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Abstract

This study explores to determine the live-work housing needs of low-income older people in informal settlements, the ways of life of whom contemporary housing provision often fails to consider. A questionnaire survey was conducted in three communities in Klong Toey, the largest informal settlement in Bangkok, to understand households' satisfaction levels and expectations regarding the interior quality of their live-work housing. Older people's specific interior spaces and housing requirements and expectations vary depending on the nature of their livelihood activities that can be categorised into three main groups, namely service, cook, and stock. The findings suggest a strong relationship between housing domains and the overall satisfaction of older people. There is a strong relationship between overall housing satisfaction and comfort in interior living spaces, as well as safety for domestic working spaces. Design, Health, Comfort, and Adaptability are important domains for live-work environments that ensure housing meets older people's expectations. Therefore, housing design and improvements should embrace the live-work concept to maintain a sustainable and healthy ageing environment.

Keywords: spatial quality, live-work housing, informal settlements, older people, resident satisfaction

Introduction

There have been recent calls for architects to give thorough thoughts into how people use spaces rather than applying preconceived spatial solutions that fail to meet occupants' needs at worst or require major adaptation to be fit for purpose at best (Durosaiye et al., 2019). While spatial quality refers to the experiential and aesthetic aspects of the physical space in the built environment, it is important for designers to create adaptable interior spaces capable of keeping pace with the evolving needs of any type of occupants, including low-income residents in the informal settlements (Yasmin & Nilufar, 2023). While poverty is often linked to substandard quality of interior space, interior designers are pointed out to have a key position in improving health, safety, and welfare of low-income people (Hicks, 2022). The interior space quality is beyond the immediate aspects of a building, including the arrangement and organisation of space and factors such as scale, proportion, lighting, materials, and human-spatial interactions (McGee & Park, 2022). Instead, a well-designed interior quality has the potential to enhance spatial functionality and evoke positive emotions (Reddy et al., 2012). Hence, our premise to determine spatial quality of the living and livelihood needs of older people derives from our conviction, through evidence-based research (Durosaiye et al., 2022), that by skilfully manipulating spatial elements and adhering to the spatial quality of housing domains deemed to be of significance to older people's living and livelihood needs, designers of live-work housing could improve older people's experience of the built environment regarding functional suitability, accessibility, and size requirements (Smith et al., 2012).

This paper presents some of the findings of the AgeingHood research project, which explored the intersection between ageing, housing, and livelihood in Klong Toey, the largest and most populated informal settlement in Bangkok, Thailand. Formed in 1939 by dock labourers working for the Port Authority of Thailand (PAT), the Klong Toey settlement attracted immigrants with many ethnic backgrounds, such as Thais, Laos, Khmers, Vietnamese, and Burmans (Maier, 2011), because of low-cost housing and job opportunities (United Nations Human Settlements Programme, 2003). At present, there are 43 communities, including 17 and 26 communities located inside and outside PAT's land, respectively. Housing in Klong Toey can be categorised into four groups: informal settlements with insecure tenure squatting in the area without paying rent; communities of walk-up flats subsidised by the National Housing Authority (NHA) since 1980s; cooperative housing supported by a government authority, the Community Organisations Development Institute (CODI), responsible for low-income housing for the poor in rural

and urban Thailand through a participatory approach; and Klong Toey Habitation Improvement Project, newly constructed housing programmes supported by the private sector in cooperation with the Thai military.

To shift towards a more commercial approach, PAT's recent extensive redevelopment plan for Klong Toey demands 80,000 residents currently living on its property be relocated (Ferrero et al., 2018a). While the relocation process should include securing the residents' livelihood and improving their living standards, housing schemes that understand ways of life and the daily challenges of low-income residents are in short supply, particularly for the older population group. The lack of consideration shows conflict with the fact that low-income housing provision has been developed explicitly as a national policy in Thailand. The Thai Government also adopted the international agreement on the right to housing for all, following Habitat III and SDGs agenda. However, a specific action plan concerning the promotion of well-being is still required to tackle urban mass housing for older people, especially for the underprivileged group. Therefore, this paper aims to determine the live-work housing needs of older people in the Klong Toey low-income community and to understand how satisfied they were with their housing conditions in Klong Toey, which could consequently lead to more appropriate housing designs for older residents on a low-income.

Housing Quality for Older People

Several studies have demonstrated that good-quality housing and neighbourhood characteristics have a positive influence on the health and well-being of older people (Sixsmith et al., 2014; Stephens & Allen, 2021). Compared to other age groups, older people are more vulnerable to the influences of their housing and neighbourhood conditions (Glass & Balfour, 2003). For older people in global urban centres, housing is more than the physical structure and associated infrastructure. Housing and neighbourhoods are often perceived by urban older people as 'lifetime homes' for their residents (Nygren et al., 2007), and thus play a crucial role in the sustainability of older people's lives and livelihoods (Dolan, 2012). Increasingly, the dual role of housing as a living space and a working space is being globally recognised, and this is also being seen as the most sustainable approach to support the notion of 'ageing-in-place' (Golant, 2015; Sixsmith et al., 2017). Yet, a successful lifetime housing design needs knowledge from many disciplines, including interior design efforts of inclusive housing interior that meet the actual housing needs of the elderly (Mnea & Zairul, 2023).

