014).

In this generation, a consumptive lifestyle leads to great energy use in daily life (Noor, 2016). It can be seen from the projection of the final energy needs of households in 2025 according to the Ministry of Energy and Human Resources, reaching about 38 million toe, even reaching 97 million toe in 2050. Energy needs in the household sector is dominated by electrical energy needs that continue to grow by 7% per year (in 2050 electrical energy needs are estimated to reach 84% of the final energy needs for the household sector). Energy needs in the household sector are distinguished for the need for cooking, lighting, air conditioning, refrigerator, TV and other household appliances (Sekretariat Jenderal Dewan Energi Nasional, 2016). The use of energy is still using energy derived from fossils that cannot be renewed.

In response to the rapid development in the digital age, utilization of digital technology to improve efficiency and productivity in energy consumption in the household sector needs to be implemented. The concept is called "Smart Housing". This concept can be applied to various cities in Indonesia integrated, as a solution to solve the problems of housing and urban areas in Indonesia along with the growth of the community in the middle-aged adult group. This concept is considered able to restrict energy consumption in residential with advanced and appropriate technology in the modern house system. In addition, the concept is also able to fulfill the latest lifestyle with various equipment that is able to improve the quality of life of its occupants (Buys, 2005). The concept of Smart Housing has been popular in developed countries. Now, the concept of Smart House has been brought to Indonesia by the developers to attract consumers to the property products offered to be a unique attraction for those who live in large cities.

In addition, another problem with the demographic bonus phenomenon is the increasing need for housing. This is caused by an increase of the population and households in Indonesia. Actually this matter has become the attention of the government and is considered a problem of housing "backlog". In general, the housing "backlog" can be interpreted as a condition of the gap between the number of houses built and the number of houses needed by the people. In 2016 the number of backlogs in Indonesia reached 11.4 million units (Rosa, 2014). The housing backlog is calculated based on the concept that one housing unit per household or head of household (Rosa, 2013). Through the one million house construction program per year carried out by the Ministry of Public Works and Public Housing, in 2016 the government is targeting the construction of 700,000 housing units for low income people (MBR) as well as 300,000 housing units for non-MBR people (Budi, 2018 & Direktur Permukiman dan Perumahan, 2015). The government program continues to run with the involvement of various SOE and private stakeholders in its development. The problem of the need for housing is not only about in meeting the quantity of housing needed but also the quality of housing physically and socially.

Faced with the phenomenon of demographic bonus and land availability, it will be difficult to realize private housing that will require a large enough land for each family. Therefore the direction of housing development can be more community-based or sharing, that is, residential which consists of more than one or two families in one location. Based on the phenomenon of increasing population and increasing number of families in the 21st century based on the phenomenon of demographic bonus, community-based housing such as co-housing can be a sustainable solution to accommodate the needs of housing provision. The concept of co-housing is considered to be able to solve the problem based on the needs of house providing (D. J. Williams, 2005) The concept of co-housing is a concept of housing by gathering people who are interested to live in one location and then build it together and live together as well. This concept emphasizes the very strong social aspects of housing, from the land determination, planning, construction, operational to residential maintenance stages carried out together.

The various problems mentioned above resulted in the need to study both concepts. The concept of smart house is considered to be able to accommodate the needs of millennial society with sophisticated and appropriate technology that is efficient in residential energy consumption. The concept of co-housing is also considered to be able to answer the problem of providing housing by gathering several families in one location and then building it together. Therefore, it is important if the two concepts can be seen as a unity into the concept of "smart co-housing". The concept of 'smart co-housing' is a

residential concept that basically combines the idea of smart housing and co-housing. This concept consists of private space and public space which are mutually integrated with appropriate technology that can accommodate the needs and activities of its inhabitants. This concept can be a solution that is expected to not only increase the amount of housing provided but can also accommodate the needs of middle age millennials in the future. Although this concept is quite good, it is necessary to study its suitability for the character of middle age groups in Indonesia. Therefore, this study intends to see the suitability of the concept of "smart co housing" to be applied to middle age groups in Indonesia. The aim of this research is to describe the concept of smart co-housing aimed at middle-aged community groups, and to uncover the potential of the implementation of the concept of smart co-house as a solution to the problem of residential adult middle age groups in Indonesia.

