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RESEARCH ARTICLE

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Evaluating social sustainability in Jordanian residential neighborhoods: a combined expert-user approach

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Abstract

Neighborhood sustainability has assumed a pole position as a topic of interest in the past years, addressed through dedicated strands of most of the globally adopted sustainability rating tools, such as LEED and BREEAM. Considering sustainability assessment, the social sustainability of neighborhoods assumes a certain particularity, not only in terms of its high context dependence pertaining to its locality, but in its means of assessment as well, with people as a key potential evaluator for matters that are not bound to quantitative aspects. This research focused on developing a framework for rating social sustainability in neighborhoods, utilizing a quantitative approach that builds upon insights obtained by an extended group of experts and end users. It combines the Delphi and AHP techniques along with the case study approach to develop a framework that suits the Jordanian local context, where a particular neighborhood, Dahiyat Al Hussein in Amman, is used for validation. The research revealed that rating the social sustainability of neighborhoods is not only highly guided by the local context it addresses, but is also reliant on the level of understanding and adoption of the concept itself as attained by the people.

Keywords: Social sustainability, Neighborhood, Rating system, Delphi technique, AHP, Local context

Introduction

The concept of sustainability, for long, has seized to be an emerging topic as it has already captured the undivided interest of nations worldwide. Sustainability or sustainable development, according to the World Commission on Environment and Development (WCED), is the comprehensive approach that aims to balance the three key pillars of environment, society, and economy at the local, national, and regional levels (WCED 1987). Stemming from the need of formidable sustainable development, countries all over the globe has raced into actioning formidable plans towards achieving this concept, with many adopting specialised rating systems to assess where they

stand to be used as their starting points towards continuous improvement. Indeed, sustainability assessment rating tools are considered quite instrumental in driving sustainable practices at large (Ferreira et al. 2014). Multiple commonalities can be found amongst the most prominent sustainability rating tools, with regard to aspects pertaining to energy consumption, water, indoor and outdoor environments representing the majority of the assessment categories. Nevertheless, categories, factors, and other elements are bound to feature differently, with levels of maturity that vary in between the regions and countries (Awadh 2017).

With a large number of prominent sustainability rating systems (such as LEED, BREEAM, Casbee, among others) leading the way, not many of them has fully addressed the sustainability on the neighborhood level. Compared to sustainability measured on the building level, neighborhood sustainability is considered a multi-disciplinary

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concern, calling for the consideration of multiple issues as a whole in order to come up with holistic interventions and measures (Uwasu and Yabar 2011; Ameen 2017). Such issues comprise matters pertaining to environmental, economic and social concerns such as infrastructure, unemployment, community participation, provided services, depletion of natural resources and political/economic stability (Lee and Chan 2008; UN-Habitat 2009). Despite its importance, neighborhood sustainability assessment did not obtain noticeable attention until the beginning of the 2000's (Wang et al. 2016), a point that witnessed moving from building-oriented assessment to one that focused more on the neighborhood, representing a middle step prior to the overall consideration on the city level. The consideration of the neighborhood or community reflected the need for a different perspective; one that parts from the restrictedness of the building to address the collective, urban-related concerns (Lützken-dorf and Balouksi 2017). Measuring such sustainability would accordingly come with its own challenge, where any tailored rating system should entail the promotion of sustainable behavior and best practices in a manner that resonates with the multiple stakeholders involved, including users, promoting the values of environmental health as well as social and economic equity (Veeravignom 2015).

A number of sustainability assessment and rating tools have started considering urban sustainability, driving the thought process further towards urban development (Kaur and Garg 2019; Sharifi 2020; Sharifi et al. 2020). These, however, were not free of shortcomings, as their outcomes were restricted by their emphasis on environmental indicators with a globalised perspective that failed in conceiving context particularities, along with their emphasis on quantitative indicators, where qualitative values are deemed to provide a significant contribution (Kaur and Garg 2019; Merino-Saum et al. 2020).

Social sustainability and user involvement

In response to the need for having the sustainability of neighborhoods properly assessed, a number of initiatives were taken to develop relevant assessment tools in a number of countries and by a number of organizations (Shen et al. 2011). With consideration of the variant contextual differences in between different locales, the developed frameworks were bound to reflect such variety, whether in regulation, challenges, culture or social fabric, as well as belief system resulting in their persistent need of adaptation (Ameen 2017).

Whilst differing in how they address the local context, the developed sustainability assessment tools shared the mission of properly identifying and, most importantly, guiding human behavior to positively impact

environmental, economic and social considerations resulting in sustainable urban development (Shen et al. 2011; Wallhagen et al. 2013). Indeed, the success of the adopted rating system, by default, relies on the relevance and representativeness of its adopted priorities and pillars, for which the social aspects assume a high level of importance (Kang et al. 2016). Deciding on the best means for assessing social sustainability is considered quite complex due to multiple challenges, commencing from how meticulous it is to stand on its definition considering the continuously changing needs and perceptions of society members (McKeown et al. 2002). Indeed, Hall (2014) emphasised a lack of shared understanding pertaining to social sustainability as a concept, resulting in the near absence of a holistic definition in most rating tools (Fenner and Ryce 2008). Reference has been made in certain occasions to the ability of fulfilling human basic needs, which also bears variances. Sonntag (2008), for example, identified such needs in terms of relations between individuals and groups, provision of services, and ensuring wellbeing in general.

For the better understanding of neighborhood sustainability, it becomes quite important to move beyond the mere aesthetics and economies to focus more on what expectations, culture and values the community reflects, where neighborhood sustainable design becomes entangled with the local identity and socio-cultural values as manifested through daily routines, beliefs and characteristics (Bragança et al. 2010; Tawayha et al. 2015; Ahmad and Thaheem 2017). Earlier research tackled this matter while attempting to contextualise sustainability rating tools to particular localities within the region. For instance, AlQahtany et al. (2014) and Alyami et al. (2015) developed tools that focused on the urban planning of the city of Riyadh, Saudi Arabia. Yigitcanlar et al. (2015) developed a multi-leveled framework covering the subdivision, piecemeal, and planned developments in the city of Ipoh, Malaysia. Ameen (2017), acknowledging the importance of stakeholder involvement, developed a sustainability rating system for Iraq with consideration of its contextual concerns and issues.

People are bound to be part of any sustainable development endeavor if it is deemed to become successful. This entails the need to ensure that urban design meets user expectations and aspirations with the end goal of creating a sustainable society. Previous studies had attempted to identify the key pillars for probing societal consensus in regard to this key matter. Hall (2014) identified nine pillars that were seen as assuming most interest of the neighborhood residents; quality of the living environment, school availability, safety, cleanliness and friendliness of the locale, pre-school childcare, integrated social housing, proper planning,

community outreach, as well as adequate amenities. A glance over newly developed social indicators within a number of sustainability rating tools reveals a joint focus on general comfort, community engagement and promotion of communication channels, overall health matters, as well as nurturing sustainable behavior.

Social sustainability—the Jordanian context

Similar to other world nations, Jordan has for long shared concern over the environment and the persisting need for expediting sustainable development. The country's national agenda, strategic plans, and reforms were geared for sustainability over the different economic, environmental and social pillars (Saleh 2020). With certain achievements in social welfare, unemployment and reduction of poverty, Jordan still faces escalating pressures in result of its geopolitical status in the region, entailing challenges in healthcare development, managing the Syrian refugee crisis, limited resources as well as the regulation of urban growth (Fakhoury 2015).

Although sustainability rating tools are more common in the developed compared to the developing countries (Abdelgadir et al. 2019), Jordan has taken quite a few steps in this area. As part of its pursuit of sustainability assessment, a green building rating system was developed to assess sustainability on the local level. Despite its incorporation of multiple building types, the assessment of sustainability on the neighborhood level is still lacking. Social sustainability assumes prime importance for the country, mandating its accurate assessment and rating. This is a result of a number of factors, most importantly, lower economic development that entails a lesser environment footprint associated with low industrialization. Furthermore, the variety in between developing countries, primarily in their unique social fabric and trends, makes it even more important to ensure a proper level of contextualization of any social sustainability rating attempt (Abdelgadir et al. 2019).

This research aims at developing a customised neighborhood social sustainability rating framework governing integrated communities in the city of Amman, Jordan. It aims at capturing the most relevant social categories and factors as seen by experts as well as end-users with the aim of achieving relevance and applicability, taking the case study of Dahiyat Al-Hussein suburb. It aims at bridging the gaps found in current literature on three key domains; the neighborhood level, the social dimension level, and the local context level, considering how the latter varies significantly from one country to the other.

Material and methods

The research adopted a quantitative approach mixed with qualitative exploration aiming to identify and assess the categories and factors most relevant to social sustainability on the neighborhood level. The combination of multiple stakeholders aimed at addressing the sensitivity of the local context pertaining to the research subject. The utilised approach went through a number of stages that entailed identifying the long list of factors, building the conceptual model, and managing its validation.

Desk research and comparative assessment

The research's started with an extensive exercise to identify a long list of potential categories and factors. This was accompanied with a number of informal discussions with sustainability professionals, engineers, governmental officials and urban planners. Upon such initial orientation, a dedicated desk research was conducted with the purpose of comparing how multiple leading global and regional rating tools addressed social sustainability in their assessment frameworks, where such comparison resulted in a preliminary set of inputs (Libovich 2005). The key rating systems considered included, for example:

- LEED Neighborhood Development (LEED-ND), developed in 2007: as a next step from its single-building focus, the assessment sprawled to cover the neighborhood. With its focus on smart location, urban sprawl, and the preservation of undeveloped land, it considers other alternatives that would render aspects such as transportation, neighborhood design and communal accessibility more sustainable (USGBC 2018).
- BREEAM for sustainable communities, which focuses on the mitigation of the overall impact of neighborhood-level development projects. It is considered a recent tool that relies on the European Union norms as an independent, third-party assessment certification standard (Sharifi 2013; Yıldız 2016). It addresses the economic, environmental, and social issues impacting the urban area to enable the stakeholders determine its sustainability (Method 2005).
- CASBEE- Urban Development (CASBEE-UD), which focuses on the combination of buildings in a neighborhood along with their outside areas. Its main categories focus on environmental quality and load reduction in urban development, and global warming ((IBEC) 2014; Alqahtany 2014).
- The PEARL rating tool, issued in compliance with Estidama targets covering economic, social, cultural, and environmental concerns consists of seven

categories; integrated development process, natural systems, livable communities, precious water, stewarding materials, resourceful energy, and innovating practice addressing the formulation of sustainable communities (ADUPC 2010).

- Green Star Communities, which covers five key categories including governance, design, livability, economic prosperity, environment, and innovation. It targets stimulating new initiatives and thoughts pertaining to sustainability through these key axes (GBCA 2020).
- Sustainable Community Rating Tool (SCRT), which was developed by VicUrban in 2007, recognises best practices for establishing new communities by focus on five pillars; community well-being, environmental leadership, urban design excellence, housing affordability, and commercial success (Hurley 2011; Akito 2013).
- Eco Districts, focusing on properly planning the sustainable communal activities. It accordingly measures their performance by reference to eight categories that include equitable development, health and wellbeing, community identity, access and mobility, energy, water, habitat and ecosystem, and materials (Institute 2012).

Other rating tools were also included in the research in order to ensure a proper mix of references in terms of implementation maturity (years in effect), geographical spread (global/regional/local), as well as focus areas (depth and breadth of categories). For example, BREEAM communities, CASBEE-UD, and LEED-ND were included for their global appeal, whereas PEARL, GSAS and Green Star communities were considered as more specialised customization of the more globalised earlier two (Cole and Valdebenito 2013). PEARL and GSAS assume particular importance due to their localised effect, being the closest to the subject matter of the research.

The Delphi technique

After obtaining a long list of categorised factors, informed opinions were required to identify the most relevant to consider for rating neighborhood social sustainability. This was achieved through a two-round Delphi approach that included experts and end users as key stakeholders.