However, in the advent of global population ageing, while a number of recent studies have contributed to our collective understanding of the effects of housing and neighbourhood environments on older people—including far-reaching research that supports the concept of ageing-in-place—the actual implementation of supportive housing and neighbourhoods is still elusive to many older people in the world (World Health Organization, 2007). Most attempts to improve housing situations for low-income older people have often fallen short of their needs because of a lack of attention to the complex relationship between older people, their housing, and livelihood (Durosaiye & Hadjri, 2022). It is therefore imperative to investigate the notion of ageing-in-place through the prism of housing solutions for the older low-income urban population.

Some of the consequences of this ill-preparedness offered the backdrop to this research project in Klong Toey, especially to older people of 65 years old and over. It has been reported that members of this population group face a number of problems in their housing and neighbourhood, including the interior quality, which adversely affects their livelihood and their health and well-being.

Most of the studies that explored the housing situation in Klong Toey have proposed eviction and relocation of residents as the panacea to the resolution of the area's complex living and livelihood challenges (Ferrero et al., 2018a, 2018b). Hitherto, no study has carefully explored older people's living conditions in relation to the nuances around their livelihood (Usavagovitwong et al., 2013). However, it is undeniable that the combination of uncertainties around housing and livelihood and inadequate and inaccessible infrastructures has negative impacts on the health and well-being of low-income older people (Rojnakarint, 2002; Tangkoblar, 2005).

It is, thus, necessary to thoroughly understand the specific needs of older low-income people to help devise a mechanism to fulfil their housing and livelihood needs, particularly because these low-income communities are sustained on limited resources. Yet, affordable housing concepts for urban households should go beyond minimising sizes and put more concern on residents' needs and wants through participatory design, which enables more efficient, flexible, and personalised ways of spatial utilisation (Pirinen & Tervo, 2020). Most housing in Klong Toey could be categorised into what Dolan (2012) defines as live-work housing, which is typically a single flexible space for both live and work activities, allowing the user to adapt it to many different configurations and resulting in mixed-use and flexibility benefits. Additionally, it makes a tremendous contribution to the

vitality of the neighbourhood and to building a lifelong community, especially for older people to 'age in place.' Scholars researching the situation in Klong Toey should ask whether they fully understand the live-work housing needs of these older people and what can be done to support and maintain their livelihood. It is against this backdrop that the AgeingHood project sought to understand how older residents of Klong Toey live and work, as well as explore how they are affected by the threat of eviction and resettlement. The project used a mixed methods approach. This article only presents the findings from the questionnaire survey. The findings of the other methods, including interviews, post-occupancy evaluation, and co-design workshops, are presented in other publications and not discussed in detail here. The lessons learned from the questionnaire survey could contribute to the range of solutions for redevelopment and relocation and support the provision of affordable and adequate live-work housing options for vulnerable residents through bottom-up advocacy, particularly for older people on a low-income.

Methodology

Data collection for the questionnaire survey was conducted at three case study communities between November 2020 and February 2021. As shown in Figure 1, the quantitative data was collected and analysed following the quantitative approach. This research employed various analysis methods to understand the needs of low-income older working people and their requirements for live-work housing.

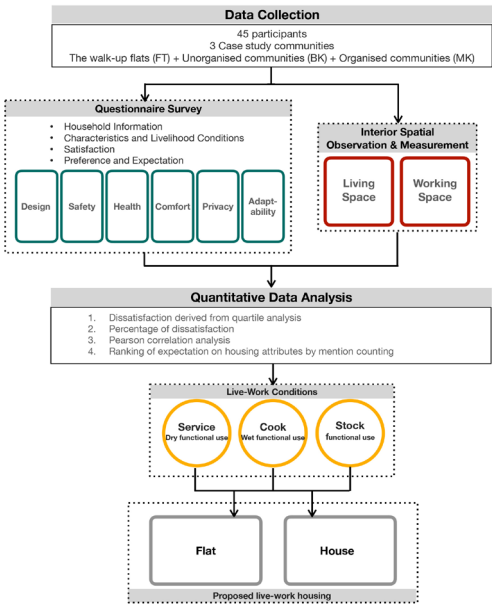


Figure 1
Research methods
diagram (Image by
authors)

The methods for quantitative data analysis included: 1) dissatisfaction derived from quartile analysis, 2) percentage of dissatisfaction, 3) Pearson correlation analysis, and 4) ranking of expectation on housing attributes by mention counting. To validate the results, the quantitative data were triangulated with the findings from interior spatial observations and measurements. For ethical clearance, this study was registered and approved by the Kasetsart University Research Ethics Committee in Thailand.

Case study communities

This research chose three communities from 26 Klong Toey informal communities located on the PAT's land as case studies to understand the lives of older people in different physical environments and organisations. The first case study chosen, the walk-up flats (FT), was regarding 4,598 resident units in five-storey walk-up flats with typical 30 square metres studio. With no elevator, this accommodation had made the lives of older people more difficult, as it was designed without any concern for accessibility and mobility. The second case study, unorganised communities (BK), is an example of 5,643 residential units informally built in Klong Toey. This self-built housing is mostly constructed with poor-quality materials and is densely packed together. The third case study, organised communities (MK), represents a collective housing development of 1,334 units that had been properly planned, built, and organised in the Klong Toey area. This type of two-storey detached house allows the inhabitants to run their businesses at home on the ground floor.

