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LIVING-DINING-KITCHEN (LDK) DESIGN IN INDONESIAN TINY HOUSE BY ACTIVITY TYPOLOGY AND SPATIAL ORGANIZATION ANALYSIS

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Abstract: *Konsep Tiny House (TH) muncul sebagai salah satu solusi terhadap keterbatasan hunian perkotaan di Indonesia. Namun, perancangan ruang yang mampu mengakomodasi kebutuhan aktivitas penghuninya masih menjadi tantangan. Penelitian ini bertujuan untuk mengidentifikasi kombinasi ruang esensial pada Tiny House di Indonesia berdasarkan preferensi pengguna milenial (Millennial User Preferences/MUP) serta merumuskan tata letak Living–Dining–Kitchen (LDK) yang optimal melalui analisis tipologi aktivitas dan organisasi ruang. Metode penelitian menggunakan pendekatan kualitatif yang mengombinasikan studi literatur, analisis konten media sosial, dan kuesioner daring terhadap lebih dari 300 responden milenial di Indonesia. Hasil penelitian menunjukkan bahwa LDK merupakan kombinasi ruang esensial yang paling dominan karena mampu mewadahi aktivitas utama seperti memasak, makan, berkumpul bersama keluarga, dan aktivitas rekreasi. Analisis organisasi ruang menunjukkan bahwa tata letak LDK yang optimal memerlukan persentase area sirkulasi minimum sebesar 60%, dengan luasan furnitur efektif sekitar 7,16 m² pada total luas ruang 17,92 m². Meskipun tata letak dengan sirkulasi lebih rendah lebih disukai pengguna karena konfigurasi dapur yang kompak, penyesuaian dimensi dan penataan furnitur diperlukan untuk menjaga efisiensi fungsi dan kenyamanan psikologis. Penelitian ini memberikan kontribusi pada pengembangan desain Tiny House berbasis pengguna di Indonesia.*
Kata Kunci: *tiny house, living-dining-kitchen (LDK), preferensi pengguna milenial, organisasi ruang, Indonesia.*

Abstrak: The Tiny House (TH) concept has emerged as a potential solution to urban housing constraints in Indonesia. However, spatial design that adequately accommodates user activities remains challenging. This study aims to identify the essential room combination for Indonesian tiny houses based on millennial user preferences (MUP) and to propose an optimal Living–Dining–Kitchen (LDK) layout using activity typology and spatial organization analysis. A mixed qualitative approach was employed, combining literature review, content analysis of social media platforms, and online questionnaires involving over 300 Indonesian millennial respondents. The findings indicate that LDK is the most preferred essential room combination, accommodating core domestic activities such as cooking, dining, family interaction, and leisure. Spatial organization analysis reveals that an optimal LDK layout requires a minimum circulation area of 60%, corresponding to an effective furniture area of approximately 7.16 m² within a 17.92 m² space. Although layouts with lower circulation ratios were favored by users due to compact kitchen configurations, adjustments to furniture dimensions and arrangement are necessary to maintain functional efficiency and psychological comfort. This study contributes to user-centered design strategies for tiny houses in Indonesia and provides practical guidance for spatial planning of compact residential environments.
Keyword: tiny house, living-dining-kitchen (LDK), millennial user preference, spatial organization, Indonesia.

INTRODUCTION

Tiny House (TH) has recently pushed the comprehensive philosophy of small size as an opportunity to provide a beautiful, ecological, and inexpensive house. The emergence of TH in industrialized countries like the United States of America (USA) greatly minimizes the adverse environmental impact when compared to large and traditional dwellings (Carlin, 2014; Mitchell, 2010; Mutter, 2013; Wilson & Wadham, 2023). Compared to industrialized countries, user preferences for LDK in TH in developing countries such as Thailand and Indonesia are determined from slightly different perspectives, resulting in suboptimal practice. In Thailand, the preferences address the limited availability of land due to inefficient extensive dwelling usage as a living space. Living in TH in Thailand allows people to afford a house in the city

center on a lower budget because it only requires a smaller plot of land (Becker, 2018). In Indonesia, TH is defined as one that fits into the restricted space available in urban locations. In our previous study, most millennials are predicted to contemplate adopting the TH concept or purchasing it for their living space if they know it. With the affordable cost and promising appearance, TH has emerged as one of the potential options, allowing them to exploit its social image in society (Analisa & Okada, 2023). Even though TH appears to be the perfect answer to housing problems, the precise design to meet its user needs is challenging to achieve.

