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Cohousing design guidelines for better social integration in the United Arab Emirates

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Considering cohousing as a new typology in the United Arab Emirates' (UAE) housing market is a challenge due to the cultural and societal dimensions. However, the variety of societies in the Emirates reflecting various habits, experiences, and traditions can allow testing such new types of housing which can be adapted to the local context, considering the needs of the society. This study aims at developing design guidelines for future cohousing in the UAE, considering the pillars of the Estidama program, i.e., social, cultural, economic, and environmental aspects, in addition to the role of architecture design. The present study is based on an empirical investigation from the viewpoint of future cohousing residents in the UAE. Semi-structured interviews considering 87 individuals were conducted. Moreover, a focus group discussion targeting eight professionals was performed. Furthermore, the Quality Function Deployment (QFD) method was applied to include the people's voices directly when developing the design guidelines for cohousing in the UAE. The study showed that the aspects of culture and privacy are crucial in the future of cohousing in the UAE. In addition, providing local facilities such as majlis and praying rooms is vital to consider. Moreover, other aspects such as sustainable design, universal design, and safety are also valuable. For the outdoor environment, the study highlighted the importance of urban design quality, landscape solutions, shading, and natural ventilation strategies in outdoor spaces. Future cohousing in the UAE is expected to enhance social interaction and contribute to sustainability in the long-term perspective.

KEYWORDS

architecture design, cohousing, quality function deployment, social interaction, United Arab Emirates, urban design

1 Introduction

Providing shelter is one of the most critical needs of human beings and is considered one of the fundamentals in Maslow's hierarchy of needs. Humans' demands are genuinely being developed, and the concept of housing has been shifted from being of basic and physical shelter to a place to create, save, and practice memories in a comfortable and safe place (Cowans et al., 2021). Kaufman (2006) stated that safety when providing housing is a necessity for the family. Without a decent place to live, people cannot be productive members of the community, children cannot learn, and families cannot thrive. Additionally, housing is one of the core domains within the

framework of integration into society (Ager and Strang, 2008). According to Ragette (2006), shelter satisfies a human's physical and psychological needs. Physical needs are represented as protection against unpleasant weather (heat and cold) and different attacks from others in the surroundings. Psychological needs usually come after satisfying physical needs, such as security and self-expression.

Over the decades, different housing types, forms, and definitions have been developed worldwide, attempting to consider the needs of domestic people. Housing types, such as courtyard housing, townhouse, towers, and villas, are common housing typologies. Another categorization of housing is divided into attached and detached housing forms. A third is categorized into low-, mid-, and high-rise housing forms. Meanwhile, considerable interest has been found in developing other contemporary housing types based on a sharing approach (Babos et al., 2020). In the second half of the 20th century, a new trend of collective forms of housing with the sharing approach appeared in Europe, which led to a wide variety of alternative housing models. Housing forms such as collective living, communal housing, collective initiatives, cooperative housing, and collective living are examples (Lang et al., 2020) focusing on the sharing approach, which became a fundamental issue of contemporary urban housing (McIntosh et al., 2010). Hence, using different terms expressing the sharing approach is sometimes contradictory or overlapping (Vestbro, 2010).

To understand the idea behind developing different collective forms of housing, one must shed light on the concept of an intentional community, which refers to a relatively small group of people who have created a whole way of life to attain a particular set of goals. Intentional communities have emerged as a group of people consciously and purposefully coalescing to realize a set of aims. This group attempts to create a unified way of life, i.e., one lifestyle that can be applied to the whole community; hence, unlike organizations or social movements, they are intentional communities (Shenker, 2011). Intentional communities can include housing types such as ecovillages, cohousing, urban housing, housing cooperatives, conference and retreat communities, rural homesteading communities, spiritual communities, religious communities, and income-sharing communes (Sanguinetti, 2013).

Cohousing, as a definition, has different meanings; one reason behind that is the use of the term in different countries, languages, cultural backgrounds, etc. (Vestbro, 2000), and therefore, Vestbro called for the need to find terms that could be used worldwide to avoid misinterpretation (Vestbro, 2010). The most used terms for "housing with shared facilities and other shared characteristics" are "co-housing" and "cohousing" (Babos et al., 2020). Based on current research, Vestbro (2010) defined cohousing as housing with common spaces and shared facilities. The author argued that the co-housing concept does not precisely state what "co" stands for; it could be collaborative, cooperative, collective, or communal (Vestbro, 2010). Babos et al. (2020) recommended separate definitions for the two terms. The co-housing term is a general expression; several different models can be distinguished under this broader concept. The author stated that housing forms such as collective self-build housing, collective self-help housing, collective living, community-led housing, condominiums, collaborative housing, eco-village, eco-district, and intentional community are examples of co-housing. On the other hand, cohousing is a particular form of housing with shared characteristics. Such shared characteristics must apply four features simultaneously: sharing spaces, activities, creation, and tenure (Babos et al., 2020). In co-housing, the residents participate in creating the communities. Residents typically collect multiple households with shared land, facilities, and public space with their neighbors without invading each household's privacy. The primary purpose of co-housing is to create a social environment. It may differ in size, location, design, and type of ownership. They have, however, common characteristics (McCamant and Durrett, 2011), such as 1) a participatory development process; 2) a design that facilitates community (neighborhood design); 3) common facilities (shared areas that are designed for daily use); 4) complete resident management (the residents manage the development and decision-making of their concerns at the place in community meetings); 5) non-hierarchical structure and decision-making; 6) a separate income source (residents have their own income), making it different from communal living (George, 2006). Co-housing development consists of private houses and common facilities where all activities and socializing occur. The specific features of common facilities depend on the interest of residents. Still, it usually has a common kitchen, laundry, living room, dining area, playroom for children, community meetings area, and guest rooms. The outdoor area can include a common garden, common socializing and meeting spots, and parking lots (Sanguinetti, 2013).

Co-housing aims to create a community within a neighborhood, with shared facilities, without sacrificing the privacy of the people (Bamford, 2008). One of the reasons for developing collective housing is the wish to design a community for children by creating a safe, encouraging environment, a "child-friendly environment." Children's movements are often restricted, with play beyond the front fence restricted as it is unsafe or believed to be so (Bamford, 2008), while in cohousing, children have more freedom and opportunities to play and interact with other children because they live close by and know their neighbors well (Vestbro, 2000; McCamant & Durrett, 2011).

With the technology boom after the industrial age, lifestyle has changed drastically and changed the way people interact with each other (McGraw-Hill, 2022). For example, using technological devices, including computers, mobile devices, and smartphones, contributed to shifting the meeting zone from physical to virtual through using different online platforms. In addition, working remotely from home changed the way of living and the way of interacting with others during the day (Gutman et al., 2022). On the other hand, technology addiction can lead to social isolation, characterized by a lack of contact with other people in everyday life (Hosale, 2013). According to Alghamdi (2016), anyone who browses the internet frequently is likely to spend less time with friends and family than non-internet users. Through architecture and different types of co-housing, it is possible to change habits and solve the problem of isolation by facilitating a community that allows people to socialize and interact with each other, bringing back the sense of a neighborhood and community and creating spaces where people feel safe and feel like belonging and integrate with others even during challenging periods such as COVID-19 (Arroyo et al., 2021).

Considering different housing forms categorized under the term co-housing (Babos et al., 2020), one of the early examples in the 1930s is the Swedish word kollektivhus (literally collective building), which is the most frequently used term for housing with shared facilities (Vestbro, 2014). The aim was to reduce women's housework so they could retain gainful employment even when they get married and have children. In the 1960s, the modern type of cohousing originated in Denmark as some families were dissatisfied with existing housing and communities that did not meet their needs (Caves, 2004). It blossomed exponentially in the 1990s in North America, following the publication of the book "Co-housing: A contemporary approach to housing ourselves" by two American architects Kathryn McCamant and Charles Durrett in 1988, who adopted the concept from Denmark (McCamant and Durrett, 1988). Durrett and McCamant first developed the term cohousing in the United States. Afterward, cohousing increased in popularity around the world, and many projects have been established in countries such as Sweden, Germany, the Netherlands, Australia, Canada, the United States, Spain, France, Italy and the United Kingdom, and Asia (Bamford, 2008; Sanguinetti, 2013; Arbell, 2022).