Following a purposive sampling approach, 15 residents from each case study community were recruited to participate in the questionnaire survey. All participants were 50 years or over, and were selected in a non-random manner, based on their ability to work and their different livelihood characteristics within the context of the Klong Toey community. This intentional selection method focused on participants' particular knowledge and experience to clarify specific themes or concepts. This method is used in qualitative and mixed methods research (Robinson, 2014; Schutt, 2018). However, purposive sampling may be used for quantitative research due to its efficiency and the quality of data gathered. Purposive sampling has been used in quantitative methods, including in the administration of questionnaires and statistical analyses (Tongco, 2007).

In reference to the demographic variations of the case study communities, this study covered a total sample size of 21.43% of older people across the three case studies, which could lead to an argument regarding whether the sample size was adequately representative

for this research. Having said that, such a judgemental sample can be logically seen as representative of a cross-section population that provides expert knowledge of the population (Battaglia, 2008). Thus, to ensure the best reflection of samples for the purpose of this research, community leaders were invited to take part in the selection process. Among these participants, about 87% were women, to help the research team understand inequality, as well as social advantages and disadvantages due to gender.

The questionnaire survey consisted of questions that explored how the older residents of Klong Toey use their interior domestic spaces for living and working. Therefore, all invited participants were also asked to open their homes so that the research assistants could conduct a spatial measurement of their interior spaces for living and working. All participants in this study provided their informed consent verbally.

Development of the questionnaire

The questionnaire was designed to understand how participants live and work in their residence, how they feel about the interior domestic spaces of their current residence and their preferences for, and expectations of, future housing if they are able to choose. The questionnaire comprises four main parts. Part 1, *Participant and Household Information*, aims to collect the participant's basic information about the participant that may have an impact on how they live and work—including age, gender, occupation, workplace, health condition, ability to take care of oneself, mobility, weight and height, and household members. This is provided mostly through multiple-choice questions, with some open-ended questions.

Part 2, *Characteristics and Conditions of Current Residence and Livelihood*, aims to understand the participant's daily lives in their residence and around the Klong Toey community, especially regarding how they use interior domestic spaces to support their living and livelihood activities. This part employs open-ended questions and some multiple-choice questions; including the length of stay in the current residence and the Klong Toey community, the monthly rent, a list of activities in the residence, their workplace and working period, their live-work routine throughout the day, and their favourite interior space in their residence.

Part 3 of the questionnaire, *Satisfaction of Interior Domestic Conditions of Current Residence*, aims to understand the participant's values regarding the interior domestic spaces for living and working based on their satisfaction with their current residence. The first two

questions employed a Likert scale from 1 (very unsatisfied) to 5 (very satisfied) to rank their experience of the current interior living spaces and domestic working spaces, respectively, in specific domains. The six essential domains include Design, Safety, Health, Comfort, Privacy, and Adaptability (Durosaiye et al., 2022). Questions 3 to 6 in this part are open-ended, asking for the participant's opinions on their current residence and community, and to specify their most satisfying and problematic qualities.

Part 4, Living Preference and Expectation of Interior Domestic Spaces of Future Housing, aims to understand the participant's expectations of residence and living conditions if they have opportunities to choose freely, and their personal preferences. Questions 1 to 3 are multiple-choice questions that inquire about their preferred type of housing. Question 4 corresponds with the six domains used in the third part of the questionnaire to allow cross-validation. It asks interviewees to rate their expectations of specific attributes of interior domestic spaces in their future housing, which will improve the quality of life of a working older person, through scales from 1 (unnecessary/unimportant) to 3 (very necessary/very important). Then, questions 5 and 6 are open-ended questions that ask participants to specify the three most important qualities they expect in their residence as a working older person.

Older People of Klong Toey and Their Current Housing Situations

The majority of participants were between 60 and 69 years old (51.1%). The participants had been living in Klong Toey for 48.9 years on average, and frequently for many generations. With such a long period of residency, they are likely to have high levels of attachment to their home and community. As shown in Table 1, the average number of household members is about five people per unit for a detached house in the organised community (MK), while the participants from the walk-up flats (FT) mostly live alone. However, the maximum number of members in each household reaches up to eight people living in a 30 square metre flat, and nine to ten people living in a 65–85 square metre house. The inadequacy of the interior domestic space in relation to the number of residents clearly shows overcrowding. Several families in FT had therefore added a mezzanine, which allows extra interior space for living or working.

Based on the questionnaire data and survey, older people in Klong Toey normally do most of their daily activities at home and sometimes within the community. Most of them work at home. The interior spaces of their residences are normally used for sleeping, cooking, storing, sitting, relaxing, dining, washing, taking a bath, and working.

Due to the highly limited space of the residence, most interior space is frequently open-planned or informally partitioned and functionally identified by loose furniture rather than formally divided into smaller rooms for specific uses (Figure 2). A single space is usually multi-purpose or adaptable to serve different uses at different times, except for the toilet and kitchen. The resident's types of work highly contribute to how the interior space is organised and proportioned.

| Case study | Housing characteristic | N=45 | Age (n.) | | | | Gender (n.) | | No. of family members | | | House area (m ²) |
|------------|------------------------|------|----------|-------|-------|-----|-------------|-------|-----------------------|-----|------|------------------------------|
| | | | -60 | 60-69 | 70-85 | 85+ | Female | Male | min | max | mean | |
| FT | Walk-up flat | 15 | 3 | 10 | 2 | 0 | 15 | 0 | 1 | 8 | 1 | 30.00 |
| BK | Unorganised community | 15 | 1 | 8 | 6 | 0 | 10 | 5 | 2 | 10 | 3 | 85.26 |
| MK | Organised community | 15 | 7 | 5 | 3 | 0 | 14 | 1 | 2 | 9 | 5 | 65.82 |
| Sum (%) | | 45 | 24.4% | 51.1% | 24.4% | 0% | 87.0% | 13.0% | | | | |