2. METHODS

This study has a problem formulation of implementation suitability of smart co-house concept in mid-adult community groups obtained from occupancy factors, including price affordability, accessibility, physical quality of buildings and environment, environmental and social quality, building technology applied.

This study uses qualitative research methods that are descriptive-exploratory in nature (Creswell, 2003, & Groat & Wang, 2013). Descriptive research methods are methods that systematically describe a situation, problem, phenomenon, service or program, or extract information about a condition of a settlement or community or describe a norm of a particular issue (Kumar, 2011). According to Whitney (1960), the descriptive method is fact finding with the correct interpretation. Descriptive research studies problems in society, as well as the procedures that apply in society and certain situations, including relationships, activities, attitudes, views, ongoing process and the effects of a phenomenon (Whitney, 1946).

Explorative research aims to find, explore and identify the concept of smart shared houses that have not been applied in Indonesia. This study begins by first describing the concept of smart shared houses by collecting text data about the concept of smart houses and precedents, the concept of shared houses and precedents, formulating the concept of smart shared houses and analyzing potential applications using SWOT analysis (strength, weakness, opportunity, threat), so we get the 2 sides effect of the application of this concept, namely the positive and negative potential. Text data analysis was performed using the literature review method through the axial coding approach. This axial coding approach is carried out to search for key words contained in the application of concepts in various countries (Pusat Litbang Permukiman, 2009).

3. RESULTS AND DISCUSSION

3.1. The concept of co-housing and smart housing

3.1.1 The concept of co-housing

The concept of co-housing is a concept of dwelling that began to be known in Indonesia as the concept of shared dwelling. Co-housing is an innovative form of accommodation. This residential concept provides economic, environmental and social benefits over the existing forms of development (J. Williams, 2008). This concept has been widely applied in Europe, America, Japan and other developed countries. In America, this concept has been applied since 20 years ago as an innovative form of housing. Also found, in Denmark, the concept of co-housing has developed since the 1990s, which has also developed into a residential area that also develops for single people and the elderly (Lojaya, 2019). The concept of co-housing is a concept that contains 4 definitions of occupancy, including (McCamant & Durrett, 1989):

- a. Social contact design (SCD), occupancy includes physical design that accommodates users to have an awareness of community life and collaboration between families who live together.
- b. Extensive common facilities, housing still contains various zones of space that meet the needs of residential houses, but in the zone of public and semi-public spaces the function of space is integrated with community functions that accommodate the needs of several families living in the dwelling.
- c. Residents contribute and participate directly in the process of accepting members of the residential community, production, and building operational processes.

- d. Collaborative lifestyles, housing to accommodate lifestyles that mutually meet the needs of family members (inter-dependence), living and social systems that support each other, as well as the responsibility of security and comfort of living together.

The concept of collaborative housing has an understanding (Stratmann, Ferreiro, & Narayan, 2013):

- a. Community co-housing is designed, managed, maintained and managed by community members,
- b. Elements of planning and design community co-housing combines and fosters a strong sense of community,
- c. Through its design co-housing can be an optimal platform for collaboration, sharing, and participation.

Housing with the concept of co-housing divides the area of the house into 3 parts, which is public, semi-public and private area. Public areas, for example, are shared parking spaces and living rooms where all families receive guests. Semi-private areas are shared dining areas, parks and open areas where children play, shared kitchens, and other facilities such as warehouses and storage areas. In addition, semi-private areas can also be developed according to the needs of its inhabitants. For private areas, in the form of bedrooms, living rooms and small kitchens that become personal authority for each family.