1.1 Cohousing in the United Arab Emirates

The United Arab Emirates (UAE) has considered and embraced a range of approaches, leading to the current flourishing economy. Diversity in the UAE is the significant difference in how residents identify with different subjects. The country has over 200 nationalities as residents, implying the variation in ethnicity, culture, background, gender, beliefs, etc. Although the UAE has significant experience integrating different ethnicities, the concept of cohousing is yet to be promoted in the housing market. Few individual initiatives in Dubai promoted and adapted the concept of co-living differently to fit the local needs in the housing market. The new vision of co-living in Dubai is a new trend among millennials for renting shared apartments to save money and live with like-minded people. It consists of a well-designed, fully furnished place, with utensils and utilities covered by one bill (Coliving, 2023). The UAE is a modern country influenced by globalization, making it a reflection of all civilizations without preserving its own identity.

The standard housing types in the UAE consist of apartments/condominiums and villas/landed houses. The major cities for the housing market are Dubai, Abu Dhabi, and Sharjah (Mordor Intelligence, 2023). The type of tenure is divided into 1) owned housing, where the housing unit is built on the property of the owner. The government-subsidized housing and government villas that are owned by UAE nationals, and the owner of the same resides in them, are also included in this type; 2) lease housing, where the housing unit is not furnished, and the owner is renting it directly from the owner or his/her agent; 3) furnished lease, where the housing unit is furnished and leased to the owner directly from the owner or his/her agent; 4) housing provided by the employer, where the employer provides the house to the holder, whether the house is owned or rented by the employer; and 5) other housing types such as gifts and donations (SCAD, 2023). The average housing prices in dirhams per square foot in Dubai, for example, in the period 2008–2020, varied from 1.95 to 911 K, where sales of off-plan properties in Dubai registered strong growth in 2021 (Mordor Intelligence, 2023).

Meanwhile, the traditional Arabic city used to share what is so called a "sense of belonging," where all citizens are strongly tied to what they feel is part of them. Bringing back essential core values and positive habits means understanding what formed the complex urban fabric back then. Considering the ongoing urban development in the UAE and different types of residential areas hosting various ethnicities with diverse cultures and backgrounds, there is a need to develop new housing alternatives that can be added to what existed in the market. This new housing alternative should consider social, cultural, economic, and environmental aspects, the four pillars of the so-called "Estidama," which means the sustainability program applied in the UAE (Estidama, 2010). Designing co-housing in the UAE is a challenge of making new typologies that fit the local context, considering aspects such as different ethnicities and demographics, various cultures, and new building technologies. By conducting an empirical investigation, this study aims at developing design guidelines for future cohousing in the UAE, considering the pillars of the Estidama program, i.e., social, cultural, economic, and environmental aspects, in addition to the role of architecture design.

1.2 Estidama program

"Estidama," which means "sustainability" in Arabic, aims to develop more sustainable, cost-effective communities, cities, and global companies while balancing Estidama's four pillars: environmental, economic, cultural, and social aspects. Estidama's goals are reflected in Plan 2030 and other Urban Planning Council (UPC) policies, for example, the Development Code. Estidama was founded in 2008 and is the first program of its type in the Middle East. Estidama's immediate focus is on the quickly changing built environment. The UPC is making substantial achievements in this field to affect projects under design, development, or construction. The Pearl Rating System is one of Estidama's primary endeavors (Estidama, 2010). There are seven fundamental categories of sustainable design, according to Estidama: integrated development process, conserving natural environment, livable communities, precious water, resourceful energy, stewarding materials, and innovating practice.

The ultimate goal of Estidama is to preserve and enrich the physical and cultural identity, and it has already tackled many aspects, such as building the city and adequately using available resources, all in an effort to attain a sustainable state of living. By working closely with all stakeholders, Estidama has already improved the mindset and implementation practices of the construction industry and will continually develop to encourage societal improvement. As for outcomes and impacts, the Pearl Rating System provides regulatory guidance on design, construction, and operational performance. Meanwhile, sustainability principles are also embedded in new planning documents through Estidama's continual improvement and participation in policy development. Estidama buildings, for example, have been designed to reduce energy by 31% and use 37% less water. More impressively, 65% of construction waste has been diverted from landfill. There are also unquantifiable impacts,

such as improved health of buildings and quality of life for residents, due to mandatory reduction of unhealthy materials and the encouragement of passive design measures. These and many other improvements occur at all scales, from single homes to whole communities, through the Pearl Rating System for villas, buildings, and communities. As Estidama becomes more recognized, it is also being implemented in other Emirates and countries in the region, including Bahrain and Seychelles (Urban Agenda Platform, 2023).

2 Materials and methods

As mentioned previously, the present study is based on an empirical investigation from the viewpoint of future cohousing residents in the UAE considering the pillars of the Estidama program, i.e., social, cultural, economic, and environmental aspects, in addition to the role of architecture design. Semi-structured interviews with 87 individuals were conducted. Moreover, a focus group discussion targeting eight professionals was performed. Furthermore, the quality function deployment (QFD) method (Akao, 1997) is applied to include the people's voices directly when developing the design guidelines for cohousing in the UAE.

2.1 Semi-structured interviews

The semi-structured interviews aim to investigate the needs of the people when developing cohousing communities in the UAE. The advantage of using semi-structured interviews (Hitchcock & Hughes, 1989) is that the interviewer controls the process of obtaining information from the interviewee. Still, it is free to follow new leads as they arise (Bernard, 1988). In this study, interviews with 87 individuals were conducted face-to-face and then transcribed, coded, and analyzed. The design of the semi-structured interviews is based on the Estidama sustainability pillars, as mentioned previously. The interview form includes general questions about age, gender, the city of residency, etc. Moreover, the form includes 18 questions divided into Estidama's four pillars, in addition to the role of the design, as shown in Table 1. The target sample tends to be mixed, consisting of local Emiratis and residents interested in the concept of cohousing or who might be future residents in cohousing projects in the UAE, investigating their potential needs in such a type of cohousing. The interview process considers people of all ages with various ethnicities, cultures, religions, etc. The sample included university students, public and private employees, and people in public facilities such as university campuses, malls, and offices. In this study, about 69% of

TABLE 1 Semi-structured interview questions based on Estidama's four pillars.

Q	Parameter	Question
1	Culture	To what extent would you like to live in a community where all neighbors know each other, share activities, and meet others?
2		To what extent are you interested in sharing daily life common facilities (majlis, kitchen, dining rooms, and BBQ spaces) with your neighbors?
3		To what extent are you willing to adopt new habits and culture, such as cooking together, doing common activities, and co-parenting?
4		To what extent would you live in a cohousing that preserves and enhances your privacy and your society's values?
5		To what extent would you like to invite guests to the community majlis (common guest room) rather than your private one?
6	Environment	To what extent are you interested in living in sustainable communities that apply friendly energy solutions for a better environment?
7		How important is providing shaded and ventilated sitting areas for outdoor activities?
8	Social	How much do you engage with your neighbors performing common activities?
9		Your kids spend more than 3 h a day chatting on electronic devices solely
10		Your kids spend more than 3 h playing with other kids outside (after school)
11		How much do you think people are isolated from their environment by spending more time on social media than interacting with family members?
12		By living in cohousing, to what extent do you agree that your kids will spend more time in outdoor spaces (than time spent on social media) to interact with other kids safely?
13		By living in cohousing, how much do you agree to have common indoor and outdoor facilities (both for adults and kids) that facilitate different activities next to your private unit?
14	Economic	To what extent do you agree to have a 10% smaller private apartment in a collaborative community and have, in turn, more space for common facilities to reduce living costs?
15		To what extent do you agree to share service fees, cleaning equipment, drilling machines, etc., with your neighbors to reduce the cost of living?
16		To what extent do you agree that cohousing is more money-saving than individual houses?
17	Design	To what extent do you agree to have two courtyards (private and public)?
18		To what extent do you agree to be involved in the planning and designing phase (designing your housing unit)?

respondents were local Emiratis, while approximately 31% were residents, and all were living in Dubai and Sharjah, which were the targeted geographical locations in this study. The purpose of the sample is exploratory, not representative. According to Denscombe (2014), in exploratory samples, the research scale tends to be smaller, which is due to the likelihood that every person in the sample will be studied in great depth, and the size of this sample type is not governed by matters of accuracy but by considerations of how informative the sample is. The sample size should only be sufficient for the researcher to feel that adequate information was collected (Denscombe, 2014). In this study, about 89% of respondents were local Emiratis living in Dubai and Sharjah, while the rest were residents in the two cities.