Table 1
Respondents' information



Figure 2
Live-work interior domestic space of a house in unorganised communities (Photographs and images by authors)

Livelihood Conditions of Older People in Klong Toey

This attachment Klong Toey residents have with their home and neighbourhood impacts how they live and work. The economic factor is linked to livelihood opportunities, as it enables more

accessibility to the necessary livelihood resources. Housing can be seen as a production unit supporting the informal economy and other economic opportunities, and one of the major livelihood resources (Rahman, 2016; Soma et al., 2022). Yet, housing transformation by residents also addresses the importance of domestic spaces for income generation in low-income housing (Mahmud, 2003).

Based on the survey, Klong Toey is not only considered a residential area for low-income people; there are also many economic activities for those living on-site and nearby. Stores and diners can easily be found at every corner, and older people engage frequently not only as customers but also as local shopkeepers. These housing and community attributes benefit the livelihoods of Klong Toey residents by offering them work opportunities and providing secure financial resources. These home-based enterprises rely on housing and community. This situation is similar to that in urban poor housing in India and Bangladesh, where research has indicated that a planned or formal intervention could affect livelihood opportunities (Rahman, 2016). As a result, it is important to embrace the idea of providing residents with opportunities to work in any housing developments, and domestic space design for low-income housing should accommodate such live-work activities.

Regarding the livelihood conditions of the older people of the Klong Toey community (Figure 3), the results show that more than 91% of the selected 45 respondents were working at home or within the Klong Toey community. The top five occupations of the older participants include: 1) running a small minimart or grocery store, 2) collecting and selling recyclable waste, 3) running a small diner at home, 4) selling goods and products at the market or online, and 5) cooking and selling food at the market.

Data from the spatial observation shows that those different livelihood activities require certain facilities and spatial arrangements of interior domestic space to support their businesses in the home (Figure 4). To that extent, the questionnaire findings suggest that the live-work conditions of older residents in Klong Toey can be categorised into three main groups in response to their specific spatial requirements. The three groups of livelihood activities are service, cook, and stock.

The first group, service (dry functional use), involves work that needs a semi-dry working area that can be easily divided and managed in order to accommodate visiting customers. This group includes hair salons, garages, grocery stores, laundry services, and tailoring and sewing businesses. The second group of occupations, cook, (wet

functional use), requires a semi-wet kitchen or working area that can generate smoke and smells and needs building systems to support the operation. Such businesses include restaurants, food carts, and food delivery services. The third type of work, stock (functional use), requires extra storage space for materials and products before distribution or delivery but does not need much workspace or a supporting system. The works in this group include collecting recyclable waste for sale, selling goods and products at markets along with online.

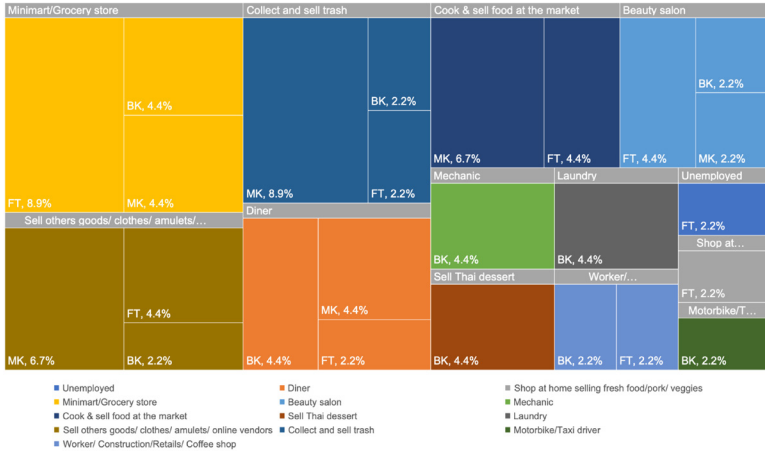


Figure 3
Livelihood activities
of older participants
(Image by authors)



Figure 4
Three groups of
livelihood activities
(Photographs and
images by authors)

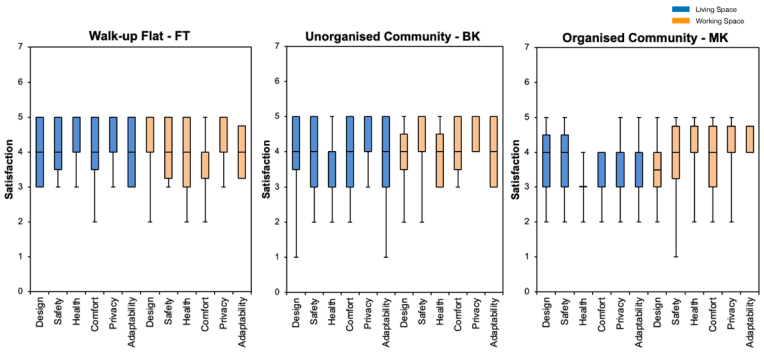
Satisfactions of Older People with Their Housing

This study aims to explore the participants' satisfaction with their existing residence in Klong Toey in relation to their live-work conditions and the adequacy and uses of interior domestic spaces. Since the physical settings and environments differ between the three case study communities, the results of Part 3 of the questionnaire were analysed separately. Yet, to better understand the participants' live-work conditions and environments, their satisfaction levels regarding interior living spaces and domestic livelihood (working) spaces were assessed separately.