The Delphi approach was chosen for its ability to combine the cumulative knowledge of experts in a panel to support a consistent decision-making process that ends up with the selection and prioritization of the components of a multi-faceted issue by obtaining their consensus in a quantitative manner (Chan and Lee 2007).

It is considered a team effort, entailing individuals with profound knowledge on the issue (Okoli and Pawlowski 2004). Accordingly, the panel is usually comprised of experts (academic, government, and professional specialists) who share opinions through a series of questionnaires that aim at agglomerating their views and opinions (Ursic 2019).

This research further combined expert opinions along with end user perceptions. This decision was based on the successful selection of social sustainability factors, while entrenched in expert opinions, being a matter of user interest and ongoing commitment. The Delphi method has been traditionally used with the appointment of specific experts that are commonly known to have extended knowledge and expertise. The development of new variants has been accompanied by epistemological and methodological changes to the traditional understanding and use of the Delphi method. The definition of the term “expert” has been used with further flexibility, where it has been broadened and blurred, either basing on their individual scientific/professional expertise or life-worldly experience. Pill (1971), in describing the Delphi method, defined the expert as anyone who can contribute with relevant inputs and thus might include a consumer in the case of constructing consumer preferences. For example, the study of Fernandes et al. (2013) and Guzman et al. (2015) included patients or users of an intervention as part of the expert panel. Also, the study of Li (2013) included residents as part of the panel. The effects that the associated heterogeneous composition of the expert panel may have are quite unclear. Previous analysis has shown that the diversity in the expert group can forward discussion processes about forming judgments (Niederberger and Spranger 2020). Limiting decisions to expert opinions, in its traditional/restricted sense, could lead to perspectives that are fairly narrow and may not provide the required value when addressing a complex issue, pointing to the importance of setting appropriate inclusion criteria (Stone Fish and Busby 2005). In the paper, the term “expert” is used in its broadened sense, although we kept the terminology to refer to people with relevant knowledge and expertise while users are recruited by merit of their daily experiences.

Table 1 demonstrates the distribution of the extensive panel involved in the process. A non-random selection was utilised to source the experts, considering their specialty and relevant experience (Ameen 2017), where the chosen experts were chosen with a focus and interest in sustainability through their multidisciplinary expertise. Random targeting was utilised for sourcing the end users through snowballing (current/earlier residents), where attention was provided to matching the key aspects (gender and level of education) to the demographics of the

Table 1 Distribution of the panel involved from the experts and users

Experts sample distribution	
Gender	(%)
Male	55.6
Female	44.4
Background	(%)
Academia	48.9
Professional	15.6
Government	35.5
Educational level	(%)
Graduate	45.7
Post graduate	54.3
Users sample distribution	
Gender	(%)
Male	56.8
Female	43.2
Years at neighborhood	(%)
Below 5 years	21.3
5–10 years	37.1
Above 10 years	41.6
Educational level	(%)
Secondary	18.9
Graduate	68.3
Post graduate	12.8

concerned area according to the communication with and the statistics issued by the bureau of statistics. With regard to spatial distribution, the neighborhood was segregated into four zones (A–D), where it was ensured that an equal number of participants were from each. The distributed questionnaires collected participant views about the organization, categorization, and factors proposed for consideration in the rating framework.

The first and second Delphi rounds involved the selected experts in order to qualify, add or remove categories and factors based on how they viewed their

relevance and importance. This relied on knowledge and subject matter expertise considering their understanding of the local context. The framework was accordingly refined and then shared with the users, with subsequent two Delphi rounds, where user input was shared on the framework developed by the experts earlier. This approach enabled the proper and aware integration of expert/user views, where the sequential manner it followed resulted in further refinement and alignment (see Fig. 1). The users would, for example, suggest the removal of a certain factor, directly or by assigning it a lower level of importance. If this would correspond to a similarly low importance assigned by the experts, such factor could be removed for better alignment in between both groups. The final weights associated with the categories and factors combined both views. While the experts still received prime focus in this research, it is worthy to highlight what it achieves through user consideration, where other traditional approaches rely solely on expert opinions.

The first stage Delphi included 55 experts invited, from whom 49 experts responded in the first round and 44 in the second. As for users, 114 were sourced, out of which 79 responded in the first round and 59 in the second.

Analytic hierarchy process (AHP)

AHP is utilised as a multi-criteria decision-making tool originally developed by Thomas Saaty, which grew to become among the prominent decision-making support approaches. It primarily aims at quantitatively breaking down a complex issue through conducting paired comparisons comprising a multiplicity of aspects, resulting in relative priorities and weights (Ameen 2017). AHP is a structured, multi-attribute decision-making method, combining multiple quantitative methods.

The considered categories and factors underwent such paired comparisons, where the relative importance/weight of each came through a square matrix utilizing Saaty’s nine-point scale system (Saaty 1990). The rating

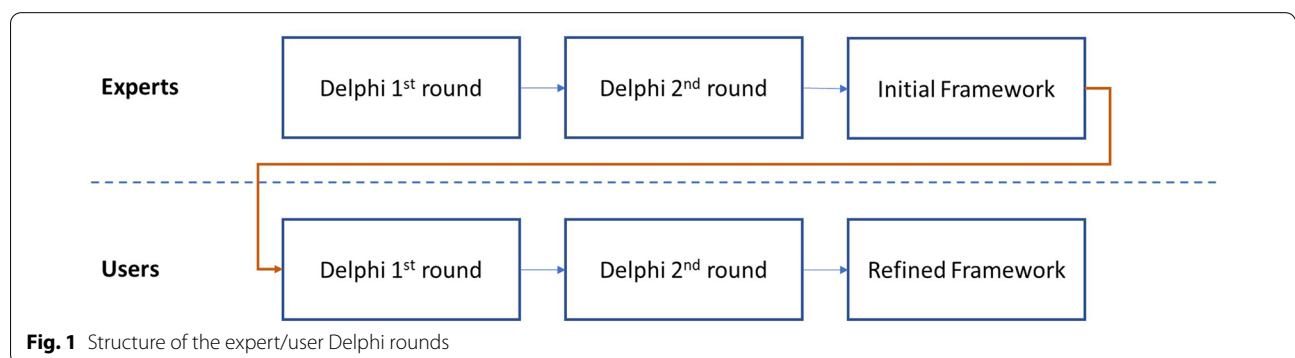


Fig. 1 Structure of the expert/user Delphi rounds

scale ranges from 1, for the equal weight of the two compared aspects, to 9, representing the highest level of importance of the considered aspect (Alqahtany 2014) (see Fig. 2). Once the paired comparisons are completed for all categories and factors, their relative weights can be obtained by summing the total points each factor achieved over the cumulative points (Ali and Al Nsairat 2009).

To ensure the consistency of the obtained results, consistency ratio (CR) was calculated. With such human influence over the outcomes, accuracy and consistency was validated where the CR value did not exceed 0.1 (Saaty 1990). The consistency ration is calculated through the following equation:

$$CR = CI/RCI,$$

where, $CI = \lambda_{max} - n / n - 1$; CI : the level of consistency; λ_{max} : the maximum eigenvalue of the matrix; RCI : a random consistency index taken according to the number of factors.

The case study approach

Upon reaching the framework confirmed through participant consensus, its outcome was tested by application over the selected case study, Dahiyat Al Hussein in Amman, Jordan (Fig. 3). As the research objective was to build a neighborhood social sustainability rating tool, the chosen case would need to be qualified as suitable to test its outcomes. Dahiyat Al Hussein suburb is considered the first official housing project in Jordan, built by the Public Corporation for Housing in 1968 and first occupied in 1972. The neighborhood included 500 apartments, along with surrounding gardens, with a main park

situated in its center (Alshamaelh 2014; CSBE 2019). Considering the time when it was developed, the neighborhood emphasised communication, enhance socialisation, and relationships in between its residents, matters that are in line with today’s social sustainability priorities. Being remotely located at the time, self-sufficiency was a key attribute, as the neighborhood was supported with inside and nearby facilities such as grocery stores, post office and day care (Sharif 2020).

The developed rating framework was tested by assessing the level of sustainability of Al Hussein suburb as it stood today, as reported by its current/previous residents. The assessment was done through direct observations (site visits) as well as collecting residents’ qualitative and quantitative feedback (through casual conversations and questionnaires).

Combining the quantitative survey with the case study approach was considered suited to the subject matter of the research, as it offered means for systematic data collection, analysis, and validation, which resulted in a better understanding of the problem in context, with the necessary level of depth.

Findings

Social sustainability categories

The experts and users demonstrated an aligned understanding of the relevant importance of each of the social sustainability categories proposed, with no significant comments on their numbers and importance. Some voices were given for an alternative naming to the “Comfort and Convenience” category by a number of experts, for which reason it was renamed as “Socio-Economic Wellbeing” for a more accurate depiction.