In order to overcome the challenges, the combination of essential rooms in such a house is considered. For instance, the combination of essential rooms into a minimal housing unit requirement by utilizing activity relations and anthropometry methodologies devoted to four inhabitants with 12 primary which resulting in the minimum space requirement to form a complete dwelling space (Susanto et al., 2022). In the case of MUP, two findings regarding the most essential room are defined: 1) various rooms, such as a guest room, storage, and a backyard, are not required; 2) several rooms can be combined into a compact room without firm separation: living room, dining room, and kitchen (LDK) (Analisa & Okada, 2023). Moreover, because every square meter of TH counts, users should only store essential household items in. It is a furnished habitable TH with necessary amenities such as a full-size washing and dryer, bathtub, full-sized closet, septic system, tiny comfy living area, and kitchen (R. Maharjan, 2020). According to prior study, the combination of essential rooms for TH in Indonesia should address the major activities of its users, particularly the millennial generation.

With the relevance of its user's major activities, the detailed layout of the combination of essential rooms must be solved. The detailed layout is highly related to the spatial authenticity and usability for the users, which promotes pleasure with their domestic environment and increases the representational significance of these dwellings (Hutchinson, 2016). In order to investigate the spatial authenticity with an improved space efficiency, more user-centric studies are needed. Here, adaptive space anticipates and accommodates change from the start, allowing inhabitants to adapt the space to meet changing demands, for instance, applying the tech-friendly appliances and furniture (Goessler & Kaluarachchi, 2023; Murphy, 2014). The adaptive space efficiency is determined by considering the types of space by Mies van der Rohe's open plans adapted from Ransoo Kim (Kim, 2006) reviewed and summarized by Hassan Estaji (Estaji, 2017) which are flowing, dynamic, and clear space. In the case of TH, dynamic space which considers "open plan that characterized by a complementary contrast between interior material freestanding walls and exterior full glazed walls" is preferred. Once the space is adapted efficiently, the longevity is determined by its space plan (Brand, 1995). The space plan in TH itself should address the multifunctionality of such a room, in this case the combination of essential room, with a rearrange-ability features (Geraedts & Geraedts, 2008; Raviz et al., 2015). Therefore, the combination of essential rooms in TH in Indonesia is specified by constructing a plan that considers the adaptive and functional space with selective furnishings depending on its user's major activities and occupancy rates (Shearer & Burton, 2019).

In this present study, two objectives are presented which are 1) to determine the combination of essential room for TH in Indonesia based on activity typology of MUP, 2) to propose the LDK design layout as the essential room combination by optimum area ratio. Finally, discussions of recommended kitchen layout, area-to-furniture size, and movement space are presented to comprehend the study.

LITERATURE REVIEW

Space Organization Analysis for Optimum Area Ratio of LDK in TH

Space organization is analyzed to determine the optimum area LDK in TH. In general, space or spatial organization refers to the distribution and arrangement of space as a building goal that is more than just its physical goal. Hence, configuration is a fundamental relationship between form and space that is appropriated in the processes that transform buildings from physical objects to social and cultural artifacts (Raviz et al., 2015). In typical house in Indonesia, LDK is defined as a space that connects the front yard, the main area (main room in the house), and the backyard, as well as the central room that connects the other rooms in the house. Hence, LDK is typically the center of human circulation as a user and air circulation evaluated by the circulation area in a room. **Table 1** shows the standard of circulation area and its relation to the activity typology and psychological comfort.