The spatial qualities used to assess the participants' satisfaction and expectations refer to the housing domain and design criteria that determine the interior quality of low-income informal settlements. The subjective feedback of the older residents on all six domains was separately examined for the interior domestic spaces for living and livelihood activities in all case study communities using quantitative data analysis.

Generally, as shown in a boxplot graph (Figure 5), the older participants in FT are quite satisfied with most of the domains (median is 4 and above) for both living and working spaces. Likewise, those participants who live in both BK and MK are also quite satisfied with their domestic working spaces (median is 4 and above). This higher level of satisfaction implies that low-income residents have lower expectations of their housing conditions. However, for the living spaces in the cases of BK and MK, the domain of Health has a median and the interquartile range on average (Q2 and IQR are both 3), which is similar to the Comfort and Privacy domains (Q2 = 3) in the living spaces of MK.

Figure 5
Older residents' satisfaction with their housing (Image by authors)



In addition, participants living in houses pointed out that they are very unsatisfied (minimum is 1) with the domain of Design

and Adaptability in living spaces and Safety in working spaces. Furthermore, satisfaction with many domains for both flat and house are less than average ($Q1 = 3$), which indicated some dissatisfaction. Hence, to understand the real situation and issues, more detail on dissatisfaction was explored by adding up the participants' responses of 1 (very unsatisfied) and 2 (quite unsatisfied), then calculating the percentage of dissatisfaction of all responses.

| | | | Design | Safety | Health | Comfort | Privacy | Adaptability |
|-----|-----------------------|---------|----------|----------|----------|----------|---------|--------------|
| ALL | All community | Living | 6.67% | 6.67% | 13.33%* | 11.11%* | 2.22% | 8.89% |
| | | Working | 16.28%* | 9.30% | 4.65% | 6.98% | 4.65% | 4.65% |
| FT | Walk-up flat | Living | 0.00% | 0.00% | 0.00% | 6.67% | 0.00% | 0.00% |
| | | Working | 7.14% | 0.00% | 7.14% | 7.14% | 0.00% | 0.00% |
| BK | Unorganised community | Living | 6.67% | 13.33%* | 20.00%** | 6.67% | 0.00% | 20.00%** |
| | | Working | 20.00%** | 6.67% | 0.00% | 0.00% | 0.00% | 13.33%* |
| MK | Organised community | Living | 13.33%* | 6.67% | 20.00%** | 20.00%** | 6.67% | 6.67% |
| | | Working | 21.43%** | 21.43%** | 7.14% | 14.29%* | 14.29%* | 0.00% |

* Percentage of dissatisfaction between 10–20

** Percentage of dissatisfaction higher than 20

Table 2
Percentage of
dissatisfaction by
each domain

Considering the percentage of dissatisfaction (Table 2), more than 20% of older people who live in houses (BK and MK) reported dissatisfaction in many domains. They are quite unsatisfied with Health, Comfort, and Adaptability in living spaces. Besides, a higher percentage are shown to have been dissatisfied with the domains of Design (21.43%) and Safety (21.43%) in working spaces. The next domain that indicated more than 10% dissatisfaction was Privacy in the working space (14.29%). In contrast, older participants living in FT expressed less dissatisfaction than those living in the houses. The main dissatisfactions of older participants from all communities lay in the domain of Design (16.28%) in working spaces and the domains of Health (13.33%) and Comfort (11.11%) in living spaces.

The results show higher satisfaction with interior spaces for living and working in a flat than in a house, and the results from participants living in houses are similar regardless of whether communities are organised or unorganised. In the context of a house, this paper highlighted the critical areas of dissatisfaction raised by older residents; which include the Health, Comfort, and Adaptability domains in the living spaces, also the Design and Safety in working spaces. Yet, for a flat, the Design domain in working spaces is not satisfactory. Health and Comfort in living spaces are also the other domains that the older participants living in a flat are not satisfied with.

Housing Domains and Older People's Satisfaction Levels

As previously discussed, housing can benefit the livelihoods of low-income residents by offering them work opportunities. A further analysis is needed to understand how housing and home-based work conditions are related and how satisfied older people are with their working spaces at home. This research then conducted a more detailed analysis by sorting data into three groups according to livelihood activities, including service, cook, and stock.

The results shown in a boxplot graph (Figure 6) suggest that older residents who live in a house report less satisfaction with a wider interquartile range than those living in a flat. Further details on the median value of older people's satisfaction with their interior domestic spaces for living and working by livelihood activities (Table 3) reflect that most participants are quite satisfied with the housing conditions in response to their different work activities (Q2 = 4 or above). However, for the service work, the domains of Health in living spaces were given an average score (Q2 = 3). For the cooking work, the respondents displayed an average level of satisfaction with the Comfort domain in interior domestic spaces for living, along with Health and Privacy (Q2 = 3). For the stock work, residents are not satisfied with the Comfort domain in interior domestic spaces for both living and working in a flat (Q2 = 2.5).