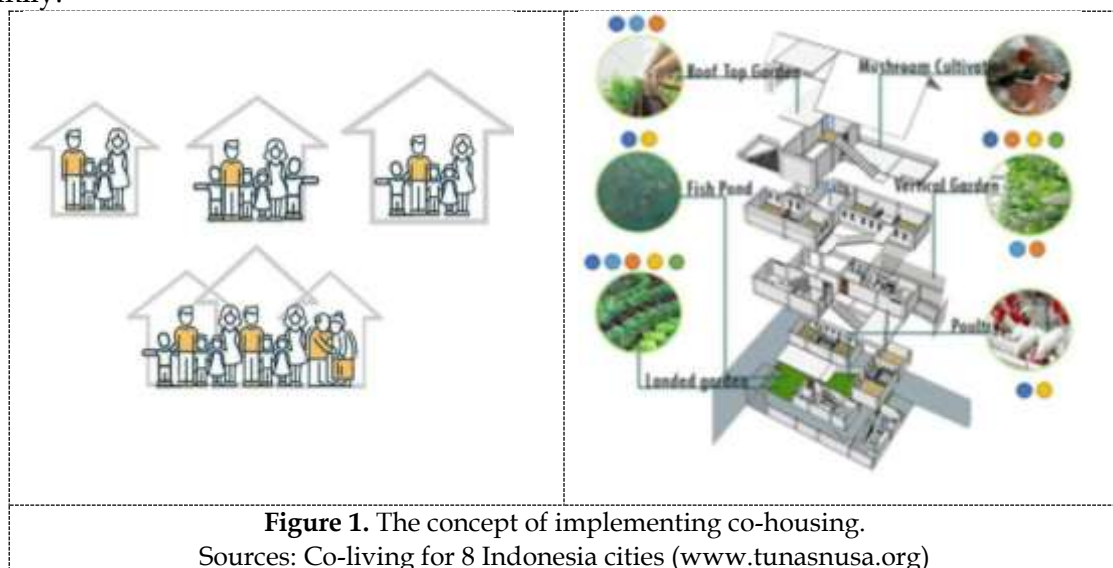


Figure 1. The concept of implementing co-housing.

Sources: Co-living for 8 Indonesia cities (www.tunasnusa.org)

The idea of the Co-Housing concept is to develop a housing complex by gathering people who are interested to live in one location and then building it together. The planning process can also be carried out with a process of deliberation among the prospective occupants. One of the advantages of following the Co-Housing concept is that we can adjust how much we want to build the cost of housing. The impact is the overall costs incurred will be far more efficient than buying a house at the developer. And also this concept allows each family member to work together in producing food obtained from the development of green land in their houses. The concept of co-housing has several benefits, including:

- a. Security and environment that support each other. The concept of shared housing will increase security and increase support between families who live together, because living together will increase the sense of security and mutual care for one another, even when one family is traveling.
- b. Expand opportunities for social interaction. The concept of co-housing will increase interaction between families and will increase cooperation so that more benefits will be obtained.
- c. As a way to contribute to social and environmental life. Co-housers will give each other the opportunity to share their skills and knowledge with other members such as cooking, gardening, music, repairing bicycles, or other household needs.
- d. Providing opportunities to share. By sharing resources, people living in cohousing have more access to facilities than they do themselves.
- e. Assist in the task of parenting. Co-housing is the ideal way to raise children and with the support of others - especially for single parents. Children have a safe place and suitable facilities for playing

outside their home. Children have playmates in their community. Parents have relatives and friends to share the task of caring for children.

- f. Environmentally friendly. Sharing resources with other family members can reduce the environmental burden. Work as a group, opening more opportunities to reduce, reuse, and recycle.
- g. Save land for buildings and increase allocations for green land. By collaborating and combining houses, the co-housing community will allocate more green space in their home environment.
- h. Decreases middle life. Shared meals, bulk buying, sharing of resources such as car pooling, sharing baby-sitting, trading goods and less trading due to more on-site activities are some examples of how daily living costs can be reduced.
- i. Save time. Co-housers have more free time due to eating together, shared assignments, less travel time due to more on-site activities, and less time caring for children.
- j. Involving family members to participate in community management deliberations. Decision making is done together by empowering all family members. So that all points of view can be considered in planning and managing the community.
- k. Facilitating inter-generational communication. Living with people of all ages provides a diversity of experiences for both young and old.