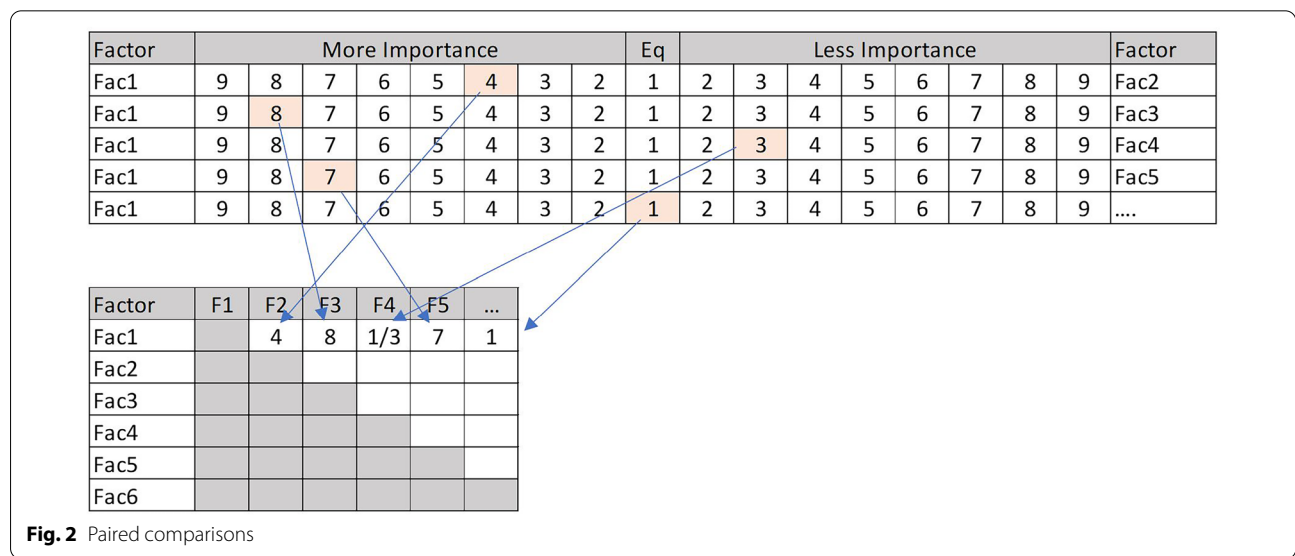


Fig. 2 Paired comparisons

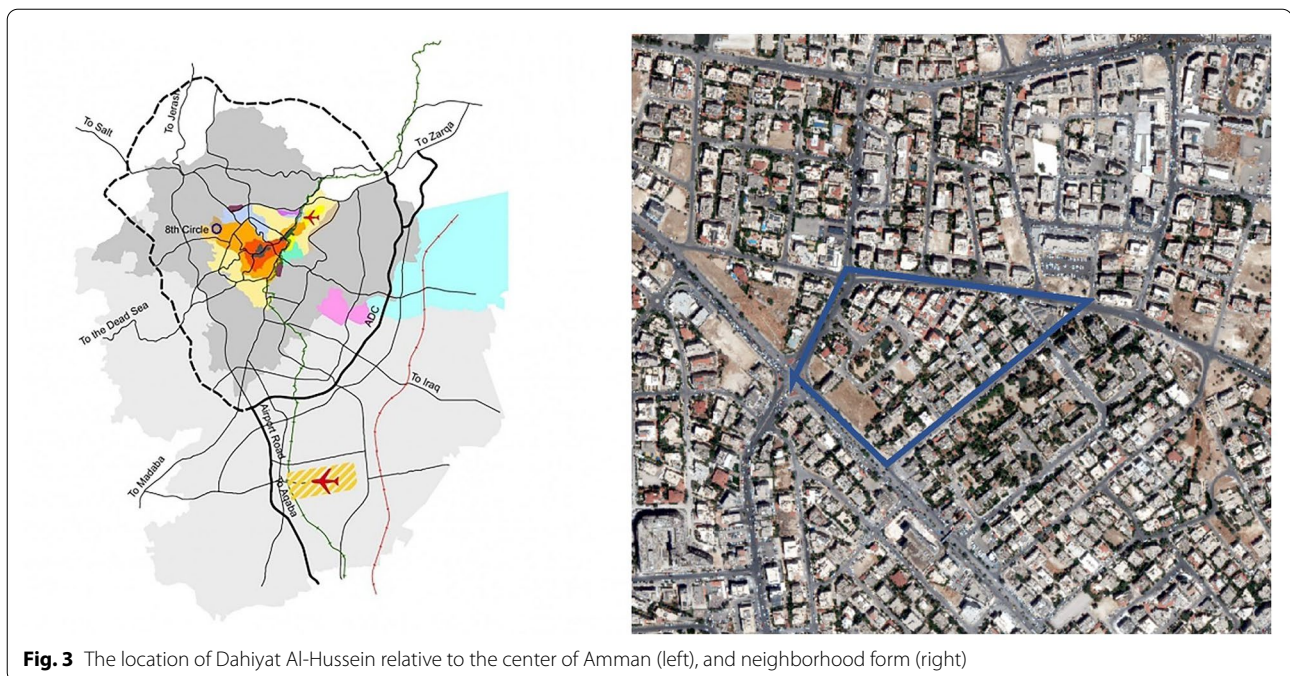


Fig. 3 The location of Dahiyat Al-Hussein relative to the center of Amman (left), and neighborhood form (right)

In comparing the detailed feedback received from the experts and users, slight notable differences were noticed. A slightly higher weight to the “Physical and Mental Health” category was provided by the users compared to the experts, as such matters had more relevance to the former. “Sustainable Behavior”, however, was seen as less important by the users compared to the experts. These differences can be understood through the slightly different perspective attained by the experts as compared to the users, where the former would be more driven towards the macro aspects of sustainability while the latter on more day to day living affairs, as both remain important to the subject of the research (Table 2, Fig. 4).

Socio-economic wellbeing

During the first round of Delphi, the experts had opted to remove, merge and add some factors within this category. The key changes proposed included the removal of the “Cycling Network” factor and introduction of the more generic “Alternative Transportation”, with the reason being the low level of adoption of such mean of commute, where the local community was more accustomed to either going in private cars, public transportation or simply walking, where cycling was not a vivid activity frequently observed. Jordan is generally marked by poor facilities for pedestrian, where walkability might in most cases not be the best option (Abed 2016).

On the other hand, the experts attained a more futuristic perspective, where new forms of transportation are prone to being introduced with lower carbon

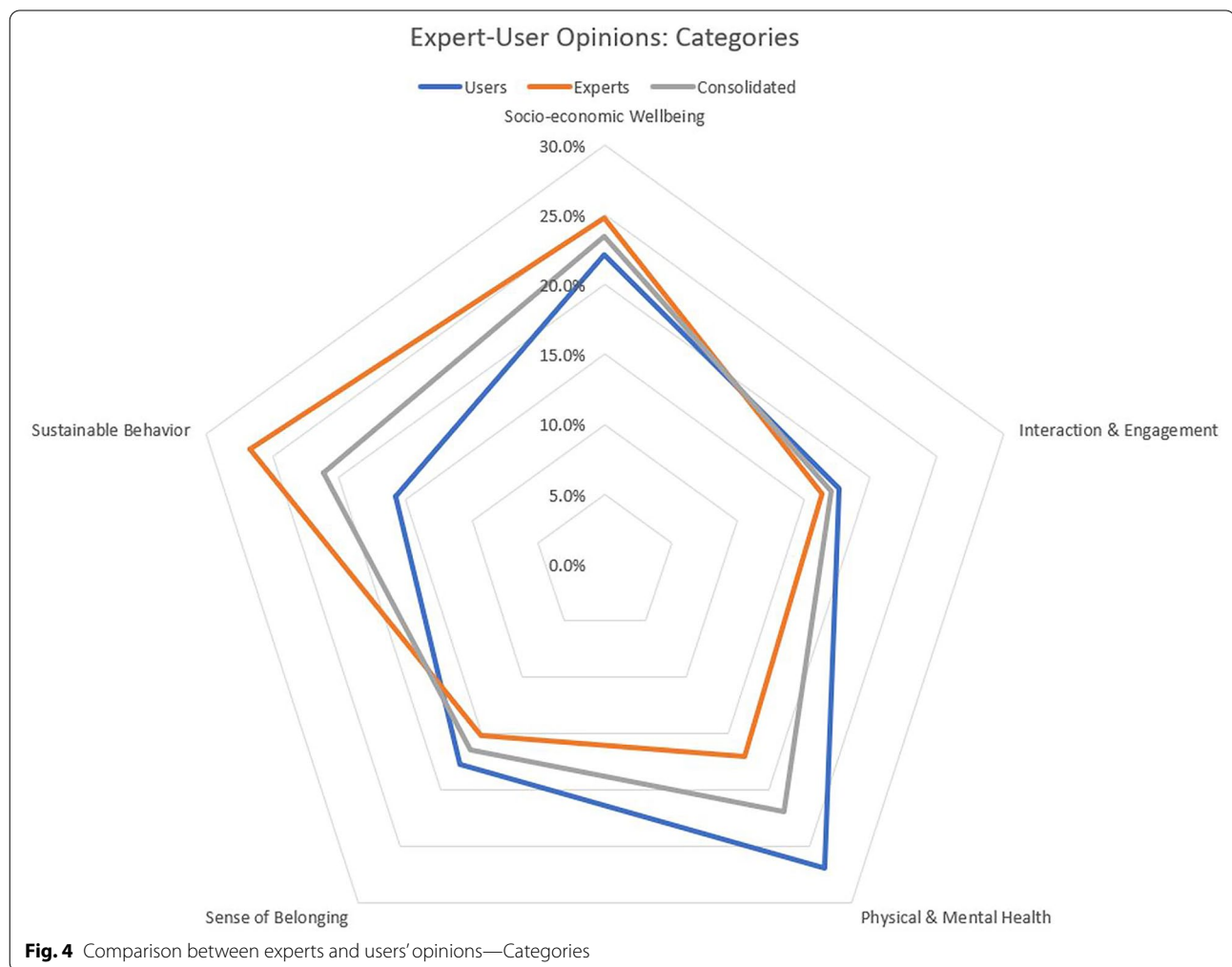
footprints. However, while going through users’ opinions, Alternative Transportation was less regarded in terms of importance, which could be connected to the current contextual realities of the matter, featuring the weakness and less convenience usually associated with public transportation in Jordan. In support of that fact, and as a shared view in between the experts and users, Access to Quality Transportation and Traffic Load were highly regarded in between both categories. Indeed, the increased use of cars has been associated with shifts in pedestrian patterns as well as the inherent sustainability of neighborhoods (Gehl and Gamzoe 2004), where higher accessibility is usually associated with higher residential stability (Ali et al. 2019). The experts proposed the incorporation of way finding as a factor to provide further emphasis on the matter.

The economically driven factors, amongst the rest of this category, received joint high scores in between the experts and users, with Housing and Transportation Affordability being amongst the highest. This reflects the reality of this particular locality, as economy retains a high level of impact on people’s daily lives, a fact that was also well appreciated by the experts, being part of the same community, where neighborhoods usually enjoy relatively good services and amenities, while facing issues of affordability (Zalloum 2015).

Another notable observation going through the feedback of experts and users was their consideration of passages, where their shading received a lower rating, which is driven from the nature of the daily routine of Jordanian

Table 2 Rating and distributed weight of the main framework categories

Category	Rating average	Experts opinion		Users opinion		Experts-users	
		Weight (%)	Points 1000	Weight (%)	Points 1000	Weight (%)	Points 1000
Socio-economic wellbeing	4.66	24.8	247.70	22.1	221.46	23.5	234.58
Interaction and engagement	3.38	16.4	164.07	17.6	176.02	17.0	170.05
Physical and mental health	4.35	17.0	169.68	26.9	268.51	21.9	219.10
Sense of belonging	3.26	15.2	151.66	17.7	176.84	16.4	164.25
Sustainable behavior	4.21	26.7	266.88	15.7	157.17	21.2	212.03



individuals and families regarding the outdoors. Passages are mostly seen by most as paths on the daily routes of commute, characterised by swift passing and less, if not even no, need for sitting, thus there was no imminent need to stress their convenience, especially when considering the relatively mild climate witnessed for most of the year. Consequently, the Width of Passages was replaced

with the more comprehensive Levels of Walkways/ Spaces. The resultant set of factors and their associated weights are shown in Table 3 and Fig. 5 below.

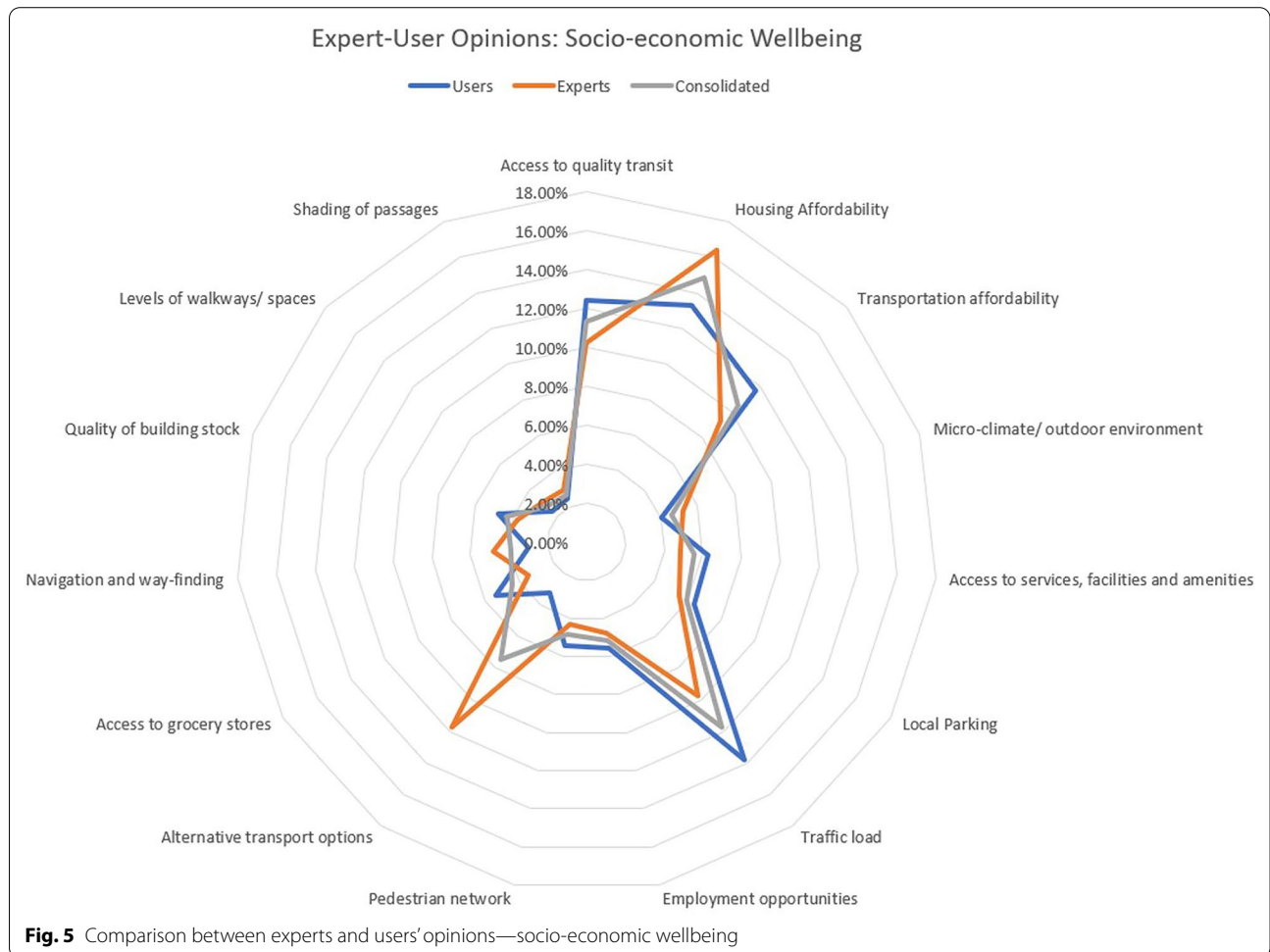
Interaction and engagement

This category featured factors that focused on the different means of community integration and the strength of