The design of the semi-structured interview form was based on the Estidama sustainability pillars, i.e., cultural, social, economic, and environmental aspects, in addition to the role of architecture design. As for the social aspect, five questions were designed to investigate whether or not the respondents 1) are keen to live in cohousing; 2) would like to share daily life common facilities; 3) adopt new habits and culture; 4) would like to live in a cohousing that preserves and enhances privacy; 5) would like to invite guests to the community majlis (a common guest room). Regarding the environmental aspect, two questions were considered to investigate the level of interest in housing units providing friendly energy solutions, shading, and ventilation strategies. In the case of the social aspect, six questions were considered to investigate social engagement with others, both for adults and kids, in addition to the risk of social isolation and consideration of common facilities next to the private units. As for the economic aspect, three questions were designed to investigate to what extent the interviewees are interested in the idea of saving by sharing (Vestbro, 2012). Investigating the role of the design aspect in cohousing includes two questions related to privacy in the architecture design, as well as the role of user involvement in the design process.

The authors were interested in collecting ordinal data to reflect on the four aspects of the Estidama sustainability program. Therefore, a five-point Likert scale was used denoting least favorable, less favorable, neutral, more favorable, and most favorable. The idea of using a five-point Likert scale was that it was comparatively easier to understand, considering a neutral standpoint and opposing extremes as positive or negative reviews.

2.2 Focus group discussion

To gain input on how cohousing can be adapted to the social, cultural, and environmental conditions in the UAE, a focus group discussion was applied. Moreover, different challenges facing the concept of cohousing in the UAE were discussed and elaborated. Focus group discussion (Morgan, 1988) is a method facilitating need assessment (Tipping, 1998). The selection criteria were based on considering professionals (n = 8 persons) with similar backgrounds, interests, and experiences, mainly in architectural design and urban development. The sample was organized to have input from both the UAE and Sweden. The reason for inviting Swedish professionals was to gain insight and experience from a European country with a solid experience in different types of cohousing and various intentional communities. Four Swedish architects and urban designers and another four from the UAE accepted the invitation.

To achieve the aim of the focus group discussion, the following triple agenda was introduced: 1) architectural design considerations, 2) cultural and social considerations, and 3) urban design considerations. The meeting was organized to be online (Edmunds, 1999) and planned for 3 h, divided into two sessions. The first session consists of a presentation showing the project's aim, objectives, procedures, etc., followed by a discussion to develop the project. The second part of the meeting was planned to be an open discussion to have input on the aforementioned triple agenda. To achieve the triple agenda throughout the meeting, the following questions, among other inquiries, were raised for further discussion: 1) what are the main obstacles/barriers/challenges/priorities affecting cohousing architectural design in the UAE? 2) How can the architectural design of future cohousing in the UAE better facilitate cultural and social aspects? 3) How can outdoor spaces of the cohousing play an essential role in facilitating social integration while considering privacy? (4) What environmental solutions can be applied in the future cohousing of the UAE?

2.3 Triangulation of empirical results

This study uses content analysis (Baxter, 1994) to analyze the outcome of the focus group discussion, focusing on expectations of how the future cohousing in the UAE will look. The output of the focus group discussion will be compared with the outcomes of semi-structured interviews via Quality Function Deployment.

2.4 Quality Function Deployment (QFD)

Quality Function Deployment (QFD) is a methodology that helps translate customer needs into design requirements to ensure that the output, whether a product or process, meets these needs (Erdil and Arani, 2018). Its applications are primarily found in design-related efforts, and many still limit QFD use to product design and development (Franceschini, 2002). The International Organization for Standardization (ISO) describes QFD as "a method to assure customer or stakeholder satisfaction and value with new and existing products by designing in, from different levels and different perspectives, the requirements that are most important to the customer or stakeholder" (ISO, 2015). The name was derived from its Japanese roots: hinshitsu cinema Tenkai (Akao, 1997). This method allows all stakeholders to exert power in the design process or modification of the existing, where every voice is counted, and the customer is put first. Moreover, it focuses on a significant critical view to putting all powers on making it the best way. QFD opens insights on critical points to customers that companies did not pay enough attention to, resulting in a highly unexpected prioritization that differs from the conventional wisdom held by the company and many of the participants before engaging in QFD (Hauser et al., 2010, page 07). Varolgüneş and Canan (2018) reported that the "architectural design process entails many problems due to its versatility. User demands, environmental factors, structure acquisition, processes, and project teams vary even for designs of the same structure type. Despite the diversity of these factors, the

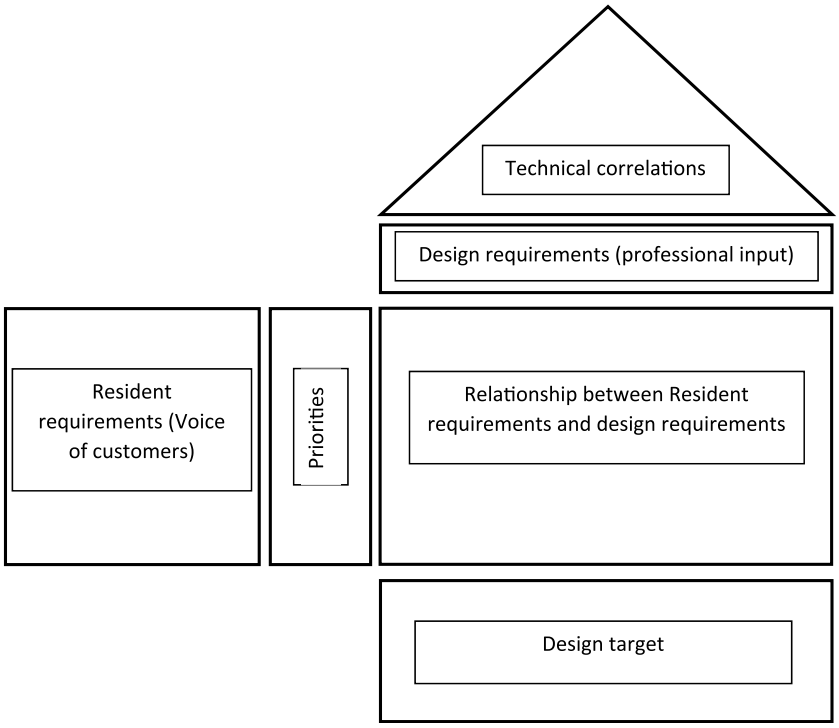


FIGURE 1
House of Quality (HOQ).

architectural design process usually develops in a designer-oriented way." This entails that the client's needs about the design are lacking in the outcome, resulting in rework and excessive meetings that add up in cost and the time required to finish the whole process.