Precedent: Share House LT Josai by Naruse Inokuma Architects

Naruse Inokuma Architects said the building was designed in response to increase the demand for houses, where unrelated individuals can share kitchens, living spaces and bathrooms. Encourage people to continue to share space naturally with one another. With the design of communal spaces for eating, cooking and relaxing, to encourage occupants to interact in different ways. Share House is a model of a residence where many unrelated people live and share kitchens, bathrooms and living rooms. In Japan, demands for home sharing are increasing, especially for singles in their 20s and 30s. Most of these share houses are provided by renovating family houses or single dorms.



Figure 2. Share House LT Josai by Naruse Inokuma Architects

Sources: (<https://www.dezeen.com/2013/08/29/share-house-by-naruse-nokuma-architects/>)

Bedrooms with typical dimensions are arranged on three floors of the building, with voids as separators, have an open living room, dining room and kitchen and a room with carpet on the first floor. The dining table near the entrance provides seating for groups in large numbers, while the kitchen table, living room and carpet room offer alternatives for meeting fewer people.

The 13 bedrooms each have a floor area of 7.2 square meters and the total floor area for each occupant is equivalent to 23 square meters, which according to architects is better than many one-bedroom apartments in the world. This is a new form of the newly built "Shared House", a single housing model, even within the architecture industry. "Shared House" is an increasingly popular lifestyle in Japan, somewhat similar to a large house (one family) where the water system and shared living room are shared by existing residents. What makes it different from a big house, is that residents are not from one family, on the contrary, it is a combination of unrelated strangers. Thus, special techniques in both management and spatial planning are important for foreigners (residents) to naturally continue to share space with one another.



Figure 3. Floor Plan Share House LT Josai by Naruse Inokuma Architects

Source: (<https://www.dezeen.com/2013/08/29/share-house-by-naruse-inokuma-architects/>)

3.1.2 Smart house concept

Smart house is a house that is equipped with sophisticated facilities and amenities, so that makes the residents feel life is easier and more practical. In the smart house, the principal concept is automation by using a variety of wireless devices, so the house control is available within one hand such as turning lights on, warming water, checking the contents of the refrigerator, opening the door, and regulating the temperature of the room, to monitoring safety, can done by finger swipes or voice commands. Smart house is here to make it easier for the occupants of the house to manage all matters related to comfort of the house residents.

In Indonesia, the concept of smart house has begun to be offered by several developers. This is done to attract market interest that continues to want innovation in their residences. This technology-based smart house concept will be a bright prospect in the property sector, especially housing. For developers who have succeeded in building smart houses, they have their own pluses. The presence of smart house devices is not just a trend, but has become a necessity for modern society today, namely for the needs of early adulthood groups. The application of the concept of smart house will be able to accommodate the lifestyle of today's modern society. The concept of smart house aims to make it easier for humans to do homework so that the quality of life becomes better. Here are some things we can apply using the concept of smart house, which are:

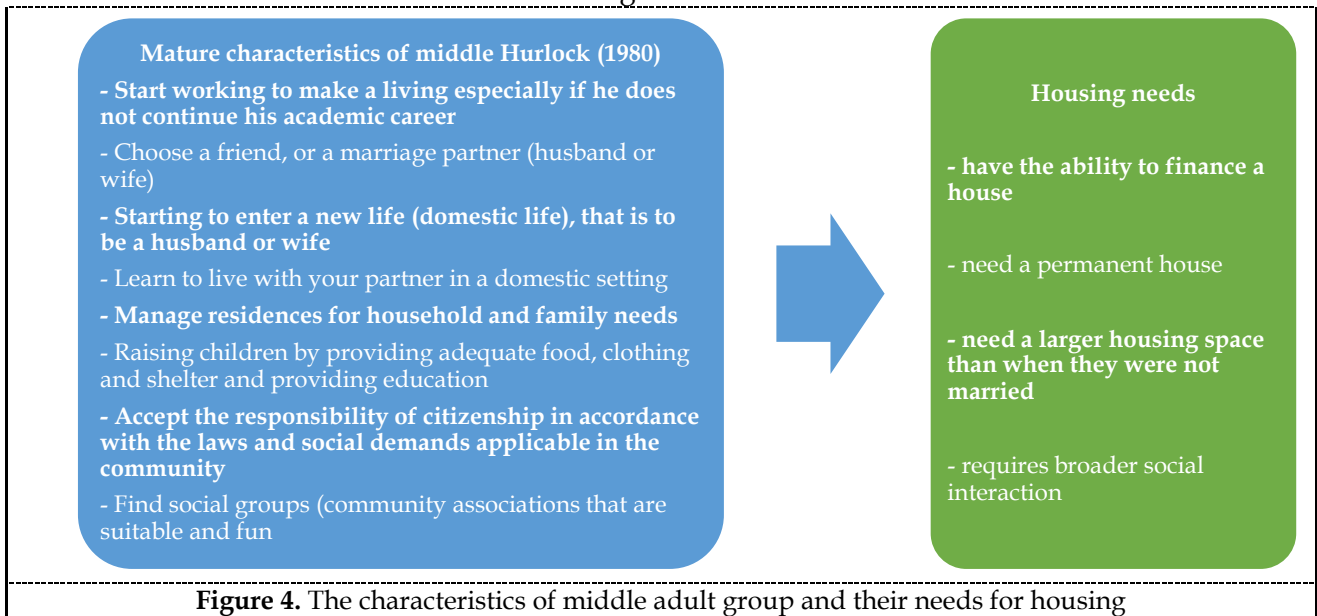
- a. Security system,
- b. Power system for energy savings, and
- c. Deal with possible disasters and hazards.

Table 1. Impact of smart house concept implementation

Positive impact	Negative impact
Practical and Easy Life	Expensive price
Economical and Efficient	Inadequate Infrastructure
Can Remotely Monitor and Control Your House	
Improve security	

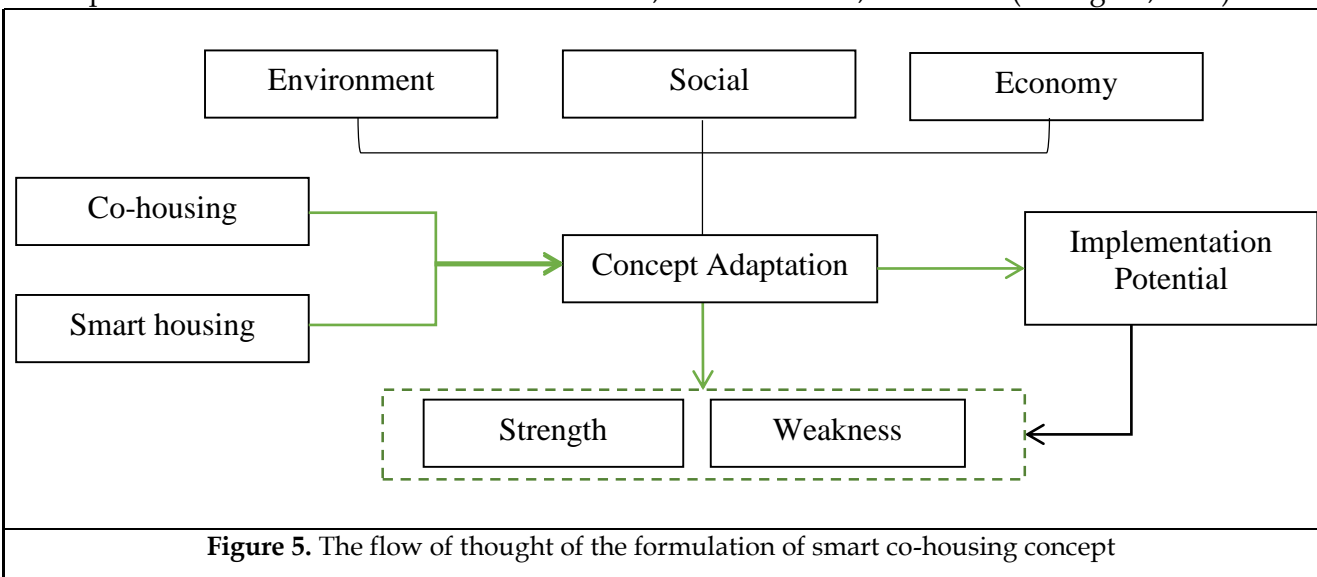
3.2. Middle adult group and housing needs