Table 3 Rating and weights of factors in the socio-economic wellbeing category

Socio-economic wellbeing	Rating average ^a ± SD	Experts opinion		Users opinion		Experts-users	
		Weight (%)	Points (234.6)	Weight (%)	Points (234.6)	Weight (%)	Points (234.6)
Access to quality transit	6.94 ± 1.03	10.22	23.98	12.40	29.08	11.31	26.53
Housing affordability	9.13 ± 2.12	16.44	38.58	13.30	31.20	14.87	34.89
Transportation affordability	6.43 ± 1.63	9.29	21.78	11.65	27.33	10.47	24.56
Micro-climate/outdoor environment	2.82 ± 0.78	5.18	12.15	4.03	9.44	4.60	10.79
Access services and amenities	3.41 ± 1.08	4.84	11.36	6.27	14.72	5.56	13.04
Local parking	3.65 ± 1.33	5.49	12.89	6.40	15.02	5.95	13.95
Traffic load	7.23 ± 1.59	9.75	22.87	13.82	32.42	11.79	27.65
Employment opportunities	3.16 ± 0.66	4.75	11.14	5.53	12.98	5.14	12.06
Pedestrian network	2.98 ± 0.45	4.29	10.05	5.41	12.69	4.85	11.37
Alternative transport options	4.59 ± 1.17	11.75	27.56	3.20	7.51	7.47	17.53
Access to grocery stores	2.71 ± 0.56	3.43	8.05	5.41	12.68	4.42	10.37
Navigation and way finding	2.40 ± 0.87	4.81	11.29	3.02	7.08	3.91	9.18
Quality of building stock	2.62 ± 0.26	3.77	8.83	4.79	11.23	4.28	10.03
Levels of walkways/spaces	1.66 ± 0.22	3.05	7.16	2.37	5.55	2.71	6.36
Shading of passages	1.64 ± 0.49	2.94	6.90	2.41	5.65	2.68	6.28

^a CR-experts: 0.02–0.05/CR-users: 0.04–0.08



ties built within and between the residents of the neighborhood, or as argued by Polese and Stren (2000), to produce enough cohesion through bringing people together. Certain insights received from the experts and users assisted in the enrichment of the factors comprising this category.

The top two aspects focused upon by the experts, and sequentially well-received by the users, were the gathering spaces, community connectedness and safety. These factors were rated amongst the highest factors of this category. This comes as no surprise considering the social nature of the local community, where the availability of quality gathering spaces and means for strengthening local ties were highly rated. It also reflects the sensed detrimental impact of technology on the direct interaction in between people, separated by the digital interface (Ruggeri and Young 2016). In retrospect, the aspects of safety and security were seen as quite important to ensure the proper support to community engagement on the neighborhood level.

Other factors, on the other hand, received recommendation for removal or, if kept, received lower importance scores. An example of these factors included building orientation, which was not well regarded by the experts, where architects did not appreciate its direct influence in achieving social sustainability, as it was eventually replaced with Design Quality and Aesthetics. This trend has frequently been addressed in previous studies, where a lack of awareness is quite evident when attempting to associate special elements with social sustainability ((HAPI) 2015; Yoo and Lee 2016). Street furniture was another factor recommended for less consideration. Despite the importance of community engagement and interaction category, streets in general were seen as a

less important influencer of such interaction, an opinion later on confirmed by the users, where both assigned lower levels of importance. With reference to the shading of passages addressed in the earlier category, streets were not regarded as places prone for long stays, conversation or socializing, but rather veins for swift commute. This was also compounded by a typical sense of carelessness regarding furniture in public spaces (Alhiary 2004; Aljafary 2006). This resulted in a lower focus on the necessity of provision of street furniture. On the other hand, the Availability of Seats factor was assigned a higher level of importance, where such seats were foreseen as more available in dedicated gathering places, such as courts or neighborhood parks. The resultant list of factors is shown in Table 4, Fig. 6.

Physical and mental health

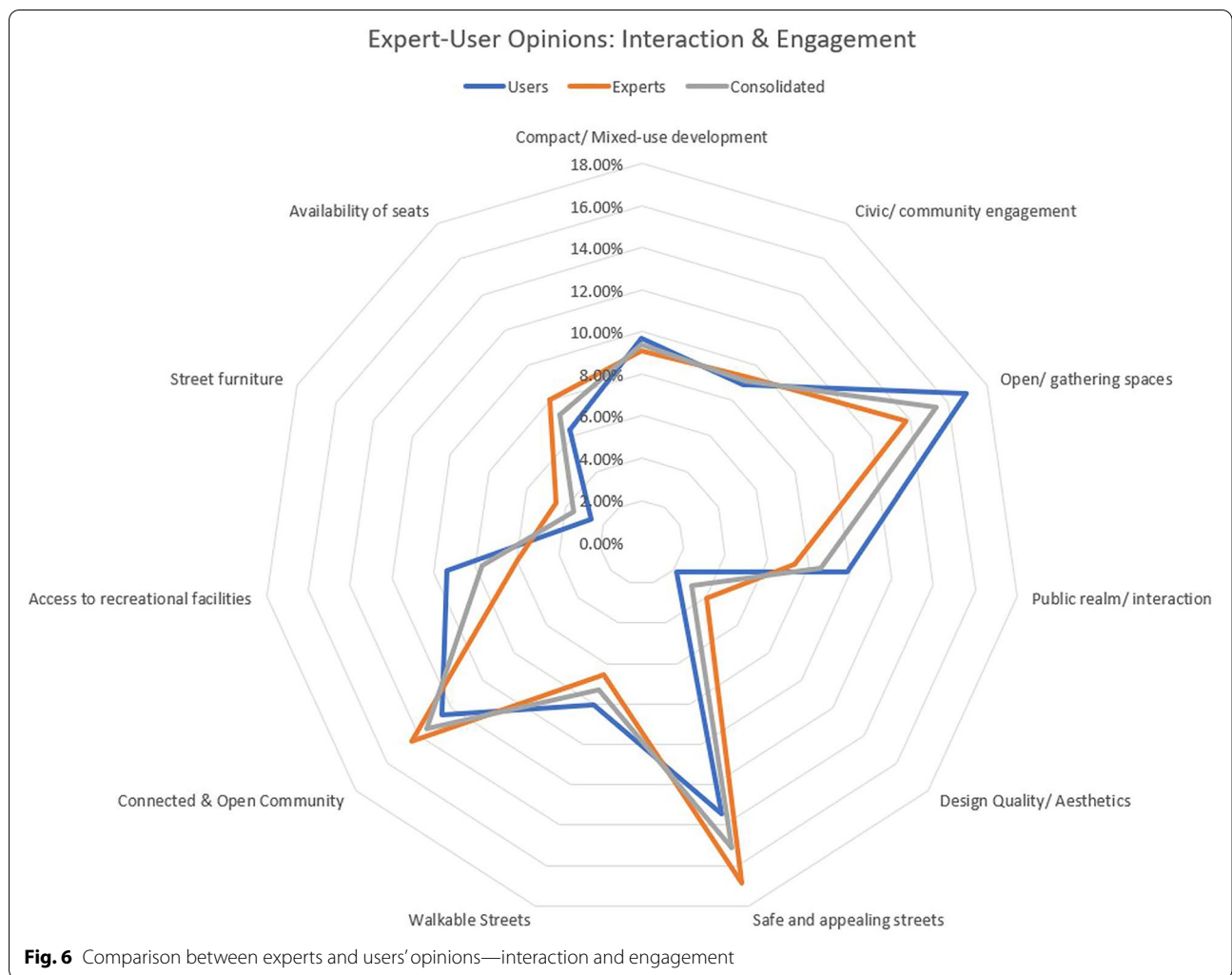
This category addresses quite a significant aspect of social sustainability, mainly targeting the overall health of the community in a manner that nurtures active interaction and engagement. This category, while equally important to the others, featured more noticeable alignment, and sometimes difference, between the experts and users. To start, the experts and users both assigned a relatively high level of importance to the design for the differently abled and the elderly (where the latter was actually added through expert recommendation). These factors were seen of such importance considering the contextual reality in the locality. While such design principles are quite common in the more advanced countries, turning them into a standard, they are till date quite immature in Jordan, while being seen as of utmost importance.

Regarding pollution-relation factors, the experts saw Noise and Light Pollution as equally important aspects to

Table 4 Rating and weights of factors in the interaction and engagement category

Interaction and engagement	Rating average ^a ± SD	Experts opinion		Users opinion		Experts-users	
		Weight (%)	Points (170.0)	Weight (%)	Points (170.0)	Weight (%)	Points (170.0)
Compact/mixed-use dev	3.77 ± 1.06	9.11	15.49	9.71	16.51	9.41	16.00
Civic/community engagement	3.66 ± 0.87	9.30	15.82	8.92	15.17	9.11	15.50
Open/gathering spaces	6.18 ± 1.34	13.82	23.51	16.98	28.87	15.40	26.19
Public realm/interaction	3.45 ± 0.73	7.35	12.50	9.87	16.78	8.61	14.64
Design quality/aesthetics	1.25 ± 0.21	4.05	6.89	2.16	3.67	3.11	5.28
Safe and appealing streets	6.08 ± 1.59	16.87	28.69	13.42	22.81	15.14	25.75
Walkable streets	2.92 ± 0.93	6.54	11.12	8.04	13.68	7.29	12.40
Connected and open community	5.41 ± 1.23	14.44	24.56	12.55	21.34	13.49	22.95
Access to recreational facilities	3.07 ± 1.07	5.97	10.15	9.34	15.88	7.65	13.01
Street furniture	1.44 ± 0.23	4.49	7.63	2.67	4.53	3.58	6.08
Availability of seats	2.89 ± 0.73	8.06	13.71	6.35	10.80	7.21	12.25

^a CR-experts: 0.04–0.06/CR-users: 0.03–0.07



address, as both impacted the healthiness of the community, with their reduction enhancing social sustainability. The experts also added Air Quality and Hygiene from that respect. The users concurred with regard to Noise Pollution and Air Quality but did not assign significant importance to Light Pollution. This can be explained with reference to users' concern for daily aspects of living, where noise pollution is more noticeable and disturbing. In association with overall community health, factors such as Healthy Weight were removed by request of the experts, due to the lack of direct association (final factors showing in Table 5, Fig. 7).