The House of Quality (HOQ) is the matrix or tool used to present the technical response of the given rows of requirements; it is also a communication tool between the QFD team and the management (Varolgüneş & Canan, 2018). The development process starts with understanding customer needs and how well the company products or services respond to them from customers' perspective. The VOC is represented in the WHATs section of the matrix on the left side (Figure 1). The WHATs section identifies and classifies customer needs and desires that should be considered in the final design and/or product. The relative weight of each requirement is obtained from a survey or interview conducted with the customer, in which they rank how important each of them is. The middle part of the HOQ is the treatment of each need into a technical specification that is ranked by a strong, moderate, and weak scale symbolized by ●, ○, and ▽ and given a weight of ±9, ±3, and ±1, respectively. The triangular roof of the house indicates the correlation between various technical treatments to have an idea about how the treatment of a particular need might affect or repel the effectiveness of others. The remaining part at the bottom resembles the determination of targets and relative weights using a simple calculation of each column (Figure 1). In this study, the critical points of the cohousing QFD were categorized under the same main categories that semi-structured interviews were based on, i.e., cultural, social, environmental, economic, and design aspects. The data analysis obtained relative weight when translating the Likert scale results to a 1–5 scale. The inputs for the WHATs are as follows:

- Bringing back the sense of the old Fareej (traditional housing)
- Sharing daily life facilities
- Adapting new habits
- Preserving and enhancing social values
- Sustainable building
- Protection from the weather conditions in outdoor space
- Inviting guests to the community majlis (guest room)
- Knowing neighbors
- Kids going back to the urban space
- Time spent on social media

These WHATs are placed on the left side of the HOQ (Figure 1), and the HOWs form the horizontal belt of technical requirements that experts thought are most relevant and beneficial to the design process of co-housing. These HOWs have target values, either quantitative or qualitative; they are set to achieve a goal and to use it to benchmark with other case studies. The goal of benchmarking is to analyze what they did to succeed and what design considerations were the most important. The HOWs or the design requirements are derived from the focus group discussion (see Section 2.2). The central interrelationship section used the scale of the symbol (●, ○, and ▽) to study which design elements affect a critical point the most; one critical point might be affected by more than one design element. Shading pathways, for instance, are affected by thermal comfort study and innovative design. As the concept of cohousing is new in the UAE, no comparisons with other

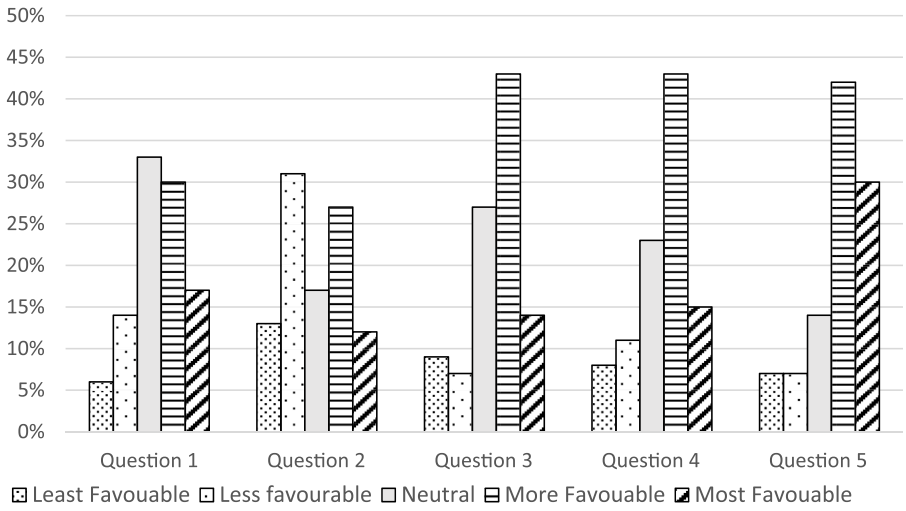


FIGURE 2
Cultural parameters that affected the concept of developing cohousing in the UAE.

cohousing projects were carried out; therefore, "competitive evaluations" in the HOQ are not applicable.

3 Results

This section presents the results divided into three parts. The first part introduces the outcomes of the semi-structured interviews related to the pillars of the Estidama program. The second part of the results presents the outcomes of the focus group discussion related to how cohousing can be adapted to the UAE's social, cultural, and environmental conditions. The third part illustrates the QFD outcomes.

3.1 Parameters affecting the development of cohousing in the UAE

3.1.1 Cultural parameters

Figure 2 illustrates that about 47% of the samples favor living in a community where all neighbors know each other, share activities, and meet others. In contrast, only 20% do not to prefer to live in such a community, whereas approximately 33% are neutral and have no preferences (see question 1 in Figure 2). Moreover, about 39% of the respondents are interested in sharing common daily life facilities such as majlis, kitchens, dining rooms, and BBQ spaces with their neighbors. In contrast, 44% do not favor sharing such facilities, and 17% are neutral and have no preferences (see question 2 in Figure 2). The results also show that about 57% of the interviewees are willing to adopt new habits and culture, such as cooking together, doing everyday activities, and co-parenting. On the other hand, only 16% favor not adopting new habits and cultures, whereas 27% do not indicate their preferences (see question 3 in Figure 2). The results also highlight that approximately 58% of the studied samples would like to live in a cohousing that respects privacy and society's values. In contrast, only 19% do not favor and prefer to live in such a community that respects privacy and society's values, whereas approximately 23% are neutral and with no preferences (see question 4 in Figure 2). The study shows that approximately 72% of the respondents favor inviting their guests to the shared guest room rather than to their private room at home, whereas a few (about 14%) favor inviting their guests to the living room in the residential unit, and approximately 14% favor not to identify their preferences (see question 5 in Figure 2).

3.1.2 Environmental parameters

In the context of exploring whether or not the interviewees are interested in environmental parameters in the future design of cohousing in the UAE, Figure 3 shows that the majority of the interviewees (86%) are interested in living in sustainable communities that apply friendly energy solutions for a better environment. On the contrary, very few interviewees (5%) are not interested in such environmental solutions, whereas approximately 9% prefer not to express their opinions (see question 6 in Figure 3). The results also illustrate that it is vital in shared outdoor spaces to consider shaded and ventilated sitting areas to protect from solar radiation and reduce the amount of heat stress (approximately 47%). On the contrary, a considerable number of answers (approximately 38%) do not prioritize having shading and ventilation in the shared outdoor spaces, whereas approximately 15% decide to be neutral (see question 7 in Figure 3).

3.1.3 Social parameters

As for the social parameters, Figure 4 illustrates that most of the answers (49%) stated that engaging with neighbors performing common activities is the least favorable. In contrast, only 31% favor engaging with the neighbors, whereas other interviewees (20%) preferred to be neutral with their answers (see question 8 in Figure 4). The results show that about 57% of the interviewees consider that their kids spend more than 3 h using online chatting platforms daily, and other interviewees (30%) preferred to be neutral (see question 9 in Figure 4). In the same

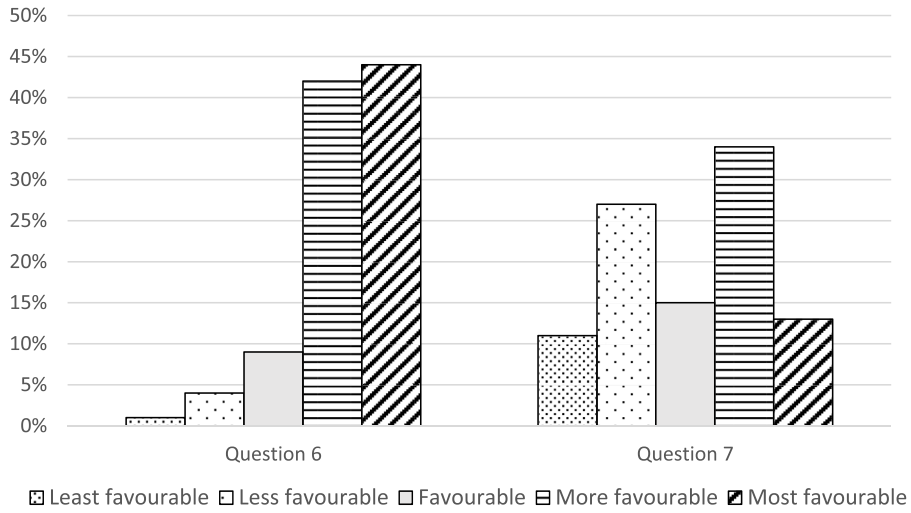


FIGURE 3
Environmental parameters that affected the concept of developing cohousing in the UAE.