Housing is one of the primary needs that must be met by all humans. At a certain age humans will have the need to have a house as a place to live with family (Ananta, 2017). Middle adulthood is seen as a stage of age that begins to have household needs, so that at this age humans will begin to think about living in their own houses. In general, middle age is the age between 35-60 years old. This period will eventually be marked by physical and mental changes. The following illustrates the characteristics of middle adulthood and their needs for housing.



3.3. Smart co-housing concept formulation

The formulation of smart co-housing concept is carried out by looking at the three aspects of sustainable development revealed in the Report of the World Commission on Environment and Development in 1987 about the concept of "Sustainable Development". Sustainable development cannot be separated from 3 main aspects, namely (1) social progress, (2) economic growth and (3) ecological balance (Steele, 1997). In addition, John Elkington (2004) introduced the concept of the Triple Bottom Line or 3P - People, Planet and Profit. In short, the three are pillars that measure the value of development success with three criteria: economic, environmental, and social (Elkington, 2004).



3.3.1. The formulation of the smart co-housing concept in terms of the environment aspect

This section discusses the formulation of the application of the three concepts discussed. On the left side of Table 2, the benefits in the environmental aspects of applying the concept of smart housing are shown. On the right side show benefits of co-housing concept. While in the middle side is the benefits combination of the both concepts.

Table 2. The formulation of the smart co-housing concept in terms of the environment aspect

Smart Housing	Smart Co-Housing	Co-Housing
Environment		
Minimize the use of electrical energy	Minimize the use of electrical energy	The flexibility of implementing Co-housing can be in urban, sub-urban or rural
Minimize the use of water	Minimize the use of water	Share to park for gardening, playing and gathering
Reducing waste	Reducing waste	Land efficiency because the dwelling consists of several households
	The flexibility of implementing Co-housing can be in urban, sub-urban or rural	Design can be flexible based on needs, can adjust the characteristics of the site
	Share to park for gardening, playing and gathering	Environmentally friendly because it saves space built up so it can add green areas
	Land efficiency because the dwelling consists of several households	
	Design can be flexible based on needs, can adjust the characteristics of the site	
	Environmentally friendly because it saves space built up so it can add green areas	

3.3.2. The formulation of the smart co-housing concept in terms of social aspect

This section discusses the formulation of the application of the three concepts discussed. On the left side of Table 2, the benefits in the social aspects of applying the concept of smart housing are shown. On the right side show benefits of co-housing concept. While in the middle side is the benefits combination of the both concepts.

Table 3. The formulation of the smart co-housing concept in terms of social aspect

Smart Housing	Smart Co-Housing	Co-Housing
Social		
Ease residents' activities with automatic and more practical features	Ease residents' activities with automatic and more practical features	Co-housing participants are usually structured, with clearly defined roles. both from the principle of cooperation and from the architecture, the structure encourages them to interact to form cooperation between members
Safety: reduce accidents in and around the house	Safety: reduce accidents in and around the house	The spatial division is designed to encourage communal interaction between members
Security: home security increases due to smart technology	Security: home security increases due to smart technology	Remain authorized in his privacy space
Universal design: flexible and comfortable for various groups	Universal design: flexible and comfortable for various groups	Applying the value of mutual cooperation from the community to their houses

	Co-housing participants are usually structured, with clearly defined roles. both from the principle of cooperation and from the architecture, the structure encourages them to interact to form cooperation between members	Sustainable resources to be used together and managed together
	The spatial division is designed to encourage communal interaction between members	Periodic meetings to discuss building operations (electricity, water, etc.)
	Remain authorized in his privacy space	
	Applying the value of mutual cooperation from the community to their homes	
	Sustainable resources to be used together and managed together	
	Periodic meetings to discuss building operations (electricity, water, etc.)	