In consideration of the aspects of education, enablement and skills, more emphasis was provided on the availability of neighborhood schools compared to general Training and Skills. This reveals a focus maintained by both experts and users towards the overall community engagement, where neighborhood schools were

seen as an integral part of its accomplishment. Training and Skills, on the other hand and as conveyed by one of the experts, is "a matter that can be dealt with in time, as people get more used and accustomed to sustainability concepts and concerns". Preparedness against natural risks and perils (such as earthquakes, volcanos, pandemics, etc.) as well as man-made perils such as terrorist attacks, riots, or civil wars were also dropped for the much less probability of occurrence in this part of the world in general.

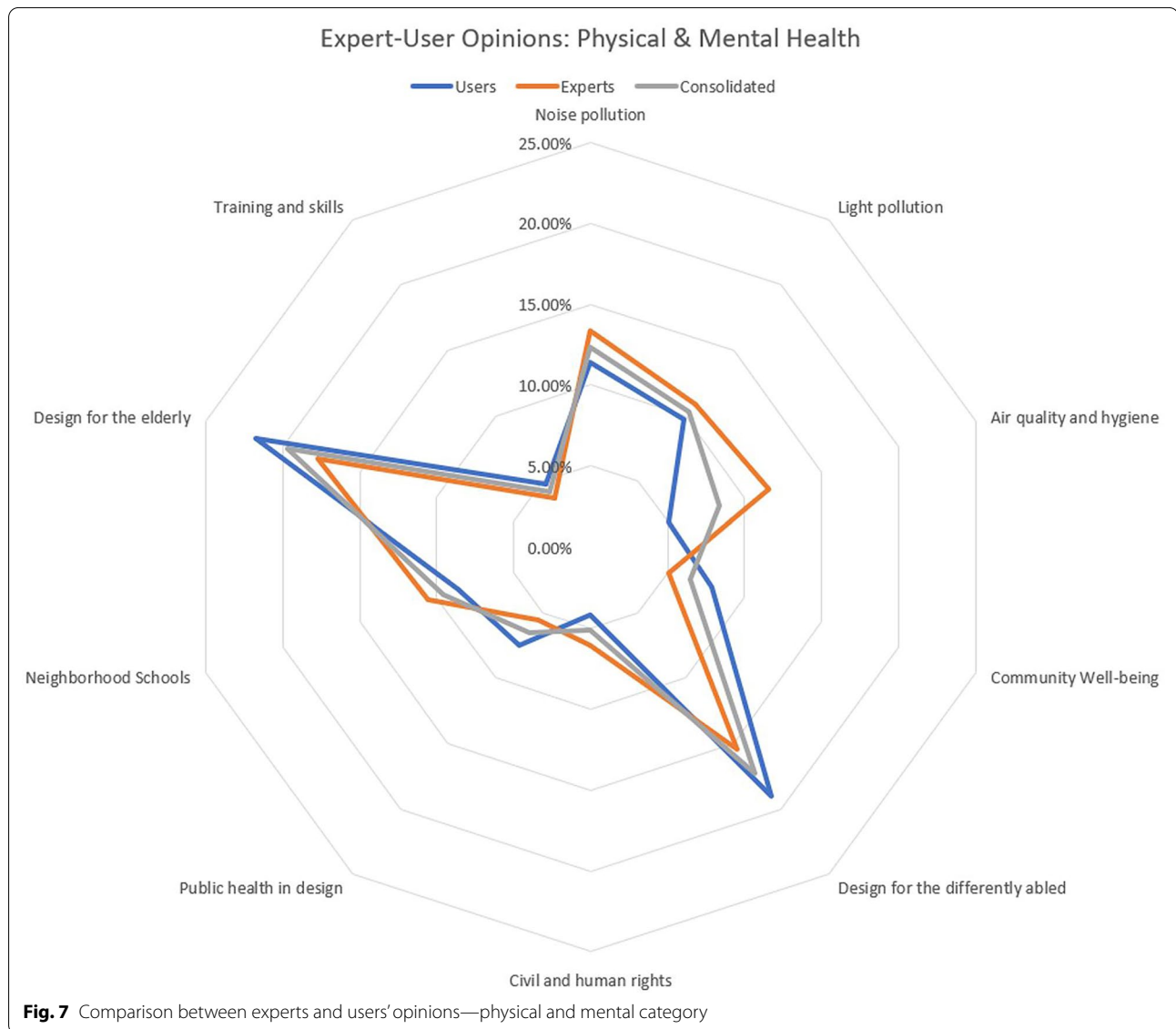
Sense of belonging

This category is supposed to clarify the factors that would enhance the people's sense of belonging to their neighborhood, utilizing ties that are either social, cultural, or convenient in nature. The experts and users, in that regard, emphasized two key factors: Culture and Identity as well as Crime Rate. These were indicative of the interest of both in ensuring the fortification of the belonging

Table 5 Rating and weights of factors in the physical and mental health category

Physical and mental health	Rating average ^a ± SD	Experts opinion		Users opinion		Experts-users	
		Weight (%)	Points (219.1)	Weight (%)	Points (219.1)	Weight (%)	Points (219.1)
Noise pollution	4.26 ± 1.43	13.36	29.26	11.39	24.95	12.37	27.10
Light pollution	3.66 ± 1.05	10.94	23.96	9.77	21.41	10.35	22.69
Air quality and hygiene	1.90 ± 0.33	11.56	25.33	5.09	11.15	8.33	18.24
Community well-being	2.95 ± 0.53	5.09	11.16	7.89	17.28	6.49	14.22
Design for the differently abled	7.13 ± 1.77	15.43	33.82	19.05	41.74	17.24	37.78
Civil and human rights	1.58 ± 0.31	6.04	13.23	4.22	9.24	5.13	11.24
Public health in design	2.80 ± 0.21	5.51	12.08	7.50	16.43	6.50	14.25
Neighborhood schools	3.21 ± 0.41	10.61	23.25	8.57	18.78	9.59	21.02
Design for the elderly	8.13 ± 2.06	17.70	38.78	21.75	47.65	19.72	43.21
Training and skills	1.79 ± 0.23	3.76	8.23	4.78	10.46	4.27	9.35

^a CR-experts: 0.02–0.04/CR-users: 0.05–0.08



to the neighborhood while maintaining it as a safe and secure environment on the long run. From the same perspective, the Walkable Cultural Institutions factor was rated low by both experts and users, as it was seen as rather of less importance compared to other factors in this category that were seen worthy of more immediate attention. Housing Typologies were seen by the experts as of less direct influence over the Sense of Belonging of the residents and was thus recommended to be removed.

The Local Vernacular portrayed a debate between the experts and users. The experts deemed such aspect considerable to include, with architects in particular believing that such buildings were an integral part of social identity. The users had a different perspective, where vernacular buildings were seen as old, less maintained, and abandoned buildings that resulted in negative influences on overall sanitation, aesthetics and crime rates. As the score assigned by the experts to such factor were not high, the decision was made to remove it from the developed framework. Users still acknowledged the importance of Historic Conservation and Heritage, similar to experts, by assigning a relatively high score (see Table 6, Fig. 8).

Sustainable behavior

This category is meant to identify the key habits and customs aimed to driving a feeling of commitment towards sustainability practices in daily life routines. For that reason, Green Spaces attained a primary focus from the experts and users. This was attributed to the necessity of having such spaces to promote an overall appreciation of nature and the importance of its conservation, which can assist in entrenching certain sustainable behaviors amongst the neighborhood, leading to its social sustainability supported by an overall sense of safety (Aljafary 2006). On the other hand, Street Vegetation received less attention for them being considered as routes for swift commute and was accordingly dropped. The users also considered such greening wasteful considering Jordan's scarce water resources, being among the poorest in the

world (Saleh and Al-Rawashdeh 2007; Johansson et al. 2009), as such focus was felt better attending to dedicated green spaces, such as parks. Eco-friendly Transportation also attained high ratings from the experts as well as the users, where such means were seen as ways that could influence even the private transportation utilised currently by the people.

Sustainable buildings, on the other hand, were seen as less influential on the neighborhood scale, where they convey personal choice rather than sustainable behavior on the community level. It was accordingly dropped according to expert recommendations. Sustainability Regulations were alternatively seen as possible drivers to better awareness and adoption of sustainable behavior, for which this factor was added upon expert suggestion.

Efficient lighting and water saving techniques received relatively lower scores, while being maintained within the framework. This was due to the lesser attention given to external lighting, with energy efficient lighting becoming more common within the local context with the use of LED lights at homes as part of a growing level of adoption of efficient energy fixtures (Jordan Green Building Council (JGBC) 2017). Water efficient landscaping was seen related to the optimized use of water, which was already something achieved in consideration to relatively expensive water tariffs applied locally, which automatically drove water use savings. Waste management was moderately regarded, which could be interpreted considering the relatively higher awareness of such aspect as well as its commonality, where Jordan is relatively highly ranked in the region in terms of cleanliness, landfill engineering and waste management (Jordan Green Building Council (JGBC) 2017). The Availing of additional/emergency resources was also removed upon expert feedback due to the economies associated with such arrangements that were not seen in line with the national economic limitations. The final list of factors included in this category are shown in Table 7, Fig. 9.

Table 6 Rating and distributed weight of factors in the sense of belonging category

Sense of belonging	Rating average ^a ± SD	Experts opinion		Users opinion		Experts-users	
		Weight (%)	Points (164.3)	Weight (%)	Points (164.3)	Weight (%)	Points (164.3)
Economic distt. equity/impact	3.15 ± 1.08	10.54	17.32	8.78	14.42	9.66	15.87
Culture and identity	6.71 ± 1.68	19.20	31.53	22.04	36.19	20.62	33.86
Historic cons. and heritage	5.01 ± 1.29	14.66	24.08	16.10	26.45	15.38	25.27
Communal diversity	2.42 ± 0.83	8.77	14.40	6.09	10.00	7.43	12.20
People stability/displacement	3.64 ± 1.07	9.67	15.89	12.66	20.79	11.17	18.34
Crime rate	7.17 ± 1.88	23.49	38.59	20.51	33.69	22.00	36.14
Walkable cultural institutions	2.08 ± 0.32	7.77	12.76	4.99	8.19	6.38	10.48
Neighboring	2.40 ± 0.13	5.89	9.67	8.84	14.52	7.36	12.10