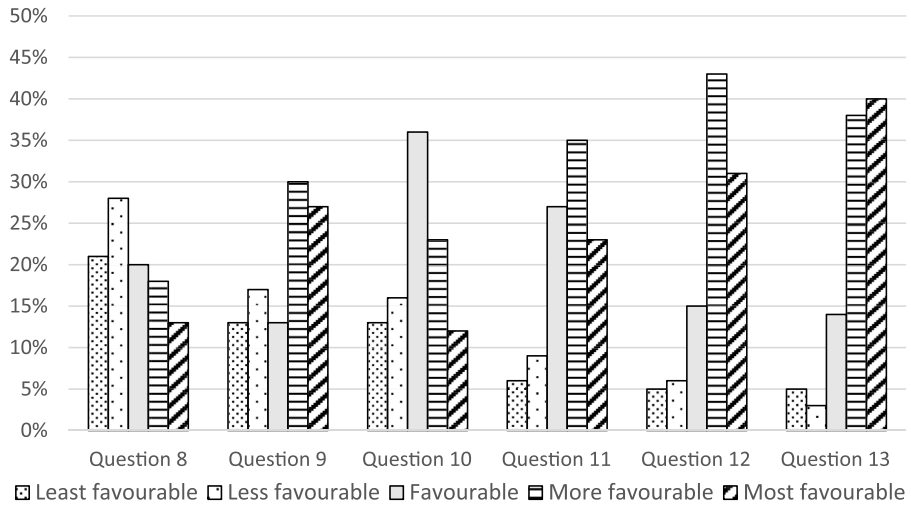


FIGURE 4
Social parameters that affected the concept of developing cohousing in the UAE.

context, fewer interviewees (35%) consider that their kids spend more than 3 h (after school) playing with other kids outdoors, and other interviewees (35%) preferred to be neutral (see question 10 in Figure 4). The results reveal that 58% of the samples consider that people are isolated due to the massive time spent on social media than the time spent interacting with families. On the contrary, only 15% do not believe that people are socially isolated due to the massive time spent on social media, whereas about 27% decided to be neutral (see question 11 in Figure 4). Many interviewees (74%) think that by considering cohousing as an option, the kids will spend more time in outdoor spaces (than time spent on social media) to interact with other kids safely. On the other hand, 11% do not believe that the kids will spend more time outdoors than indoors in the cohousing, whereas 15% preferred to be neutral (see question 12 in Figure 4). By considering cohousing as an option, the results show that 78% agree to have common indoor and outdoor facilities (both for adults and kids) that facilitate different activities next to the private units. On the other hand, only 8% do not agree to have common indoor and outdoor facilities next to their private units, whereas about 14% show no preferences (see question 13 in Figure 4).

3.1.4 Economic parameters

Regarding the economic parameters, Figure 5 shows that about 45% of the answers agree to have a 10% smaller private apartment in a collaborative community and have, in turn, more space for

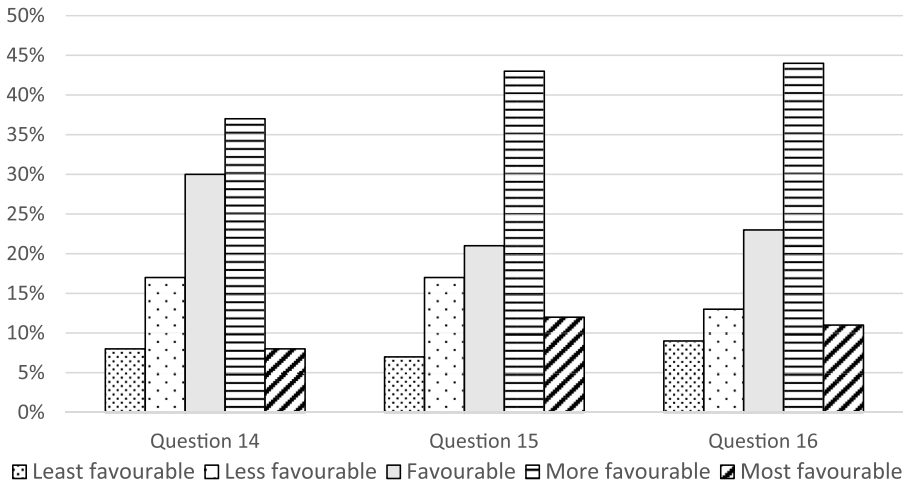


FIGURE 5
Economic parameters that affected the concept of developing cohousing in the UAE.

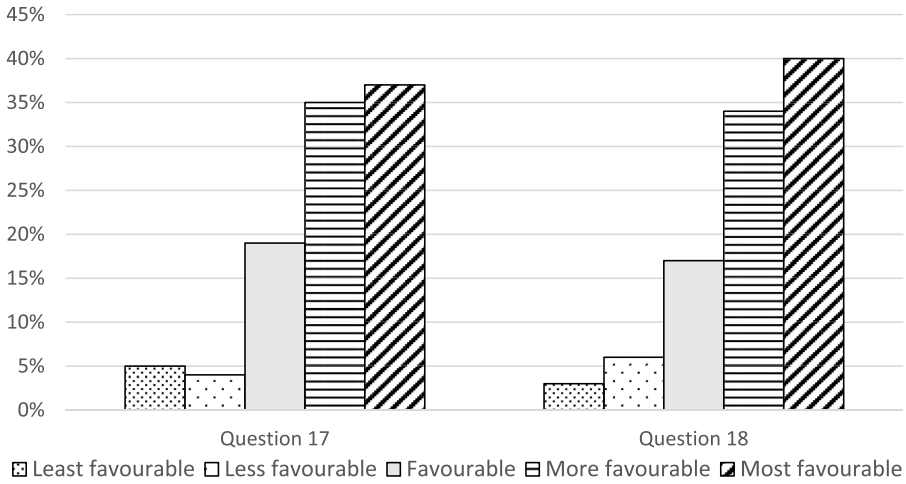


FIGURE 6
Design parameters that affected the concept of developing cohousing in the UAE.

common facilities to reduce living costs. On the contrary, about 25% disagreed with living in a limited-size apartment, whereas about 30% of the answers were neutral (see question 14 in Figure 5). The results also reveal that the majority of the respondents (55%) agree on sharing service fees, cleaning equipment, drilling machines, etc., with the neighbors to reduce the cost of living for the community (see question 15 in Figure 5). In contrast, only 24% did not agree on sharing stuff with others, and about 21% of the answers were neutral (see question 15 in Figure 5). The results illustrate that many interviewees (55%) agree that cohousing is more cost-effective than individual houses. On the other hand, about 22% of the samples disagreed with the approach of saving by sharing, and only 23% of the answers were neutral (see question 16 in Figure 5).

3.1.5 Design parameters

Regarding the design parameters, the results show that privacy has an important role in the future design of cohousing in the UAE. Figure 6 illustrates that most of the answers (72%) agree that the housing units of cohousing should have two courtyards (private and public) for privacy reasons. In contrast, only 9% disagree with this approach, whereas other interviewees (19%) prefer to be neutral with their answers (see question 17 in Figure 6). The results also illustrate that the sample is highly interested in participating in the design process. In this context, the results reveal that the majority of the sample (74%) would like to be involved in the planning and design phase of the cohousing project. Only 9% of the respondents disagreed with being involved in the design process, whereas about 17% preferred to be neutral (see question 18 in Figure 6).

3.2 Adapting cohousing to the UAE conditions

3.2.1 Architectural design considerations

The focus group discussion—consisting of Swedish and UAE groups—highlighted that the architectural design of future cohousing in the UAE should be given a high priority. The input from the Swedish invited group mostly focused on 1) providing new functions to be added to the cohousing, such as majlis (reception and guest room), praying room, activity room for women, office hall for online working, study room for teenagers and playroom for kids, and common kitchen attached to a separate dining room; 2) facilitating innovative design that should reflect the society's identity; for example, a courtyard system can be applied and tested to produce local architecture; (3) prioritizing safety requirements, especially for kids' indoor and outdoor spaces. It is also crucial to consider a universal design with high standards to make the building and its shared facilities accessible and safe to all, including the elderly. On the other hand, the input from the group in UAE mainly focused on 1) clearly identifying the private spaces from the public spaces to be able to draw a clear line between common facilities and private units. In this context, mixing the circulation between the common and private facilities is not recommended and 2) considering mixed building geometries (attached and detached units) with courtyards for various architectural purposes. The number of units, however, needs to be specified based on the funding available, type of tenure, etc. As the concept of cohousing is new in the UAE, starting with a small-scale community as a prototype (around 12–15 units in different sizes) is wise.