3.3.3. The formulation of the smart co-housing concept in terms of economy aspect

This section discusses the formulation of the application of the three concepts discussed. On the left side of Table 2, the benefits in the economy aspects of applying the concept of smart housing are shown. On the right side show benefits of co-housing concept. While in the middle side is the benefits combination of the both concepts.

Table 4. The formulation of the smart co-housing concept in terms of economy aspect

Smart Housing	Smart Co-Housing	Co-Housing
Economy		
Expensive at the initial cost because most use high technology	Expensive at the initial cost because most use high technology	Participatory principles from the initial stages of development and operations can save costs
Cheap in operation because of automatic features that can save electricity (long term)	Cheap in operation because of automatic features that can save electricity (long term)	
Material, construction and planning costs are cheaper	Material, construction and planning costs are cheaper	
Low maintenance making it cheaper (long term)	Low maintenance making it cheaper (long term)	
High selling price (technology)	High selling price (technology)	
Adaptable for future residents' needs	Adaptable for future residents' needs	
	Participatory principles from the initial stages of development and operations can save costs	

3.4. Strengths and weaknesses in the implementation of the Smart Co-Housing concept

Through the formulation that has been done, the application of the concept of smart co-housing can be assessed weaknesses and strengths, including:

Table 5. Strengths and weaknesses of the smart co-housing concept

Strength	Weakness
Practical	Technological dependence
Secure	When technology is not functioning due to unstable electricity conditions in Indonesia (because the houses system is very dependent on electricity) -> must have electricity backup (generator set)
Comfortable	Expensive at the beginning (initial cost)
Easy to use	
Viewed from the operational, financing will be more efficient	

As explained earlier, housing in Indonesia is faced with two important problems. The current problem is the housing backlog and future problems are the potential demographic bonus. Ultimately, both require large-scale housing construction. The large-scale construction will then lead to new impacts such as the threat of energy, material and water resources. In addition, the problem of the quality of human life is also one of the focuses that has begun to be addressed when dealing with this phenomenon.

Previous studies also discussed a lot about the relationship of these problems with the concept of sustainability and public understanding of the problem (Ramadhan, 2017). Derived criteria from the three pillars of the sustainability concept are also being developed to find the most appropriate application to achieve them, as has been done by Ramadhan, et al (2019). Various studies on the impacts and solutions of large-scale housing development which are predicted to continue to occur in the future, especially in Indonesia, have been offered by various stakeholders including researchers. Energy conservation studies in vertical buildings conducted by Hanifah, et al, (2019), morphological and connectivity studies of urban sprawl effects by Ramadhan, Septian, & Nurdini, (2019) and many other studies.

Similar to the purpose of pervious studies, this paper tries to identify the appropriateness of the combined smart and co-housing concept in order to provide more benefits for future housing development. This smart co-housing study is expected to be a new concept that can be applied in Indonesia so that it can become one of the solutions for sustainable development, especially in the environmental, social and economic aspects of middle adult group community.

CONCLUSION

In terms of economic, social, and environmental aspects, the concept of Smart co-housing can be applied in Indonesia as a solution to increasing housing needs for millennials in middle-aged adult group. However, these two concepts have weaknesses and strengths that can be interrelated in their application. Such weaknesses of the concept of smart housing which tend to be expensive at the beginning of development can be overcome by a participatory funding system from the concept of co-housing as well as financing in building maintenance and operational activities in general can be done in a participatory manner to overcome the technology financing problems of the smart house concept. In terms of security, these two concepts can work together to reduce accidents in and around the house, the level of security is getting higher with the presence of smart technology and collective supervision of house users.

In addition there are also non-interrelated weaknesses such as weaknesses of the co-housing system that allow for conflict between households that can only be prevented with a strong commitment from the beginning of planning and overcome by deliberation between families so as to reduce the conflict potential.

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