^a CR-experts: 0.03–0.06/CR-users: 0.02–0.06

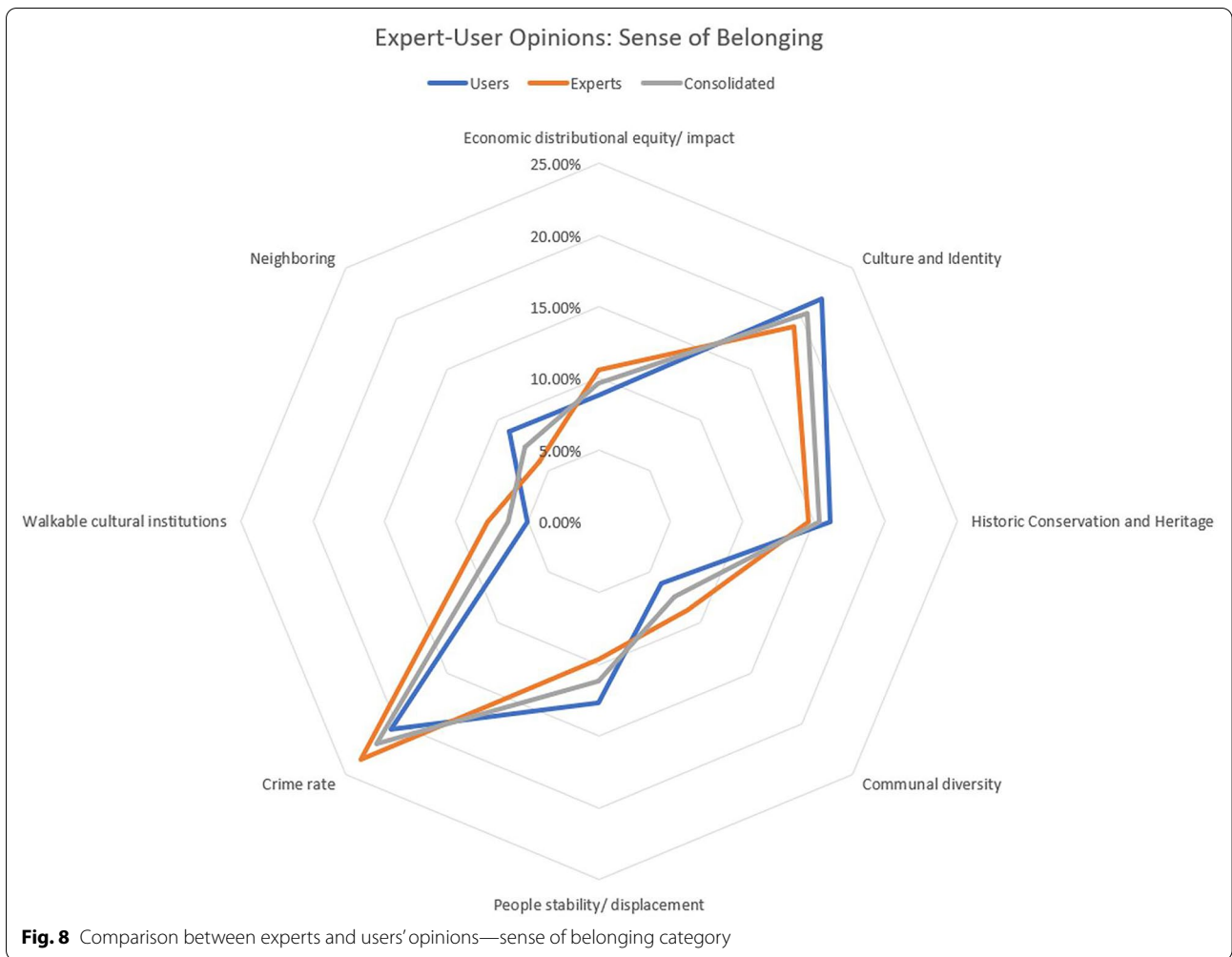
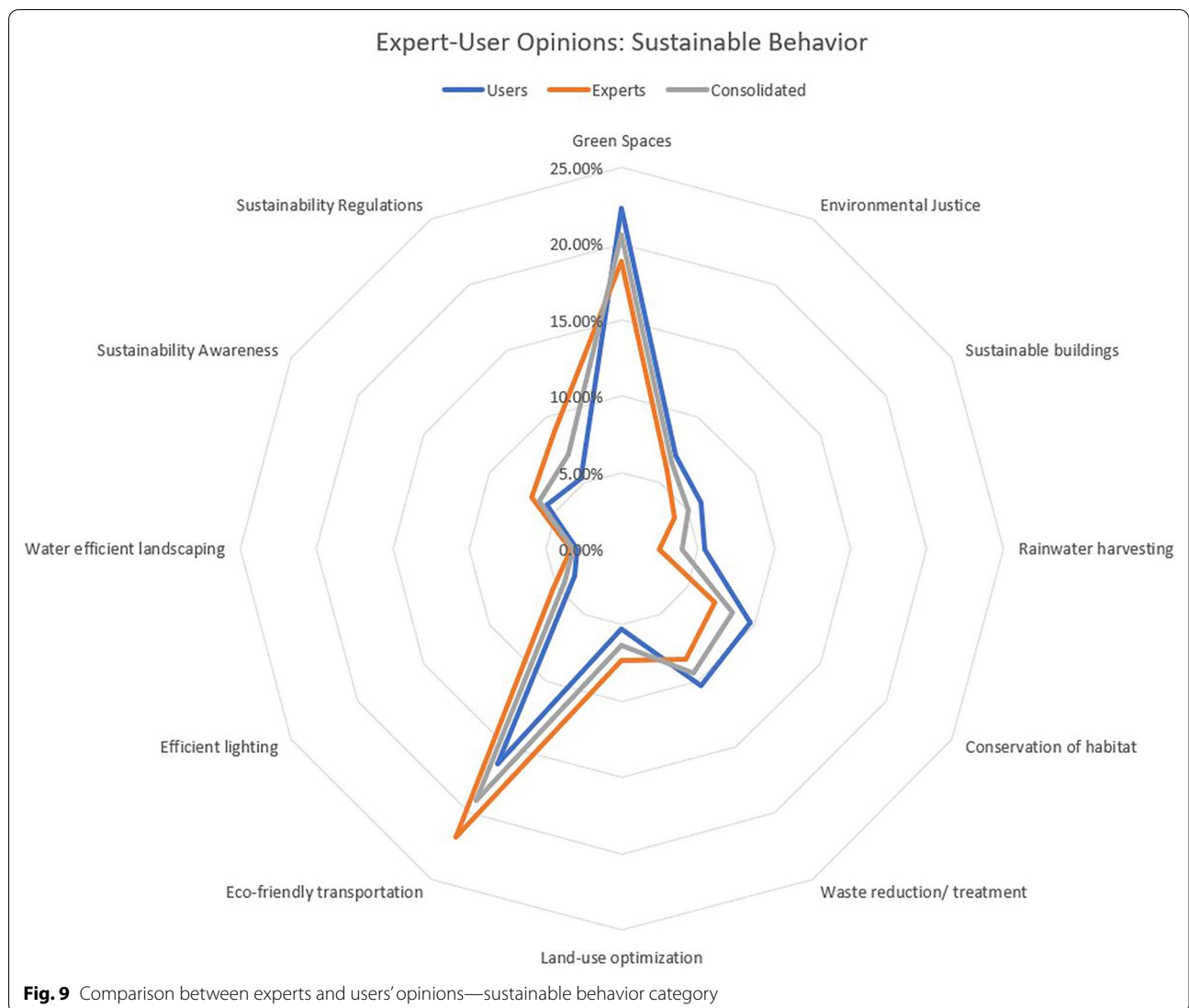


Table 7 Rating and distributed weight of factors in the sustainable behavior category

Sustainable behavior	Rating average ^a ± SD	Experts opinion		Users opinion		Experts-users	
		Weight (%)	Points (212.0)	Weight (%)	Points (212.0)	Weight (%)	Points (212.0)
Green spaces	10.53 ± 2.73	18.84	39.95	22.36	47.42	20.60	43.68
Environmental justice	3.31 ± 1.02	5.97	12.66	7.00	14.84	6.48	13.75
Sustainable buildings	2.56 ± 0.64	4.01	8.50	6.00	12.71	5.00	10.61
Rainwater harvesting	2.01 ± 0.14	2.42	5.14	5.45	11.56	3.94	8.35
Conservation of habitat	4.29 ± 1.54	7.05	14.94	9.72	20.61	8.38	17.78
Waste reduction/treatment	4.78 ± 1.27	8.31	17.62	10.41	22.07	9.36	19.85
Land-use optimization	3.22 ± 0.93	7.35	15.58	5.25	11.12	6.30	13.35
Eco-friendly transportation	9.75 ± 2.12	21.80	46.23	16.33	34.62	19.07	40.42
Efficient lighting	2.24 ± 0.76	5.20	11.02	3.58	7.59	4.39	9.30
Water efficient landscaping	1.61 ± 0.23	3.35	7.10	2.96	6.27	3.15	6.68
Sustainability awareness	3.18 ± 0.78	6.80	14.42	5.66	12.00	6.23	13.21
Sustainability regulations	3.62 ± 1.02	8.90	18.86	5.29	11.21	7.09	15.04

^a CR-experts: 0.03–0.08/CR-users: 0.06–0.09



The overall framework

When combining all categories and related factors together, the resultant consolidated framework becomes as shown in Fig. 10.

Discussion

Comparison with other rating systems

The developed framework came as a product of intensive and focused research on the social aspects of sustainability as localised within a Jordanian suburb in Amman. It aimed at including the most relevant and applicable categories and factors to properly stand on the true level of social sustainability attained within a particular neighborhood. For such system outcomes to be considered of relevance, comparisons have been made with global, regional and local frameworks

(Table 8), where the earlier locally developed rating frameworks include DIANA (Ali et al. 2021) and Saba (Ali and Al Nsairat 2009). With such comparison, some key observations can be highlighted. Firstly, a tendency to focus on the physical aspects of the environment is quite vivid, a fact that applies to global, regional and local rating standards. This is partly why the Sense of Belonging category and its comprised factors are amongst the least ones featuring in such prominent rating tools, as they attain a more abstract character. In result, factors such as access to facilities and amenities, light and noise pollution, community engagement and rainwater harvesting can be seen more frequently than the likes of communal diversity, people stability/ displacement or culture and identity.

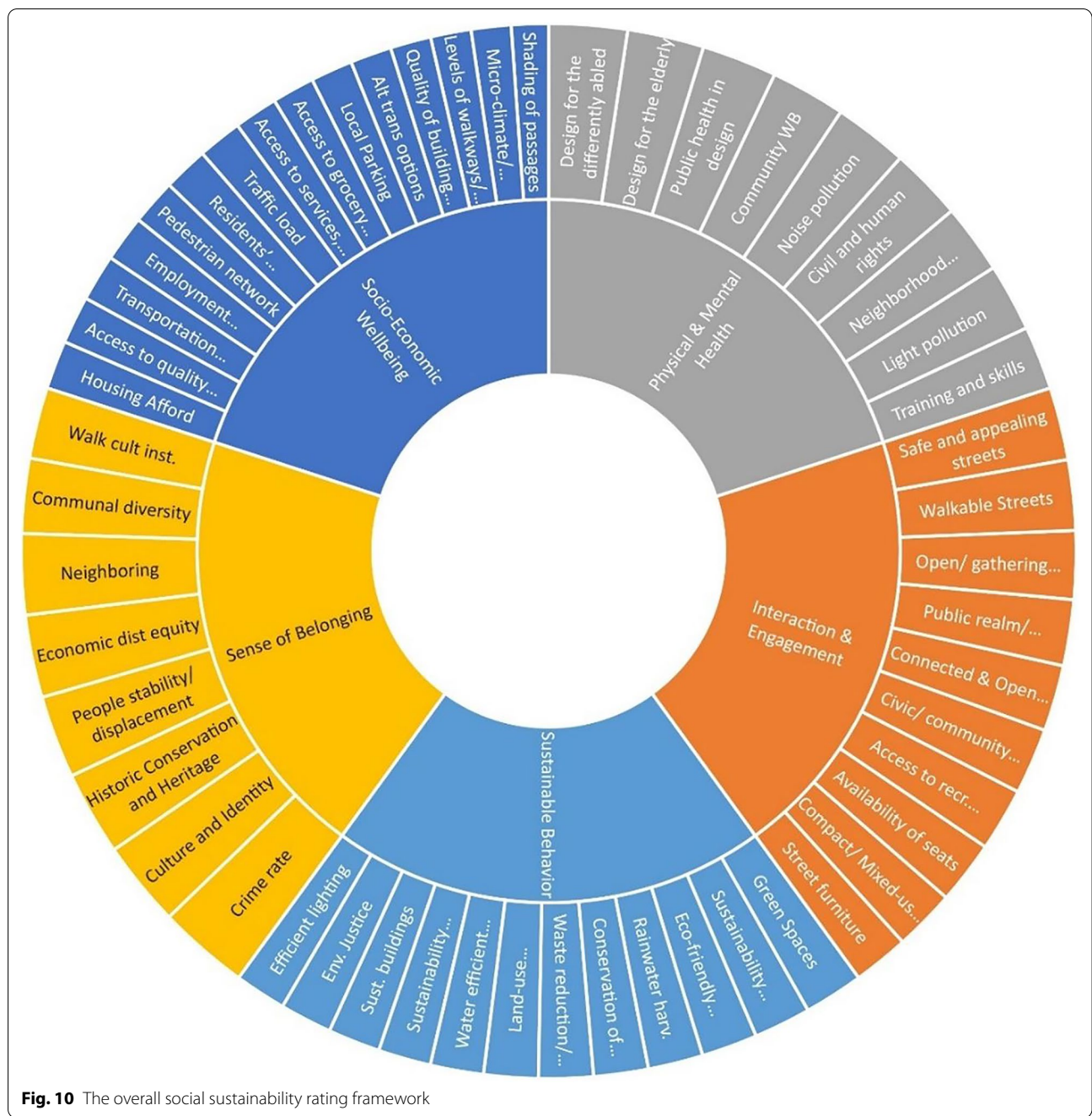


Fig. 10 The overall social sustainability rating framework

Secondly, and in relation to what has been mentioned earlier, it appears that addressing the social aspects of sustainability, within a comprehensive rating framework (comprising other economic and environmental aspects), results in less attention to details while addressing this most important pillar. This is not meant to take any importance away of the other sustainability pillar, but it is meant to demonstrate how advantageous is the dedicated consideration provided to each of them in separation.