3.2.2 Cultural and social considerations

The focus group argued that the cultural and social aspects are crucial to consider in the future cohousing in the UAE. The professionals from the UAE highlighted the importance of privacy, which should be maximized both in the units and in between units. In shared facilities, minimal privacy can facilitate social contacts between residents. Private terraces and balconies should not face each other, and visual contact between the common facilities is recommended. In contrast, exposing the private unit entrances is not recommended. On the other hand, the professionals from Sweden emphasized facilitating new experiences for the residents in the cohousing. One significant experience is the concept of sharing, where the residents can share different stuff such as old electrical equipment and grass-cutting machines. It is also essential to share cooking and meals to facilitate social coherence.

3.2.3 Urban design considerations

The professionals from both countries (Sweden and the UAE) underlined that the aspect of urban design is essential to be considered in the future cohousing in the UAE, including 1) providing high-quality urban design to attract the residents to spend time outdoors. It is recommended to consider different materials, colors, and different landscape solutions. It is also recommended to consider an urban farming approach in outdoor spaces where residents can work together to foster social bonds and produce local food, 2) enhancing thermal comfort in outdoor spaces to let people stay for longer periods and use the spaces at different times of the day in different seasons, even in the worst periods, and 3) maximizing the shade using different landscape elements. Trees should have wide canopies, allowing more shade, and better to be evergreen to provide shade all over the year. Outdoor spaces should also facilitate natural ventilation to reduce the amount of dust and the level of heat stress.

3.3 Quality Function Deployment (QFD)

The inter-relationship matrix between resident requirements or VOC and design requirements to develop future cohousing in the UAE is shown in Figure 7. The figure illustrates that aspects such as gaining new experiences, the types of common functions in the house, cultural and social aspects, privacy, innovative design, and outdoor thermal comfort have the highest priorities when developing cohousing in the UAE (Figure 7). On the contrary, other aspects, such as the number of units, typology, and unit layout, have the lowest priorities among the aspects studied (Figure 7).

4 Discussion

Table 2 presents the proposed cohousing design guidelines categorized under their respective significant criteria. The guidelines are ranked according to QFD's technical importance rating derived from 1) semi-structured interviews, which represent VOC, and 2) focus group discussion, which represents the professional viewpoint. Consequently, the proposed design guidelines are suggested for the cohousing indoor and outdoor environments and presented according to their priorities in the QFD model.

The results of this study highlight the importance of common facilities in future UAE cohousing to provide new experiences and foster, for example, social contact, cohesion, and solidarity (see Table 2; Section 3.2). This agrees with other studies showing that the cohousing lifestyle can significantly improve residents' quality of life by enhancing personal autonomy, social support, and solidarity (Labit, 2015; Glass, 2020; Monton et al., 2022). The positive social atmosphere in future cohousing in the UAE can also lead to a better environment, meaning that a cohesive sociality can induce a particular commitment to the surrounding local environment, which, if nurtured, can possibly be extended into broader environmentalism. This goes in coherence with other studies arguing that the supportive social setting often associated with a "sense of community" can contribute to the effective application of pro-environmental attitudes, and the supportive community-based social relations, on the other hand, can engender a sense of belonging and allegiance to one's locale (Meltzer, 2000). In this context, cohousing can induce individuals to engage in environmentally friendly behaviors, such as using a bicycle instead of driving a private vehicle and supporting an individual's commitment to more sustainable practices.

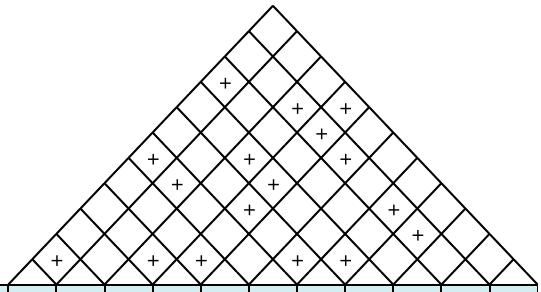
To produce adequate cohousing, the results shed light on the fact that it is vital to design the common facilities in harmony with the local community's culture and sociality, meaning that

QFD: House of Quality
Project:
Revision:
Date:

Correlations	
Positive	+
Negative	−
No Correlation	

Relationships	
Strong	●
Moderate	○
Weak	▽

Direction of Improvement	
Maximize	▲
Target	◇
Minimize	▼



Row #	Weight Chart	Relative Weight	Customer Importance	Maximum Relationship	Customer Requirements (Explicit and Implicit) \ Functional Requirements	1 Functions	2 Cultural and Social Aspects	3 Innovative design	4 Urban design	5 Safety	6 Privacy	7 Typology and unit layout	8 Outdoor thermal comfort	9 New experiences	10 Landscape solutions	11 Number of units
					Direction of Improvement											
1		10%	4	9	Bringing back the sense of the old Fareej (traditional housing)	●	●	●	○	●	●	▽	●	●	○	○
2		10%	4	9	Sharing daily life facilities	●	●	○	○	●	●	●	●	●	●	○
3		10%	4	9	Adapting new habits	●	●	▽	▽	●	●	○	○	●	○	●
4		10%	4	9	Preserving and enhancing social values	○	●	●	○	○	●	▽		●		
5		13%	5	9	Sustainable building	○		●	○			●	●	○	●	○
6		10%	4	9	Protection from weather in outdoor space	▽	○	●	●	●	○		●	○	●	
7		8%	3	9	Inviting guests to community Majlis	●	○	▽			●	●		●		●
8		8%	3	9	Knowing neighbors	●	●	○	●		●	▽		▽		○
9		10%	4	9	Kids going back to the urban space	●	○	●	●	●	○		●	●	●	
10		13%	5	3	Time spent on social media	○	▽	▽	○				○	○	○	
					Target	Co-living, common facilities and local functions	Separate common facilities from private units	Smart and sustainable design	Quality of outdoor spaces	Safe playgrounds with full accessibility for all	Visual contact : 0% near private spaces to 100% in the common spaces	Attached and detached building geometries	Shading and ventilation	the common facilities are a core to foster social cohesion and solidarity	Trees with wide canopies	Small scale community
					Max Relationship	9	9	9	9	9	9	9	9	9	9	9
					Technical Importance Rating	610	522.5	555	422.5	480	555	327.5	540	630	480	277.5
					Relative Weight	11%	10%	10%	8%	9%	10%	6%	10%	12%	9%	5%
					Weight Chart											

FIGURE 7
Matrix of Quality Function Deployment.

the design needs to meet the local needs of future residents (see Section 3.2.1). In order to do this, the participation of future residents in the design process can provide answers to questions about what types of common facilities fit the local and cultural needs of the residents. This agrees well with previous studies that argued that participation started from the involvement of future residents in designing the architectural layout of their community (Durrett, 2010; Bunker et al., 2011). By involving future residents in the design process, the number of residential units in the cohousing can be decided. In addition, the typology and unit layout can also be collectively discussed. This, in turn, will enhance the social aspect among residents. Moreover, the involvement of residents in decision-making (in addition to designing the physical layout) fosters social relationships and

TABLE 2 Proposed cohousing design guidelines.

	Theme	Design guidelines	Technical importance rating
Indoor environment	New experiences	Plan the common facilities as core to create new experience and foster social cohesion and solidarity	630
	Functions	Provide common local functions (majlis, praying room, etc.)	610
	Privacy	Consider visual and physical contact: 0% near private spaces to 100% in the common	555
	Innovative design	Apply smart and sustainable solutions, using environmentally integrated design	555
	Cultural and social aspects	Provide clear boundaries between common facilities and private units	523
	Safety	Consider safe playgrounds with full accessibility for all, by applying universal design, especially for elderly and kids	480
	Typology and unit layout	Mix attached and detached building geometries for different types of people, tenures, etc.	328
	Number of units	Design for a small-scale community (12–15 units in different sizes)	278
Outdoor environment	Outdoor thermal comfort	Maximize shading and natural ventilation in outdoor spaces	540
	Landscape solutions	Plant evergreen trees with wide canopies	480
	Urban design	Consider high-quality design in outdoor spaces to facilitate common activities outdoors	423

social capital (Williams, 2005). This study also highlighted the need to identify a clear line between private and public spaces in the future cohousing in the UAE. This agrees well with previous studies such as Gerards et al. (2015) and Sanooff (2008), who argued that the right balance between privacy and community could only be derived from a participatory design process.