Table 1 Circulation area percentage to activity typology and psychological comfort in a room

Circulation area (%)	Activity typology and psychological comfort
5-10	Minimum standard for minimal activity in a room
20	Sufficient circulation area in a room
30	Sufficient circulation for psychological comfort in a room
40	Required circulation area for psychological comfort in a room
50	Required circulation area for specific activities in a room
60	Considered circulation area for several activities in a room
70-100	Close to open space circulation area for several activities

Source: (De Chiara & Callender, 1983)

In LDK, the positioning of doors and windows is critical. The location of the door is determined by its relationship to other connected rooms. Window placement is determined by the direction of the wind. Window sizes and other ventilation should be changed in accordance with window-to-wall ratio (WWR) minimum guidelines. In placing furniture, the

first thing to do is determine the position of the fixed furniture, especially in relation to plumbing and gas installations. Meanwhile, the placement of movable furniture is arranged after the fixed furniture is settled and it is necessary to consider the electrical installation in the room. Therefore, the optimum area ratio of LDK in TH is determined by calculating the furniture area based on a specific layout. Here, the circulation area is calculated by subtracting the total area from the furniture area. Finally, the circulation area is evaluated with the circulation area percentage to activity typology and psychological comfort in a room (**Table 1**). TH spatial arrangement should be adaptive and functional to any changes needed to accommodate users' activities in a limited space. Therefore, the furniture area with a circulation percentage of ≥60% is selected as the LDK design layout with an optimum area ratio. By this circulation area percentage LDK layout could be more flexible to be arranged depending on the type of activity which not limited only to basic activities. Three kitchen types: 1) single-wall, 2) L-shaped, and 3) gallery are modeled as a variable to the constant furniture layout and size in living-dining rooms.

METHODS

The activity typology based on Indonesian MUP is first analyzed to determine the essential room combination of TH. Next, LDK is proposed as essential room combination of TH which is then further analyzed by space organization. Here, the optimum ratio is for LDK in TH is calculated based on the circulation percentage with the threshold of 60% referring the Time-Saver Standard Building Handbook.

Activity Typology Analysis for LDK Layout in TH

Activity typology analysis aims to determine LDK as the essential room combination in TH and its design layout by considering Indonesian MUP major activities. Two approaches are used to analyse the activity typology: 1) a literature review and content analysis, and 2) qualitative online questionnaires. To enhance understanding of TH, the first approach is to perform a literature review from numerous international journals and to attend international conferences connected to ethnography of TH. Following that, content analysis of popular social media platforms, particularly TH groups on Instagram, was carried out. Several YouTube series, such as "Living Big in a Tiny House," which evaluated TH features dependent on user were examined. Following the completion of the first approach, qualitative online questionnaires are built utilizing the Google Forms Survey platform.

Data collection of qualitative online questionnaires was obtained from a three survey periods, with three objectives which are: 1) to explore the millennial's user preference of TH in Indonesia, 2) to deepen explore the MUP of TH in each city, and 3) to deepen explore the major activities by MUP of TH in each city. The qualitative online questionnaires contain questions related to basic personal information, personal preference in essential rooms of TH, and personal preference in desirable major activities accommodated by the proposed LDK design layout. Since the millennial respondents are Indonesians, Bahasa Indonesia is the favoured language.

The proposed LDK layouts were chosen and prepared for the qualitative online questionnaire based on the literature review and content analysis on Instagram TH groups (see **Figure 1**). The fraction of the sample in each city is determined with a threshold of 100 samples, which corresponds to the minimal sample size to produce any type of relevant result, taking into account the city features and normalized population density (Singh et al., 2014).

Figure 1 Proposed LDK design layout in qualitative online questionnaire

Data was collected by contacting millennial respondents using social media groups such as WhatsApp society groups and randomly distributing to different communities in selected cities. The age groups of 1981-1996 birth, big city coverage, and sample amount were used to control the millennial responses. Following that, the qualitative online questionnaire data was evaluated and quantified in order to investigate the study's objectives.