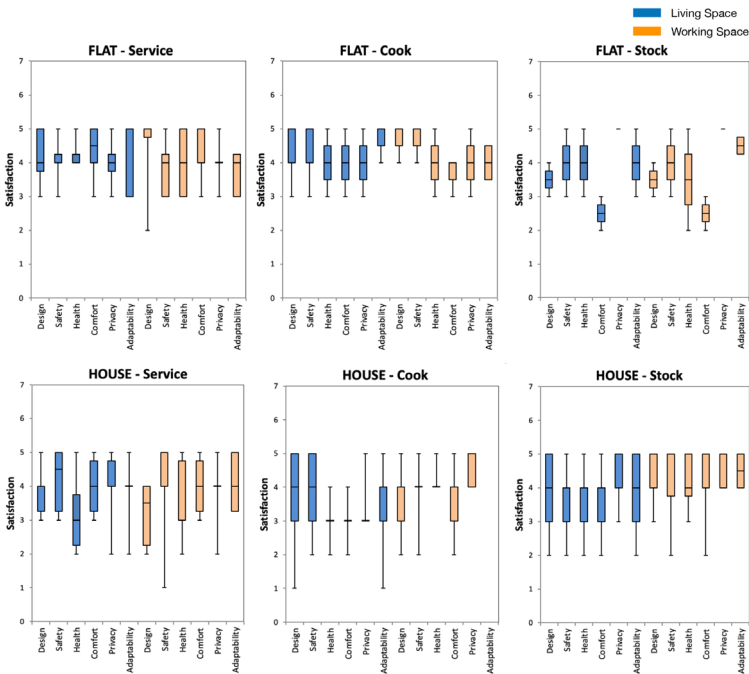


Figure 6
Older residents' satisfaction with livelihood activities (Image by authors)

Furthermore, this study evaluated the correlations between each housing domain and the overall satisfaction rated by the older participants by using the Pearson correlation analysis on IBM SPSS Statistics software. The analysis was done separately for interior living spaces and domestic working spaces. Based on the correlation results shown in Table 3, there are significant relationships between the six housing domains and the satisfaction of older people. In the living spaces, the domain of Comfort has a strong positive relationship with overall satisfaction ($p = .729$). The correlation coefficient for the Safety domains and overall satisfaction represents a slightly stronger relationship for the working spaces ($p = .776$). Interestingly, the correlation coefficient for all other domains also shows a significant value with a positive relationship, but the relationships are considered moderate. The relationship between overall satisfaction for living spaces and the domains of Health ($p = .647$) and Adaptability ($p = .674$) is quite significant, while the domains of Health and Comfort are moderately related to overall satisfaction for working spaces ($p = .684$ and $.675$ respectively).

| | | Design | Safety | Health | Comfort | Privacy | Adaptability |
|--|---------------------|--------|--------|--------|---------|---------|--------------|
| Overall satisfaction living spaces | Pearson correlation | .582** | .498** | .647** | .729** | .606** | .674** |
| | Sig. (2-tailed) | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| | N | 45 | 45 | 45 | 45 | 45 | 45 |
| Overall satisfaction working spaces | Pearson correlation | .658** | .776** | .684** | .675** | .632** | .640** |
| | Sig. (2-tailed) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | N | 45 | 45 | 45 | 45 | 45 | 45 |

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Table 3
Correlations between housing domains and older residents' satisfaction on living and working spaces

To this point, older participants' satisfaction with their households' interior domestic spaces for living and livelihood (working) leads to an understanding of the common issues and concerns with the current housing. The findings suggest a strong relationship between housing domains and overall satisfaction with both interior spaces of living and working. Moreover, the older people of Klong Toey show different levels of satisfaction with their interior domestic space conditions, and these differences are directly correlated with their housing types and livelihood activities. Thus, housing types and livelihood activities should be considered deliberately, as they affect older residents' satisfaction levels in low-income informal settlements.

Table 4
Housing quality by
livelihood activities
and housing types

| Domain | Housing quality | FLAT | | | | | | HOUSE | | | | | |
|--------------|-----------------------|---------|-------|--------|-------|--------|-------|---------|-------|--------|-------|--------|-------|
| | | Service | | Cook | | Stock | | Service | | Cook | | Stock | |
| | | Counts | % | Counts | % | Counts | % | Counts | % | Counts | % | Counts | % |
| Design | Size/ area | 9 | 24.3* | 7 | 46.7* | 3 | 33.3* | 13 | 27.7* | 12 | 24.0* | 7 | 14.9 |
| | Design/ room layout | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 5 | 10.6 | 4 | 8.0 | 1 | 2.1 |
| | Cognition | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 2.1 | 0 | 0.0 | 2 | 4.3 |
| Safety | Building structure | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 4 | 8.5 | 9 | 18.0 | 4 | 8.5 |
| | Security & safety | 7 | 18.9 | 1 | 6.7 | 0 | 0.0 | 3 | 6.4 | 2 | 4.0 | 3 | 6.4 |
| | Mobility aid | 1 | 2.7 | 0 | 0.0 | 0 | 0.0 | 5 | 10.6 | 2 | 4.0 | 2 | 4.3 |
| Health | Ventilation | 3 | 8.1 | 1 | 6.7 | 3 | 33.3* | 3 | 6.4 | 2 | 4.0 | 7 | 14.9 |
| | Health & hygiene | 3 | 8.1 | 1 | 6.7 | 1 | 11.1 | 1 | 2.1 | 2 | 4.0 | 3 | 6.4 |
| | Daylight | 1 | 2.7 | 0 | 0.0 | 2 | 22.2* | 3 | 6.4 | 2 | 4.0 | 3 | 6.4 |
| Comfort | Comfort & temperature | 5 | 13.5 | 1 | 6.7 | 0 | 0.0 | 4 | 8.5 | 6 | 12.0 | 10 | 21.3* |
| | Noise control | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 2.1 | 2 | 4.0 | 0 | 0.0 |
| Privacy | Privacy | 4 | 10.8 | 3 | 20.0 | 0 | 0.0 | 1 | 2.1 | 1 | 2.0 | 3 | 6.4 |
| Adaptability | Adaptability | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 2.1 | 1 | 2.0 | 0 | 0.0 |
| Others | Utilities | 2 | 5.4 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| | Location | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 4.3 | 2 | 4.0 | 1 | 2.1 |
| | Liveable atmosphere | 1 | 2.7 | 1 | 6.7 | 0 | 0.0 | 0 | 0.0 | 1 | 2.0 | 1 | 2.1 |
| | Community connection | 1 | 2.7 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 4.0 | 0 | 0.0 |
| TOTAL | | 37 | 100 | 15 | 100 | 9 | 100 | 47 | 100 | 50 | 100 | 47 | 100 |