This study confirms that privacy has an impact on the architectural design in the society of the UAE (see Table 2). In this context, the study suggests having a clear division of hierarchy varied from 0% privacy in the common facilities to 100% privacy in the private housing units (see Section 3.2.1). Other studies also highlighted the role of privacy in the cohousing design. Vestbro (2010) indicated that a person needs privacy in co-housing, and architects must, therefore, design semi-private zones where one can sit and talk and look without being 100% sociable all the time. Common spaces with zero privacy should, thus, be easy to enter where the visual connection is also essential, i.e., if a resident can see what is happening without entering the space, he/she can choose to enter or pass by (Vestbro, 2010).

In future cohousing in the UAE, the study shows that it is vital to apply smart building solutions to achieve sustainable building (see Table 2). This agrees with other studies that recommend applying various sustainable technologies such as biomass and solar energy and other solutions that promote energy efficiency (Zurek, 2021). Although the latest technology and smart devices and their maintenance are expensive, the building design can integrate the lifestyle of the residents for more efficient use of these innovative technologies. Sustainable building technologies, smart solutions, and housing design factors could contribute—together with the social commitment of the house—to achieve a low-carbon, even zero-carbon lifestyle. This includes waste sorting, using less heat and hot water, and growing plants and vegetables. Other studies argued that the design of cohousing needs to strike a balance between environmentally friendly technologies and what is acceptable and cost-effective to residents (Marckmann et al., 2012).

This study highlighted that the design of future cohousing in the UAE needs to consider a high level of safety and accessibility for outdoor and outdoor spaces. Regarding the indoor environment, all common and private facilities must be accessible to all ages, especially kids and the elderly (see Table 2). This goes in line with previous studies, which showed that collective housing for the elderly should be designed for all times (Kähler, 2010). If all facilities of the building are accessible for the elderly, it indicates that the building, by default, is accessible for families with children and single households (Vestbro, 2010). In this sense, the building supports the concept of universal design or design for all ages (see Section 3.2.1). This agrees with other studies, indicating the importance of universal design in all housing projects (Mace, 1988; Jones, 2014). In addition to the requirements of safety and accessibility in cohousing, the study also sheds light on the importance of designing attractive facilities for kids and teenagers, as some cohousing projects have designed adequate outdoor playgrounds for kids; however, teenagers are easily forgotten in the design (Vestbro, 2010).

This study indicated that the role of the outdoor environment in future cohousing of the UAE is essential, as many everyday activities can be organized outdoors (see Table 2). Moreover, the findings show that the quality of the urban design can foster social contact among the residents. Therefore, the design of outdoor spaces needs to facilitate adequate shading and proper natural ventilation to fit with the UAE's warm–humid climate and enhance thermal comfort and reduce heat stress outdoors (see Section 3.2.3). This agrees with other studies, which showed that collective housing should have lovely, peaceful, sheltered outdoor spaces, with covering either around or in the middle of the building, which can offer

protection against wind, rain, and snow (Kähler, 2010). In the same context, innovative landscape solutions are recommended to be applied. One of the landscape strategies is to consider evergreen trees with wide canopies to maximize the shading in outdoor spaces. In addition, to facilitate more common activities outdoors, different materials, colors, landscapes, and design elements are recommended to be considered. This agrees with Durrett (2010), who argued that the role of the physical design in the cohousing/eco-villages (indoors and outdoors), including the site design, landscape, and architectural design, is highly important in facilitating a social atmosphere and plays a significant role in directing the behavior of the residents in the house.

5 Conclusion

This study aimed to develop design guidelines for future cohousing in the UAE. Focusing on the pillars of the Estidama program, i.e., social, cultural, economic, and environmental aspects, in addition to the role of architectural design, the proposed guidelines are divided into the indoor environment and outdoor environment.

Regarding the indoor environment, the design of future cohousing in the UAE should focus on the role of common facilities as a tool to enhance the social contact between residents and provide new experiences to foster, for example, cohesion and solidarity. The future design of cohousing in the UAE also needs to provide common local functions such as majlis and praying rooms. Future cohousing in the UAE should also pay attention to the privacy of the residents as it reflects the local society's culture, religion, etc. Therefore, a clear boundary to define the private spaces from the common spaces is crucial in the design. In addition, the design layout needs to consider different levels of visual and physical contact between different facilities in the cohousing. In this context, privacy needs to be well-identified and varies between 0% in the common facilities and 100% near and inside private units. Moreover, how "privacy" is seen in the local culture is another requirement for good design, meaning that good design can guide people to the right places without reading signposts or info boards. In addition, the design of the cohousing needs to apply smart and sustainable solutions using environmentally integrated design. The design also needs to consider safe playgrounds with full accessibility for all types of people by applying universal design, especially for the elderly and kids. As for the typology, the cohousing design needs to mix attached and detached building geometries, considering different types of people, tenures, sizes, etc. Regarding the scale, it is better to start with a limited number of units for small-scale communities (12–15 units in different sizes) when developing cohousing in the UAE.

Regarding the outdoor environment, the design of cohousing in the UAE needs to contribute to a better thermal environment by maximizing the shade and natural ventilation in the outdoor spaces, enhancing the level of thermal comfort, and decreasing the heat stress outdoors. The cohousing design also needs to apply innovative landscape solutions and tree selection, for example, considering evergreen trees with wide canopies to maximize shade. One of the important guidelines for the outdoor environment is to consider high-quality design in outdoor spaces to facilitate common activities outdoors. In this context, using different materials, colors, landscapes, and design elements is recommended to be applied in future outdoor spaces of cohousing in the UAE.

Data availability statement

The datasets presented in this article are not readily available because it contains sensitive information. Requests to access the datasets should be directed to the corresponding author.

Author contributions

MY is the main author and was mainly responsible for finalizing the article and contributed to data collection, contextual analysis, and theoretical framework. MY, EM, SD, AO, and AM contributed to the the conception and design of the study. MY, YA, KA, and SY have contributed to data collection and analysis and composed the drafts of the manuscript. MY, EM, SD, AO, and AM have also contributed to the manuscript revision and read and approved the submitted version. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

Ager, A., and Strang, A. (2008). Understanding integration: A conceptual framework. *J. Refug. Stud.* 21 (2), 166–191. doi:10.1093/jrs/fen016

Akao, Y., and Mazur, G. H. (1997). The leading edge in QFD: Past, present and future. *Int. J. Qual. Reliab. Manag.* 20 (1), 20–35. doi:10.1108/02656710310453791

Alghamdi, Yasser. (2016). *Negative effects of technology on children of today*. doi:10.13140/RG.2.2.35724.62089

Arbell, Y. (2022). Beyond affordability: English cohousing communities as white middle-class spaces. *Hous. Theory Soc.* 39 (4), 442–463. doi:10.1080/14036096.2021.1998217

Arroyo, I., Montesino, N., Johansson, E., and Yahia, M. W. (2021). Social integration through social connection in everyday life. Residents' experiences during the COVID-19 pandemic in SällBo collaborative housing, Sweden. *Archnet-IJAR* 15 (1), 79–97. doi:10.1108/ARCH-10-2020-0236

Babos, A., Szabó, J., Orbán, A., and Benkő, M. (2020). Sharing-based Co-housing categorization. A structural overview of the terms and characteristics used in urban Co-housing. *Építés - Építészettudomány* 48 (3-4), 331–355. doi:10.1556/096.2020.009

Bamford, G. (2008). Cohousing – An introduction to a residential alternative. Environment design guide. Available at: http://www.jstor.org/stable/26148994.

Baxter, L. A. (1994). "Content analysis," in *Studying interpersonal interaction* (London: The Guildford Press).