Indeed, the three pillars would always entail a certain level of overlap, but such issues are considered relatively minor in comparison to the sought benefit of dedicated consideration. This issue appears when comparing the outcome of this research with the social factors articulated earlier by localised, yet more comprehensive, rating tools such as Saba and Diana, where the current research was able to shed light over multiple aspects that could not be identified within the earlier rating tools, where

Table 8 Framework comparison with other global, regional, and local tools

Factor	International					Regional	Local	
	LEED-ND	LEED-CC	BREEAM-C	CASBEE-UD	Green townships	PEARL-C	DIANA	SABA
Socio-economic wellbeing								
Access to quality transit	✓	✓	✓				✓	
Housing affordability		✓	✓					
Transportation affordability		✓						
Micro-climate/outdoor environment			✓	✓			✓	✓
Access to services and amenities			✓	✓	✓	✓	✓	
Local parking			✓				✓	
Traffic load				✓			✓	
Employment opportunities	✓				✓			
Pedestrian network	✓				✓	✓	✓	
Alternative transport options					✓		✓	
Access to grocery stores				✓	✓			
Navigation and way finding	✓					✓		
Quality of building stock								
Levels of walkways/spaces				✓	✓			
Shading of passages				✓	✓		✓	
Interaction and engagement								
Compact/mixed-use development	✓	✓			✓		✓	
Civic/community engagement		✓	✓	✓			✓	
Open/gathering spaces					✓	✓		
Public realm/interaction								
Design quality/aesthetics	✓		✓					✓
Safe and appealing streets			✓			✓	✓	✓
Walkable streets	✓			✓		✓		
Connected and open community	✓							
Access to recreational facilities	✓						✓	
Street furniture					✓			
Availability of seats					✓			
Physical and mental health								
Noise pollution			✓	✓			✓	✓
Light pollution	✓		✓	✓			✓	✓
Air quality and hygiene	✓	✓	✓	✓		✓	✓	✓
Community well-being								
Design for the differently abled					✓			
Civil and human rights		✓						
Public health in design								
Neighborhood schools	✓					✓		
Design for the elderly								
Training and skills			✓	✓		✓		
Sense of belonging								
Economic dist. equity/impact			✓					
Culture and identity								
Historic conservation and heritage	✓			✓			✓	
Communal diversity		✓						
People stability/displacement								
Crime rate				✓				

Table 8 (continued)

Factor	International					Regional	Local	
	LEED-ND	LEED-CC	BREEAM-C	CASBEE-UD	Green townships	PEARL-C	DIANA	SABA
Walkable cultural institutions								
Neighboring					✓			
Sustainable behavior								
Green spaces			✓	✓	✓			
Environmental Justice		✓						
Sustainable buildings			✓		✓			
Rainwater harvesting	✓		✓	✓	✓	✓	✓	✓
Conservation of habitat								
Waste reduction/treatment	✓			✓	✓		✓	
Land-use optimization					✓			✓
Eco-friendly transportation							✓	✓
Efficient lighting						✓	✓	✓
Water efficient landscaping				✓		✓		✓
Sustainability awareness						✓		
Sustainability regulations								

assigning a central role to the people, as users, was not attainable prior to this research.

Thirdly, it is noticeable that the more localised the compared rating tool is, the more focus can be seen on sustainability awareness as well as driving more dedicated sustainable behavior. This can be noticed through focus on elements such as energy conservation, efficient lighting, stormwater harvesting and waste management. This entails a reflection on the current reality of the locality, where sustainability is yet a concept to attract the required levels of adoption, resulting in more focus on such elements that support behavior that would potentially lead to the sought level of adoption.

Fourthly, the development process of the above frameworks relied mainly on expert opinions without clear contribution to end users in qualifying the relevance of the developed categories and factors, where this research aimed at bridging this gap in order to reach more adaptive and consensual indicators.

Comparison with previous social sustainability studies

It is believed that the strength of the current research was drawn from its, (a) focus on the localised and contextual matter and (b) its inclination to focus primarily on the social sustainability pillar as applied to neighborhood. The second attribute enabled the framework developed through this research to offer more detailed and variant categories and factors compared to other global, regional and local comprehensive rating tools. The first attribute, on the other hand, enabled it to show more distinction

and relevance compared to other studies that focused on social sustainability, with the concept being a highly localised, if not even personalised, one.

For instance, the work of Berkeley Group and the University of Reading in 2011 resulted in a framework for assessing social sustainability for developed communities in the UK (Woodcraft 2015). Their developed model entailed three categories: Amenities and Infrastructure, Social and Cultural Life, and Voice and Influence. Going through the identified factors (Fig. 11) it can be noticed that most factors corresponded to 3 out of 5 categories covered by the current research.

Another previous study administered by Curtis et al. (2020), on the other hand, focused primarily on non-physical factors, comprised in the categories of Social Justice, Inclusivity, Trust and Empowerment. While comprehensively addressing such categories, the exclusion of critical factors pertaining to comfort, wellbeing and sustainable behavior are worthy of highlighting as potential shortcomings. This research aimed at achieving a balanced approach that measures physical as well as abstract factors in order to comprehensively address the issue of social sustainability on the neighborhood level (Fig. 12).

Considering the research done by Dempsey et al. (2011) covering a comprehensive set of literature, a prolonged list of potential social sustainability indicators were identified, covering physical as well as non-physical factors. Still, dedicated contextualised studies would never be able to incorporate the majority of the identified



Fig. 11 Previous model (source: Berkeley Group 2014 [Woodcraft 2015])

indicators, should they end up with the most relevant and applicable framework.

Validation—case study

The validation approach entailed several site visits, casual conversations with the residents, as well as a formal questionnaire to measure the level of their satisfaction on the social sustainability of their neighborhood (Additional File 1). Considering the technicality of the entailed categories and factors, the questionnaire addressed them through simplified measures that would reflect the residents' level of satisfaction (Table 9). In some instances, multiple questions were utilised for the same factor, with the aim of ensuring the proper explanation and understanding of the residents of what the concern factor entails.

Resident satisfaction levels were obtained by the use of a five-level rating scale ranging from “Totally

Dissatisfied” to “Extremely Satisfied”, where the weighted average of residents' responses was taken to represent the overall outcome concerning Dahiyat Al Hussein neighborhood. An additional option of “Not Relevant” was included and analysed to reflect the relevance of the assessment framework to the residents, where choosing this option would take the concerned factor out of the overall score. A relatively high rate of choosing this option would indicate that the residents considered the concerned factors not related to the proper assessment of neighborhood social sustainability, according to their own perception. Whereas the quantitative analysis of the questionnaire provided the statistical trends pertaining to residents' assessment, site visits and casual resident interactions and conversations provided qualitative inputs that assisted the researcher in rationalizing some of the identified satisfaction/dissatisfaction trends and their reasoning.

The residents provided an overall above average rating of the social sustainability of their neighborhood, with an average of 67% satisfaction. Socio-economic Wellbeing received the highest level of satisfaction (at around 77%) followed by Interaction and Engagement (73%) and Sense of Belonging (71%). Physical and Mental Health as well as Sustainable Behavior received lower ratings comparatively, achieving 58 and 55% levels of satisfaction, respectively (Fig. 13).

As would be detailed in the following factor-based residents' assessment, the categorical satisfaction levels reflect a stability-driven trend, where the residents have been accustomed to their neighborhood for extended periods of time, enabling them to build stronger ties and familiarity with each other and becoming more attached to their neighborhood. This sentiment has been seen to overcome the lower level of satisfaction demonstrated by the residents with regard to the Physical and Mental

Health and Sustainable Behavior categories, which can be attributed to the standing of Dahiyat Al Hussein as a relatively old neighborhood, where its design, available facilities and means of technology, would be seen as not highly supportive to achieving a high level of sustainability in the most modern sense.

Regarding the Socio-economic Wellbeing category, the residents generally demonstrated a high level of satisfaction, particularly concerning quality transit, housing affordability, and access to services. This came as no surprise considering the particularity of the neighborhood, which offered a number of qualities to support such level of satisfaction. Within a relatively older neighborhood, the residential units entailed are generally considered more affordable compared to newer developments, supported by the high level of stability of the residents as they became more accustomed and comfortable with their current residential arrangements. The

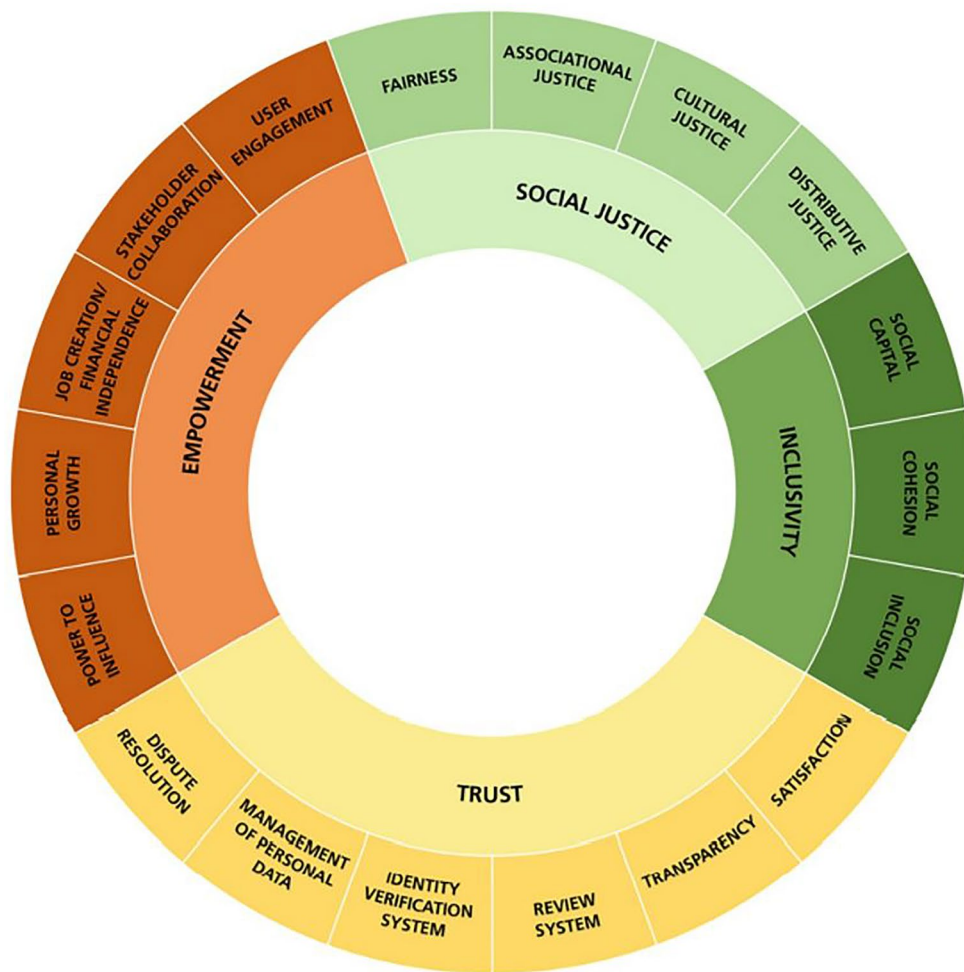


Fig. 12 Previous model (source: Curtis et al. 2020)