Older Peoples' Expectations for Their Future Housing

To cross-validate the results from questionnaire Part 3 and analyse how the livelihood conditions and work activities are related to older people's satisfaction with their interior domestic spaces and housing, all data were analysed based on two groups of housing types and three groups of livelihood activities, as suggested previously.

The results revealed that functional suitability, accessibility, and sizing under the Design domain were considered extremely important housing attributes by the older participants of all working groups (mean = 2). Likewise, for those who do the cook and stock work, high-quality flooring and surfaces in the Safety domain were found very necessary. It can be clearly seen that housing attributes in the Design and Health domains are very important for those older people living in a flat with cook or stock works. Participants from all groups expressed that furniture and building elements under the domain of Adaptability are not necessary. Although the results shared comparable trends, they also revealed differences in the specific expectations that each group of livelihood activities had on required housing attributes. In addition, data from the open-ended question on the future housing quality in Part 4 of the questionnaire

were analysed using content analysis by performing quantitative counts. The older residents openly pointed out the interior quality of housing that they find the most important for enhancing livelihood under their living and working conditions. Regardless of ranking, the key qualities are listed and categorised according to the six housing domains (Table 4). The results show that the older people in Klong Toey expressed their highest expectations in relation to size and area. Similar results are shared among all housing types and livelihood activities (ranging from 24.0% to 46.7%), except for those who do stock work and live in a house.

Consideration for Live-Work Housing of Older People

Table 5 shows how the key housing domains and design attributes for live-work housing are justified. The results are grouped by housing types and livelihood activities. The results indicate that Health and Comfort are the most important domains for live-work housing, particularly for interior living spaces. The domain of Health involves good quality ventilation, daylight, and hygiene, while the Comfort domain focuses more on thermal comfort and temperature. Better Health and Comfort provisions in housing can ensure a higher level of satisfaction of older residents. For all housing types, the next most important domain for live-work housing is Design, which is concerned with providing adequate interior domestic space for the living and working activities of all household members. For working space in a house, Safety is another domain to consider. The Design quality of housing that is highlighted by older residents applies to a strong building structure as well as security. In contrast, older people in low-income housing are not concerned about the Privacy in their housing, but the Adaptability. Regarding the results from Table 6, the domain of Adaptability is underlined for interior living spaces in both flats and houses, and it also has a strong relationship to older residents' satisfaction with housing.

It is noteworthy that the findings from the spatial observation of interior domestic spaces show that many participants had adjusted and adapted their houses in order to maximise the use of interior spaces to meet their needs. Those house adaptations range from adding a small partition that offers more privacy or awnings that provide some shading, to adding a mezzanine or extended walls that create extra interior space. Moreover, it is frequently found that the functional spaces in many households overlap due to the residents' limited ability to permanently adapt their houses. For this reason, to allow older residents to easily maximise the use of their house, the live-work housing should be predesigned to support the adaptation and time-sharing of interior domestic spaces.