BernardRussell, H. (1988). *Research methods in cultural anthropology*. Newbury Park, California: Sage.

Bunker, S., Coates, C., Field, M., and How, J. (2011). *Cohousing in britain*. London: Diggers and Dreamers.

Caves, R. W. (2004). *Encyclopedia of the city*. England, UK: Routledge, 119.

Cohousing (2023). *Living together is better*. Available at: https://coliving.com/about (accessed January 20, 2023).

Cowans, D., Alexander, J., Weightman, T., Clark, D., and Wilshaw, R. (2021). *What makes great places for people?Places for people* (The UK: ARUP).

Denscombe, M. (2014). *The good research guide: For small-scale social research projects*. UK: McGraw-Hill Education.

Durrett, C. (2010). *Senior cohousing: A community approach to independent living – the handbook*. Berkeley: Habitat Press.

Edmunds, H. (1999). "The focus group," in *Research handbook* (Chicago, IL: American Marketing Association and NTC Business Books).

Erdil, N. O., and Arani, O. M. (2018). Quality function deployment: More than a design tool. *Int. J. Qual. Serv. Sci.* 11, 142–166. doi:10.1108/IJQSS-02-2018-0008

Estidama (2010). *Estidama program*. Abu Dhabi: Abu Dhabi Urban Planning Council. Available at: https://pages.dmt.gov.ae/en/Urban-Planning/Estidama-Program (accessed January 20, 2023).

Franceschini, F. (2002). *Advanced quality function deployment*. Boca Raton, Florida: 6CRC Press.

George, V. (2006). Sustainable community: Learning from the cohousing model. *Community Dev. J.* 41 (3), 393–398. doi:10.1093/cdj/bsl015

Gerards, S., De Ridder, R., and De Bleeckere, S. (2015). Designing multigenerational dwelling: A workshop with four flemish architecture firms. *Int. J. Archit. Res. ArchNet-IJAR* 9 (2), 20–30. doi:10.26687/archnet-ijar.v9i2.658

Glass, A. P. (2020). Sense of community, loneliness, and satisfaction in five elder cohousing neighborhoods. *J. Women & Aging* 32, 3–27. doi:10.1080/08952841.2019.1681888

Gutman, J., Gordon, I., and Vilchinsky, N. (2022). Is social presence indeed present in remote social interactions? A call for incorporating physiological measures of synchrony when assessing the social nature of interpersonal interactions via videoconferencing platforms. *Front. Psychol.* 13, 822535. doi:10.3389/fpsyg.2022.822535

Hauser, J., Griffin, A., Klein, R., Katz, G., and Gaskin, S. (2010). *Quality function deployment (QFD)*. doi:10.1002/9781444316568.wiem05023

Hitchcock, Graham, and Hughes, David (1989). *Research and the teacher: A qualitative introduction to school-based research*. London: Routledge.

Hosale, S. (2013). 25 Negative effects of technology. Available at: http://roogirl.com/25-negative-effects-of-technology/.

International Organization for Standardization (2015). *ISO 16355-1:2015 Application of statistical and related methods to new technology and product development process. Part 1: General principles and perspectives of Quality Function Deployment*. (Switzerland: QFD).

Jones, P. (2014). Situating universal design architecture: Designing with whom? *Disabil. rehabilitation* 36 (16), 1369–1374. doi:10.3109/09638288.2014.944274

Kähler, M. (2010). "Living together – cohousing ideas and realities around the world. Proceedings from the international collaborative housing conference in stockholm 5-9 may 2010," in *Collective housing and well-being*. Editor D. U. Vestbro (Stockholm: Royal Institute of Technology and Kollektivhus NU).

Kaufman, T. (2006). *Healthy housing reference manual*. Atlanta, USA: Centers for Disease Control and Prevention and U.S. Department of Housing and Urban Development.

Labit, A. (2015). Self-managed Co-housing in the context of an ageing population in Europe. *Urban Res. Pract.* 8, 32–45. doi:10.1080/17535069.2015.1011425

Lang, R., Carriou, C., and Czischke, D. (2020). Collaborative housing research (1990–2017). A systematic review and thematic analysis of the field. *Hous. Theory Soc.* 37 (1), 10–39. doi:10.1080/14036096.2018.1536077

Mace, L. (1988). *Universal design: Housing for the lifespan of all people*. Rockville: Dept of Housing and Urban Development.

Marckmann, B., Gram-Hanssen, K., and Christensen, T., (2012). Sustainable living and co-housing: Evidence from a case study of eco-villages. *Built Environ.*, 38(3), p. 413, 429. doi:10.2148/benv.38.3.413

McCamant, K., and Durrett, C. (1988). *Cohousing – a contemporary approach to housing ourselves*. Berkeley, California: Habitat Press/Ten Speed Press.

McCamant, K., and Durrett, C. (2011). *Creating cohousing: Building sustainable communities*. Gabriola, British Columbia, Canada: New Society Publishers.

McGraw-Hill (2022). *McGraw-hill concise encyclopedia of engineering by McGraw-hill*. New York, NY, USA: McGraw-Hill Education.

McIntosh, J., Gray, J., and Maher, S. (2020). In praise of sharing as a strategy for sustainable housing. *J. Green Build.* 5 (1), 155–163. doi:10.3992/jgb.5.1.155

Meltzer, G. (2000). Cohousing: Toward social and environmental sustainability, PhD Thesis. Australia: The University of Queensland.

Monton, P., Reyes, L. E., and Alcover, C. M., (2022). Personal characteristics for successful senior cohousing: A proposed theoretical model. *Int. J. Environ. Res. Public Health*;19(4):2241. doi:10.3390/ijerph19042241

Mordor Intelligence (2023). United Arab Emirates residential real estate market - growth, trends, Covid-19 impact, and forecasts (2023 - 2028). Available at: https://www.mordorintelligence.com/industry-reports/residential-real-estate-market-in-uae (accessed MAY 07, 2023).

Morgan, D. L. (1988). *Focus Group as qualitative research*. UK: Sage.

Ragette, F. (2006). Traditional domestic architecture of the Arab region. *Fellb. A. Menges*.

Sanguinetti, A. (2013). *Cohousing: A behavioral approach, transformational practices, and the retrofit model (PhD thesis)*. Irvine: University of California.

Sanoff, H. (2008). Multiple views of participatory design. *ArchNet –IJAR Int. J. Archit. Res.* 2 (1), 57–69. doi:10.15368/focus.2011v8n1.1

SCAD (2023). Statistics centre Abu Dhabi. Tenure type. Available at: https://www.scad.gov.ae/en (accessed MAY 07, 2023).

Shenker, B. (2011). *Intentional communities: Ideology and alienation in communal societies*. London: Routledge.

Tipping, J. (1998). *Journal of continuing education in the health professions*.

UrbanPlatform, Agenda (2023). Best-practice, Estidama program. Available at: https://www.urbanagendaplatform.org/best-practice/estidama-program (accessed MAY 07, 2023).

Varolgüneş, F. K., and Canan, F. (2018). *The importance of the use of QFD-AHP methods in architectural design quality evaluation*.

Vestbro, D. U. (2014). Cohousing in Sweden, history and present situation. available at: http://www.kollektivhus.nu/pdf/SwedishCohousing14.pdf (accessed January 17, 2023).

Vestbro, D. U. (2000). From collective housing to cohousing – a summary of research. *J. Archit. Plan. Res.* 17 (2), 164–178.

Vestbro, D. U. (2010). Living together – cohousing ideas and realities around the world. Proceedings from the international collaborative housing conference in Stockholm 5-9 May 2010. Stockholm. May 2010.

Vestbro, D. U. (2012). *Saving by sharing – collective housing for sustainable lifestyles in the Swedish context*.

Williams, J. (2005). Sun, surf and sustainable housing—cohousing, the californian experience. *Int. Plan. Stud.* 10 (2), 145–177. doi:10.1080/13563470500258824

Zurek, D. (2021). Global dwelling - approaches to sustainability, design and participation. *Soc. Sci. J.* 60, 387–388. doi:10.1080/03623319.2021.2014215