Table 9 Measures of sample factors utilised in the residents' questionnaire

Factor	Measures
Economic distributional equity/impact	<ul style="list-style-type: none"> • Living standards • Homogeneity of residents • Similarity of provided living facilities
Culture and identity	<ul style="list-style-type: none"> • Adequacy of daily routines • Character of the neighborhood • Special appeal compared to other neighborhoods
Historic conservation and heritage	<ul style="list-style-type: none"> • Safety of old buildings • Cleanliness of old buildings • Changes through time on the neighborhood
Communal diversity	<ul style="list-style-type: none"> • Balanced distribution of age • Balanced distribution of gender • Balanced distribution of education levels
People stability/displacement	<ul style="list-style-type: none"> • Rate of movement into and out of the neighborhood • Familiarity with other citizens • Ability to identify strangers • Average tenure of most residents
Crime rate	<ul style="list-style-type: none"> • Safety during the day • Safety during the night • Frequency of disturbing incidents
Walkable cultural institutions	<ul style="list-style-type: none"> • Closeness of youth centers • Closeness to community associations
Neighboring	<ul style="list-style-type: none"> • General sentiment between neighbors • Rate of neighbor disturbance • Frequency of issues between neighbors

vital location of Dahiyat Al Hussein, with direct proximity to main roads, helped in providing easy and relatively quick access to other main locations residents need to manage their daily work and personal affairs. This, however, entailed some dissatisfaction regarding traffic load, as its location entailed instances of heavy traffic commonly experienced. Access to services and grocery stores was highly regarded by the residents as the neighborhood included multiple integrated services, with the local availability of facilities such as grocery stores, maintenance shops as well as dry-cleaning facilities. Local parking, on the other hand, received a low satisfaction level, which was mainly attributed to the less availability of convenient parking space. Whilst the provided quantity of local parking spaces might have been seen appropriate at earlier times of the neighborhood, it was unable to accommodate the increasing number of cars owned by its residents as a contemporary concern.

The factors under the Interaction and Engagement category received a relatively high level of satisfaction by the residents, with a clear appreciation to the mixed-use nature of the neighborhood, supporting residential, service, and recreational needs. The availability of gathering spaces, represented by two main parks within the neighborhood, was most notable as people would be frequently seen gathering and socializing there. Residents' familiarity with the neighborhood, as well as the proximity of its leisure and socializing facilities with its residential

buildings provided a general sense of safety and security, where the "eyes on the street" (Jacobs 1961) provided the required surveillance to hinder any disruptive activity from outsiders, as they would always have the feeling of being watched and recognised as strangers when entering the neighborhood. Street furniture and availability of seats received moderate levels of satisfaction by the residents, while both featured a relatively higher frequency of being considered irrelevant, with around quarter the surveyed sample providing such feedback. As expected, the residents creatively deployed many other informal seating arrangements while socializing in the common spaces of the neighborhood, where they were seen sitting on pavements, grassed areas as well as lower wall edges, as formal means of seating were not considered a necessity.

The Sense of Belonging, being the third highest rated category, revealed a relatively high levels of satisfaction in regard to communal stability. This was observed through a combination of residents of different ages enjoying its common facilities, where children played in the streets and parks, young men and women socialised and elderly residents chatted as they sat or strolled around its streets. This stability drove a higher appreciation to a prevalent positive neighboring spirit stemming from the overall familiarity in between the relatively stable residents. Walkability to cultural institutions was rated less by the residents, considered as reduced and less direct forms of social and cultural belonging. This factor, along with

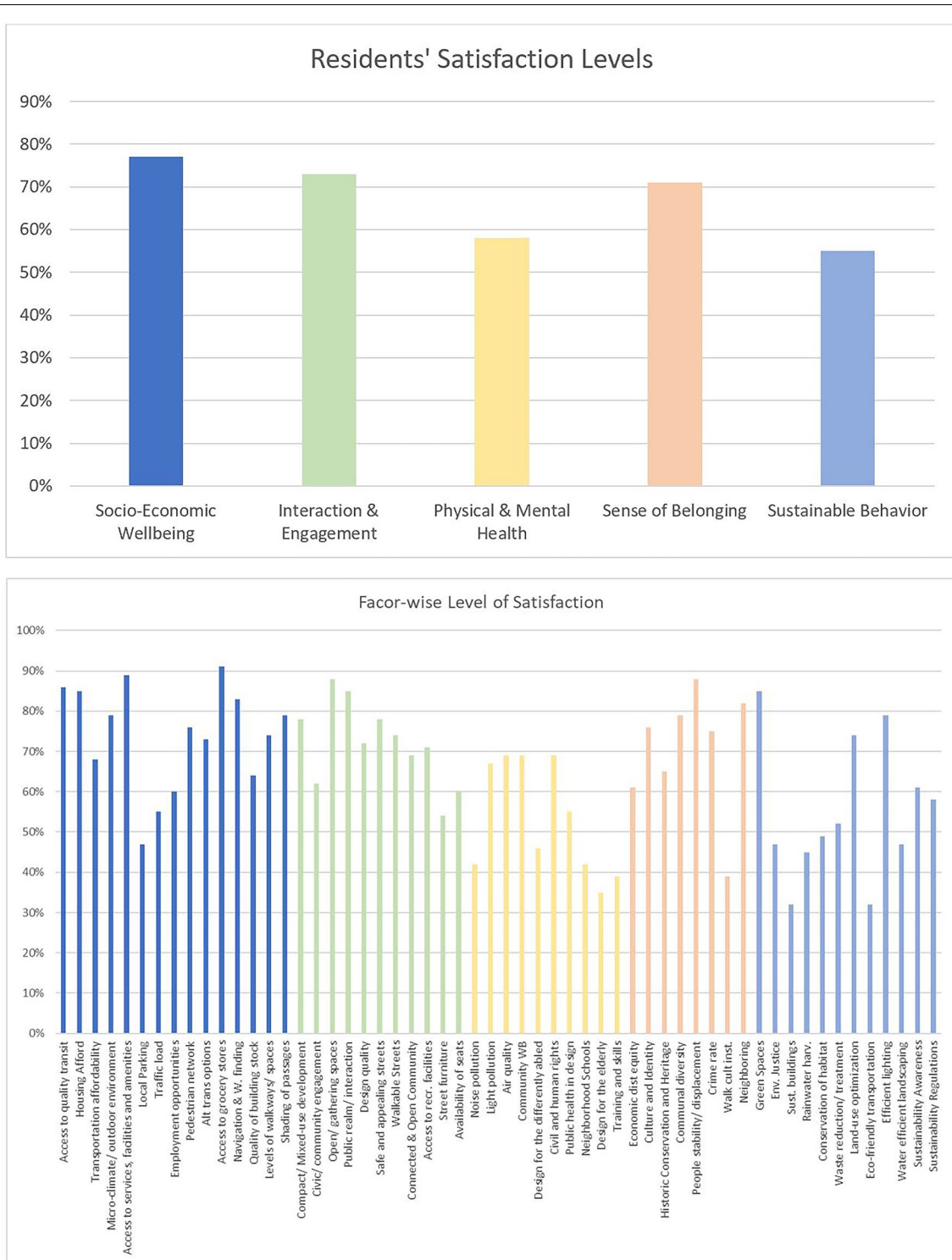


Fig. 13 Residents' satisfaction levels by rating category (top) and by factor (bottom)

Economic Distributional Equity, were seen less relevant by the residents, driven by the limited spread of Amman,

where the proximity of work locations and other economic opportunities were not seen a necessity.

Sustainable Behavior achieved a relatively low level of satisfaction, as reported by the surveyed residents. While appreciating the availability of green spaces represented by the neighborhood parks, residents were dissatisfied with the overall sustainability practices exercised. This resulted from two main factors; the old design of the neighborhood, which did not allow for the implementation of modern sustainability means that would entail the optimization of resources. This was also related to generally lower levels of awareness, which could be better supported with more orientation as well as sustainability-driven regulations, seen as still being matured within the country at large. Issues pertaining to efficient landscaping, rainwater harvesting, and eco-friendly transportation were seen as underserved, with lower levels of adoption to such technological means. Land-use optimization and efficient lighting were the two main highly ranked factors in this category, where the neighborhood was seen as generally compact and optimised in terms of spatial distribution. Light efficiency was further attributed to self-initiative by the residents as well as the ease of use of energy saving light bulbs, which assist the residents in reducing their monthly electricity bills.

Physical and Mental Health, being the lowest regarded category by the residents, reflected significant concerns that resulted in less convenience experienced. The location of the neighborhood with direct access to main vehicle arteries resulted in the detrimental impact of noise pollution from the nearby traffic, which was experienced by the residents throughout the day, and frequently at nights. The old design of the neighborhood also resulted in less preparedness to accommodate the needs of the differently abled, as well as the elderly through the design of its passages, streets, and common areas. On the other hand, the availability of neighborhood schools was seen convenient, as the residents appreciated the proximity of schools to allow walkable reachability for their children, seen as safer and more convenient. With that said, the residents still appreciated the overall wellbeing of the neighborhood, with the inclusiveness and self-containment it offered. Civil and human rights were reported as less relevant by around 40% of the residents, which can be attributed to the lower political concerns they attained in their daily lives.

Conclusion

This research attempted at developing a dedicated neighborhood social sustainability framework suited to the local context of Amman, Jordan. In doing so, it aimed at providing more focus and elaboration on the subject matter compared to the more traditional holistic view followed in the usual development of the all-in sustainability rating tools that address environmental and economic aspects, along

with the social. The customised exercise adopted the inclusion of experts and users alike and resulted in a number of insights pertaining to the context-specificity as well as the multifaceted importance of the topic, where the developed categories and factors were driven not only by the macro-developmental views of the experts, but with the daily life experiences of the users as well.

The developed rating framework conveyed several resemblances and differences compared to the social components of other global, regional and local frameworks. The differences were mainly driven by the particularity of the context addressed, in terms of special needs and requirements, as well as the level of maturity of the sustainability learning and adoption curve, which impacted the Sustainable Behavior category. It was also impacted by a combined set of expectations held by the users in terms of convenience, which affected categories such as Physical and Mental Health. Obtaining user insights in combination with the insights of local experts shed light on certain particularities, strengths and areas of improvement. While the prevalent cultural and social norms assisted in establishing a strong Sense of Belonging and Socio-economic Wellbeing, other areas were seen in need for improvement. These included matters pertaining to design that addresses the elderly and especially abled as well as the need for better sustainability encouragement through awareness and regulations to drive a more positive sustainable behavior.

The research did not aim to insinuate the need for dedicated frameworks that are specified to a particular country or, in our case, each city. It merely aimed to provide a comparative view that highlighted the necessity of user involvement in matters that are worthy of their insights, which would pave the way for better user alignment and adoption levels. Such a concept should be applicable on the country, region and global levels. The developed rating tool is rather a communication vehicle between designers and users, where the attained insights should enable the aware alignment and suitability sustainable neighborhood design.

Further extensions to the research are recommended through additional studies that would include other neighborhoods in the city of Amman and refine the proposed framework in a manner that would support its generalisation. Further focus on the inter-participant-group differences would also add value in understanding the particular areas of focus attained by experts and users, for example. In continuation to what this research was set to achieve, further research is encouraged to apply the same focus and dedication to the separate consideration of further economic and

environmental aspects, with the aim of similarly articulating context-specific categories and indicators.

Supplementary Information

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Additional file 1: Questionnaire S1. Social sustainability rating questionnaire.

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Author contributions

AAS articulated the methodology and write up, ASS participated in data collection and obtaining necessary approvals, MRQ and AK worked on the analysis and interpretation of the data, OTO provided research facilitation and final review. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interests

The authors declare that they have no competing interests in this section.

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