RESULTS

Activity Typology Characteristics of LDK in TH

The activity typology characteristics of LDK in TH is presented here. First, the qualitative online questionnaire was distributed to over 300 respondents with range age of millennial generation, 30-35 years old who have varied working backgrounds which are 34.5% as academics, 36.3% as private employees, 13.3% as an entrepreneur, and 15.9% as other professions such as public servant, art performers, financial consultant, housewife, doctor, and freelancer. They are in their productive years, have a steady salary, a stable career, and are about to establish a family. They prefer to look for a suitable and comfortable property to live in for themselves and their families once they start trying to settle down. Furthermore, they are more likely to be open to new possibilities and offers in order to obtain practical and affordable housing (Analisa & Okada, 2023).

Figure 2 shows the essential rooms in TH by MUP. By applying a threshold of 50%, MUP agrees that a guest bedroom is not necessary for TH (29%) but considers the guest room (59.3%). Interestingly, most MUP still opted to have a garage or carport (86.2%) due to insufficient public transportation in

Indonesia. Other room preferences with high percentages are considered as the main needs, including kitchen (98.6%), bedroom (97.9%), living room (91%), flexible bathroom (88.3%), laundry room (84.8%), and dining room (75.2%). In comparison, other room preferences are more related to the millennials who are in their early phase of marriage, which leads to a high percentage of kids' rooms (77.9%). Similar to the guest room, working space (57.9%) and private bathroom (51.7%) share an uncertain tendency whether they are necessary or not. On the other hand, MUP agrees to have both yards, front and back, by 81.4% and 64.8%, respectively. Based on these findings, a combination of essential rooms is needed to accommodate millennials' needs.

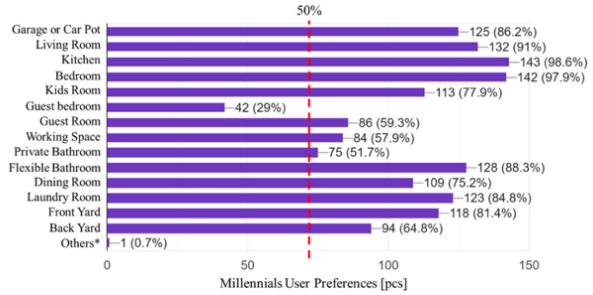

Figure 2 Essential rooms in TH by MUP

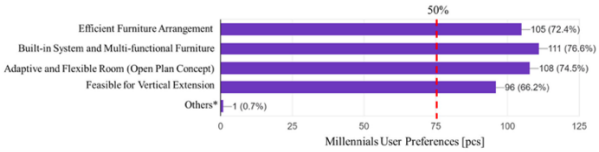

Figure 3 Basic requirements of combined essential rooms in TH by MUP

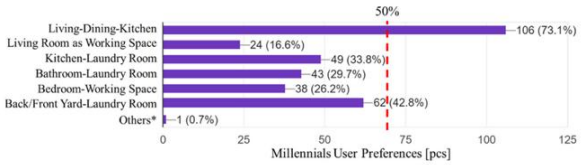

Figure 4 Combined essential rooms in TH by MUP

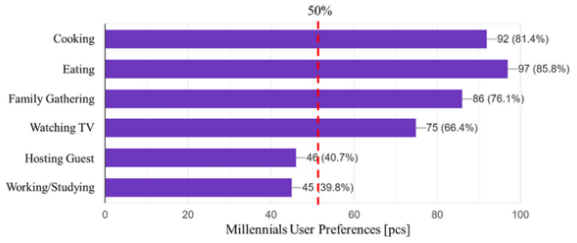

Figure 5 Preferred activities in TH by MUP

Figure 3 shows the basic requirements of combined essential rooms in TH by MUP. Four aspects which are efficient furniture arrangements, built-in system and multi-functional furniture, adaptive and flexible room (open plan concept), and feasible for vertical extensions. Efficient furniture arrangements are obtained by considering each required piece of furniture's dimensions and foldability. Hence, in the specific time when typical furniture is unused, it can be stored in the minimum possible space. In order to support this idea, a built-in system and multi-functional furniture are considered, for instance, a foldable shelf that is possibly be transformed into a dining table. Hence, the adaptive and flexible room with respect to the open plan concept is highly recommended. Here, LDK is possibly be transformed into a working space or gathering room once its furniture is stored. In addition, in order to expand the space, MUP opted to have a TH with a feasibility to be extended vertically.