Table 5
Domain and housing
quality for live-work
housing

| Domain | Housing quality | FLAT | | | | | | HOUSE | | | | | |
|--------------|-----------------------|----------|------|----------|----------|------|----------|-------------|-----------------|-----------------|--------------|--------------|----------|
| | | Living | | | Working | | | Living | | | Working | | |
| | | Service | Cook | Stock | Service | Cook | Stock | Service | Cook | Stock | Service | Cook | Stock |
| Design | Size/ area | R-1 | R-1 | R-1 | R-1 | R-1 | R-1 | R-1 | R-1 | R-2 | DSF R-1 | DSF R-1 | DSF R-2 |
| | Design/ room layout | | | | | | | R-2 | | | DSF R-2 | DSF | DSF |
| Safety | Building structure | | | | PC-1 | PC-1 | PC-1 | | R-2 | Q2 | DSF PC-1 | DSF PC-1 R-2 | DSF PC-1 |
| | Security & safety | R-2 | | | PC-1 R-2 | PC-1 | PC-1 | | Q2 | DSF PC-1 | DSF PC-1 | DSF PC-1 | DSF PC-1 |
| | Mobility aid | | | | PC-1 | PC-1 | PC-1 | R-2 | | Q2 | DSF PC-1 R-2 | DSF PC-1 | DSF PC-1 |
| Health | Ventilation | PC-3 | PC-3 | PC-3 R-1 | PC-2 | PC-2 | PC-2 R-1 | Q2 DSF PC-3 | Q2 DSF PC-3 | Q2 DSF PC-3 R-2 | Q2 PC-2 | PC-2 | PC-2 R-2 |
| | Health & hygiene | PC-3 | PC-3 | PC-3 R-3 | PC-2 | PC-2 | PC-2 R-3 | Q2 DSF PC-3 | Q2 DSF PC-3 | Q2 DSF PC-3 | Q2 PC-2 | PC-2 | PC-2 |
| | Daylight | PC-3 | PC-3 | PC-3 R-2 | PC-2 | PC-2 | PC-2 R-2 | Q2 DSF PC-3 | Q2 DSF PC-3 | Q2 DSF PC-3 | Q2 PC-2 | PC-2 | PC-2 |
| Comfort | Comfort & temperature | PC-1 R-3 | PC-1 | Q2 PC-1 | PC-3 R-3 | PC-3 | Q2 PC-3 | DSF PC-1 | Q2 DSF PC-1 R-3 | DSF PC-1 R-1 | PC-3 | Q2 PC-3 R-3 | PC-3 R-1 |
| Privacy | Privacy | | R-2 | | | R-2 | | | Q2 | | | | |
| Adaptability | Adaptability | Q2 PC-2 | PC-2 | PC-2 | | | | DSF PC-2 | DSF PC-2 | DSF PC-2 | | | |

Q2 = Dissatisfaction derived from quartile analysis
DSF = Percentage of Dissatisfaction more than 20%
PC-1* = Significant relationship with overall satisfaction by Pearson Correlation analysis $p > 0.6$, ranking from PC-1, PC-2, PC3
R-1* = Expectation on housing attributes by mention counting, ranking from R-1, R-2, R-3

These findings highlight the importance of the Design, Health, and Comfort domains for all housing types and livelihood activities. However, it is obvious that each group of livelihood activities—namely service, cook, and stock—has its specific requirements for interior quality and its expectations of housing attributes. Yet, additional information from the spatial observation confirmed that these livelihood activities require certain facilities and spatial arrangements of interior domestic spaces to support their work at home.

Conclusion

The implementation of a questionnaire survey has provided a better understanding of the interior domestic space utilisation with regard to live-work housing for the low-income older population in Klong Toey, which has in turn enabled data classification of this research area. The special needs of older people and the requirements for interior quality that must be met to support their livelihoods show that housing and livelihood are interrelated aspects of life, especially in low-income communities. Thus, it is vital to ensure that older people can maintain their ways of living and working and age-in-place in their home and their communities.

The findings from the questionnaire survey suggest that the design and development of housing for low-income older people should be more customised based on the nature of their living and working conditions. The live-work requirements can be defined by the nature of the livelihood activities because each kind of work demands certain things of an interior domestic space. The livelihood activities are categorised into three groups: service, cook, and stock. It is important to understand whether the work takes place in, nearby, or outside the houses, how the resident manages working spaces in the house, and whether there is any requirement for special facilities and building systems. The interior quality of housing solutions may be different depending on the type of residence, including the options of a walk-up flat or house.

To aid the design and development of live-work housing for older people on a low-income, six key housing domains were introduced and identified using the expectations and levels of satisfaction of older people in Klong Toey. Out of these six, the findings suggest that Design, Health, Comfort, and Adaptability are the key domains for the interior domestic spaces of living and working for older people. An interior design that offers thermal comfort, ventilation, and daylighting is important to enhance the overall comfort and health of older residents. In addition, the Design domain may involve not only ensuring that interior spaces are practical and have a liveable atmosphere, but also assessing room sizes to ensure adequate living and working spaces. The Adaptability domain, meanwhile, is focused on creating interior domestic spaces that are flexible for living and working.

However, the satisfaction levels and expectations of older people with regard to interior domestic spaces of their housing vary according to housing type and livelihood activity. The housing domain and interior design qualities of each group should be considered deliberately, to ensure the specific needs of different types of people and their livelihoods are met in their living and working spaces. The findings also suggest a strong relationship between housing domains and the overall satisfaction of older people. In particular, the strongest relationships are found in the Health domain for interior living and in Safety for domestic working spaces. It is noted that this dissimilarity between different working conditions is vital to enable a better interior quality of live-work housing for older people in informal settlements.

Finally, liveable housing in the low-income context can be seen from various perspectives. Housing provision should embrace the

live-work concept and cover the key domains in interior domestic spaces for both living and livelihood. As the housing domains and considerations identified from the questionnaire correspond well with various living and livelihood conditions, especially for older people, the key findings can help formulate an effective framework for low-income housing design and development. The lessons learned from this study also provide the knowledge of interior quality as well as housing design and considerations which will lead to better redevelopment and relocation solutions, thus support a more responsible provision of affordable and adequate live-work housing options for vulnerable residents, particularly older people on a low-income. Incorporating livelihood capabilities into housing design and development could benefit not only the residents of Klong Toey but other similar cases of low-income communities in other parts of the world.

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