The combination of essential rooms in TH by MUP is presented in **Figure 4**. Here, living-dining-kitchen (LDK) is dominantly preferred by 73.1%. The second preferred combined essential room is the back/front yard-laundry room by 42.8%. In contrast, two combinations of rooms shared a relatively similar percentage of 33.8% for the kitchen- laundry room, 29.7% for the bathroom-laundry room, and 26.2% for bedroom-working space. Surprisingly, the idea of transforming the living room into a working space is not preferred, with only 16.6% preference. Based on these findings, LDK is considered the best combined essential room for TH. Overall, TH in Indonesia can be characterized by LDK as its main room with several combined essential rooms, especially the back/front yard-laundry room, bathroom-laundry room, and bedroom-working space. While for the working space in TH, the bedroom is preferable to the living room. Moreover, based on the preferred activities in TH by MUP shown in **Figure 5**, working or studying possesses the lowest preference percentage of 39.8%. While the four most preferred activities are distributed into cooking (kitchen), eating (dining), family gatherings (living), and watching TV (living). The LDK strongly meets all the preferences held by the millennial generation in Indonesia.

Optimum Area Ratio of LDK in TH

The optimum area ratio of LDK in TH is presented in **Table 2**. Optimum area ratio of LDK in TH. Two LDK design layouts passed the requirements of ≥60% circulation area percentage, which are LDK type A and B (**Figure 1**). In contrast, LDK type C with a furniture area of 7.75 sqm failed to meet the ≥60% circulation area percentage requirement. Since the variables of LDK design layouts are limited to the kitchen type and its size, LDK type C with an L-shaped kitchen, which possess the biggest kitchen size, unsurprisingly fails to possess the optimum area ratio. On the other hand, the most favorable LDK design layout is LDK type C, as shown in **Figure 6**, LDK Design Layout Preference by MUP. It shows that even though LDK types A and B meet the requirements of optimum area ratio, a more compact layout offered by LDK type C with the L-shaped kitchen attracted more intention. This finding is supported by the tendency of time spent in LDK during weekends compared to weekdays, as shown in **Figure 7**. Here, the millennial is considered to have the core activities in the kitchen and dining room during weekdays due to their busy schedule. On the contrary, they will spend more time in the

living room during the weekend, which also does not opt out of the possibility of spending more time in the kitchen and dining room. Since the variable is only the kitchen section, the furniture layout and its size in the living-dining sections are recommended to be modified to facilitate LDK type C meeting the requirements of optimum area ratio and to accommodate the activities in the weekend.

Table 2 Optimum area ratio of LDK in TH

LDK Type	A	B	C
Furniture area (sqm)	6.5	6.65	7.75
Circulation area (sqm)	63.73	62.89	57.87
Optimum Area Ratio	TRUE	TRUE	FALSE

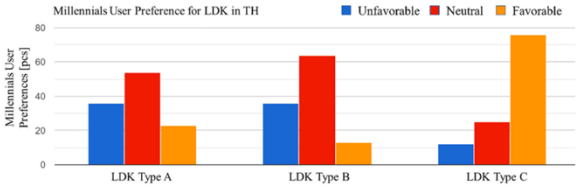

Figure 6 LDK Design Layout Preference by MUP

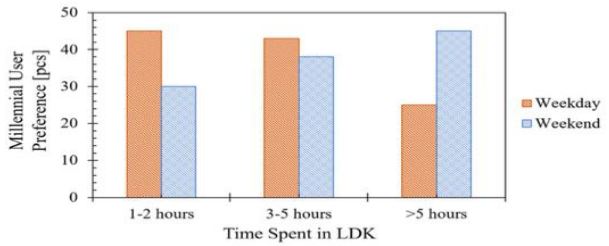

Figure 7 Time Spent in LDK by MUP

DISCUSSIONS

Type of Kitchen Layout for LDK in TH

According to the requirements and current LDK design layout which has a total area of 17.92 sqm, the furniture area, which meets the requirements of the ≥60% circulation area percentage, is limited to about 7.16 sqm with a circulation area percentage of 60.04%. According to the optimum LDK area ratio results in TH, preferable LDK type C is still functional in terms of its fundamental functions, and psychological comfort is attainable. However, space limits are unavoidable, especially given the variety of activities available in this LDK. In order to comprehensively validate the findings, three alternative LDK design layouts are presented in **Figure 8**. with its calculated circulation area percentage shown in **Table 3**. All alternative LDK design layouts adapted the U-shaped kitchen shape with a combination of a square-sized sofa (LDK type D), a square-sized sofa with a shelf (LDK type E), and a square-sized sofa, a shelf with a coffee- table (LDK type E). LDK type E has an additional furniture area of 1 sqm as compared with LDK type C. In comparison, LDK types E and F are designed subsequently with an additional area of 0.7 sqm as compared with the previous LDK type.

As a result, LDK type D is typically similar to LDK type C with an optimum area ratio of 8.5 sqm and a circulation area percentage of 52.57%. According to circulation area percentage to activity typology and psychological comfort in a room shown in **Table 2**, both LDK types are sufficient for a specific activity in a room but possibly to have several activities in limited movement space. On the other hand, both LDK type D (48.66%) and E (45.31%) share a similar circulation area percentage standard of 40% (**Table 3**), which corresponds to such a room with sufficient psychological comfort but limited to accommodate other activities than basic LDK activities such as cooking, eating, family gathering.

Table 3 Optimum area ratio of LDK in TH

LDK Type	Furniture area (sqm)	Circulation area (sqm)	Remarks
D	8.5	52.57	U-shaped kitchen layout + square-sized sofa
E	9.2	48.66	U-shaped kitchen layout + square-sized sofa + shelf
F	9.8	45.31	U-shaped kitchen layout + square-sized sofa shelf others (e.g., coffee-table)

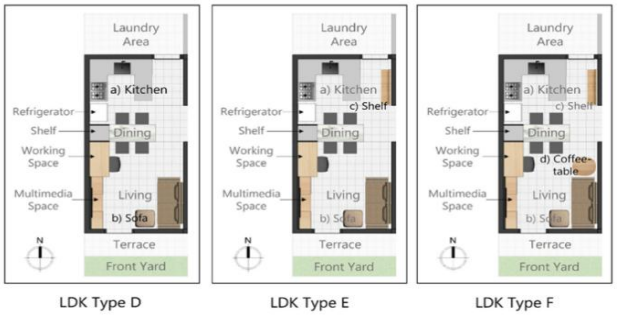

Figure 8 Alternative LDK design layouts

Movement Space of LDK below Optimum Area Ratio

The optimum area ratio is proposed as the fundamental consideration in building LDK of TH with personal preferences, which is in our study based on MUP. In the case of designing a room with a typical purpose, the optimum area ratio must be met as a minimum circulation area percentage. However, in the case of single inhabitants with no other activities other than the core activities in LDK, a circulation percentage of less than 60% is acceptable. Because of its purpose as a residence, it is recommended that the minimum circulation area percentage to be 40% in order to maintain psychological comfort. Recalling the LDK design layout preference by MUP shown in **Figure 1**, LDK Type C is favorable following the L-shaped kitchen has ample working space on the worktable. Indonesian millennials who cook with many ingredients require much more space to accommodate all the food items. The dimensions of the furniture, particularly the breadth of the furniture,

are critical in interior design at TH. The less circulation area there is in TH, the wider the furniture.

Area Ratio of Private and Semi-private Zone in TH

Tiny House is considered to be future house of millennials and next generation. Regardless of its compact size, comfort movement can be obtained from multi-functional furniture application and arrangement. MUP shows that TH is suitable for specific user, those are single user, new married couple, family with maximum of 2 kids, and elderly with limited movement availability. Therefore, it can be assumed that TH would accommodate up to 4 people. Area of 9msq per person is needed to accommodate fresh air needs in a house based on SNI 03-1733-2004 and 11.89msq per person is needed to obtained comfort movement space. Based on this standard, it could be assumed that at least 47.92msq house is needed to accommodate 4 persons.

In some cases, TH could be identified as basic house to be transformed into "rumah tumbuh" (growing house). Transformation of basic TH to accommodate more user is shown in **Figure 9**. TH could be developed to accommodate 1-2 person at the first phase of construction. The base structure of TH is designed by considering probability to be developed in the future to accommodate more users. In this case, LDK is considered as semi-private zone, and bathroom as well as bedroom are considered as private zone. By using minimum space to obtained comfort movement space and arrangement of room configuration as well as furniture, area ratio of private and semi-private determined as 41:59 for 1-2 users and slightly change to be 50:50 when the users increase into 3-4 users as shown in **Table 4**.

Table 4 Area Ratio of private zone to semi-private zone in TH

Number of user(s)	Zone	Total area (sqm)	Area Ratio
1-2 persons (1st phase)	Private (bedroom, bathroom)	15.75	41:59
	Semi-private (LDK)	11.25	
3-4 persons (2nd phase)	Private (bedroom, bathroom)	20.25	50:50
	Semi-private (LDK)	20.25	

Figure 9 Transformation of basic tiny house to accommodate more user

Application of Japanese House Default to TH Design in Indonesia

Commonly, one-storey house as a first home is common in Indonesia to save construction costs. However, higher construction costs are required to expand the house vertically as it is necessary to make changes to the building structure to be able to withstand greater building loads. This condition is contrary to the concept of Japanese house. In general, Japanese house is designed as two-story houses, broadly separating the lower floor as a semi-private space and the upper floor as a private space. Thus, the construction cost as a two-story house has been calculated from the beginning.

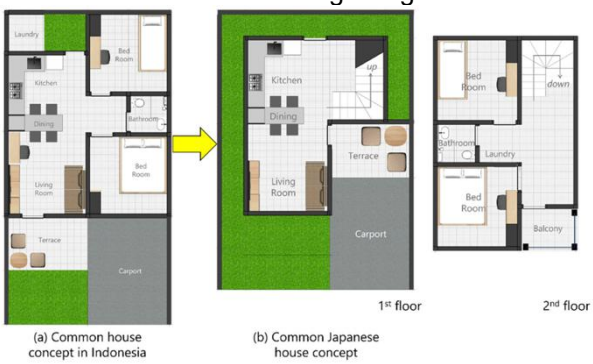

Figure 10 Comparison of (a) common landed house concept in Indonesia and (b) common Japanese house concept

Comparison of common landed house in Indonesia and Japan is shown in **Figure 10**. Based on this comparison, by developing two-storey house since the beginning, more green area could be obtained within similar land area. The separation of spatial zones can also be made explicit and potentially expanded in the future. In addition, the building is not directly attached to the surrounding buildings which offer more advantage to the user, such as avoid walls becoming damp, reduced wall surfaces that have the potential to become access to air circulation and lighting and provide building inspection paths to deal with damage that may occur. Application of Japanese house concept in TH in Indonesia needs to be considered to provide healthy house.

CONCLUSIONS

The millennial user preferences (MUP) for tiny house related to the prospective market in Indonesia is successfully studied with conclusions as,

1. The combination of essential room for TH in Indonesia is narrowed down to a living-dining-kitchen (LDK) room which accommodates most of the major activities of the millennial generations.
2. The LDK design layout as the essential room combination is determined by an optimum area ratio beyond 7.16 sqm with a circulation area percentage of 60.04%.

Based on the present study, LDK in TH is characterized as an adaptive and functional essential room which should meet the requirements of ≥60% circulation area. However, LDK type C which has a circulation area percentage less than 60% was favored most. Hence, a modified layout and its

furniture size in the living-dining section should be addressed. Moreover, LDK in TH in Indonesia can be enhanced by considering the best practices of TH in other countries (Boeckermann et al, 2019). Application of Japanese landed house concept to TH application in Indonesia can provide benefit to the users. It is a prospective concept that need to be done by house developer in Indonesia. Furthermore, our work may contribute to the paucity of academic literature on this topic and the burgeoning TH market in Indonesia.

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