# Assessing Social Sustainability within gated communities in Saudi Arabia

BY

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This thesis, written by **Yazan Mohammad Al-Kofahi** under the direction of his thesis advisor and approved by his thesis committee, has been presented and accepted by the Dean of Graduate Studies, in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE IN ARCHITECTURE.**

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I dedicate this work to Zain, my little brother, who lives within me always.

# ACKNOWLEDGMENTS

Above all, I offer my deepest praise and gratitude to Almighty Allah, the source of all blessing, knowledge, strength, and every open door. It is only through His mercy and grace that this work was possible. In moments of exhaustion, grief, uncertainty, and weakness, He granted me the strength to continue and the patience to endure. Whatever good is found in this work is by His will alone.

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This journey was not an easy one. I went through many obstacles and challenges, including deep personal loss. The pain of losing my brother Zain was one of the hardest burdens I have ever carried, and there were moments when continuing felt almost impossible. Yet Zain was never only a memory of loss; he remained a presence within me, a source of love, strength, and meaning.

For Zain, my little brother: you are not gone. You live within me, in every breath I take, in every step I walk, and in every dream I chase. You taught me so much, even though you were the youngest. You are here, not in the past, but in forever; after all this time, in every heartbeat. Always.

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I would also like to acknowledge myself: for continuing despite grief, for enduring the weight of difficult days, and for not giving up when the road became painfully heavy. This work is a reminder to me that with faith, patience, and determination, even the hardest chapters can be carried out.

Finally, this thesis walks beside the dedication that precedes it: for Zain and Yazan, my brothers and forever companions in every breath, step, and dream. Your presence lives within me in ways words cannot fully contain. This work, and every step that brought me here, carries your memory, your love, and the bond that time can never erase. Always.

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# LIST OF ABBREVIATIONS

**ANOVA**: Analysis of Variance

**BREEAM**: Building Research Establishment Environmental Assessment Method

**BC**: Normalized Breadth of Categories

**BS**: Normalized Breadth of Sub-categories

**DC**: Normalized Depth of Categories

**DS**: Normalized Depth of Sub-Categories

**CCRAM**: Conjoint Community Resilience Assessment Measure

**CCTV**: Closed-Circuit Television

**COVID-19**: Coronavirus Disease 2019

**CCRAM**: Community Resilience Assessment Measure

**CSSAF**: Comprehensive Conceptual Social Sustainability Assessment Framework

**GCC**: Gulf Cooperation Council

**GCs:** Gated Communities

**HOA**: Homeowners Association

**IQD:** Interquartile Deviation

**KSA**: Kingdom of Saudi Arabia

**KFUPM:** King Fahd University of Petroleum and Minerals

**L1:** Level One

**L2:** Level Two

**L3:** Level Three

**LEED**: Leadership in Energy and Environmental Design

**LEED-AP**: Leadership in Energy and Environmental Design – Accredited Professional

**LEED-ND**: Leadership in Energy and Environmental Design – Neighbourhood Development

**NHD**: Neighbourhood (British spelling for "Neighbourhood")

**M:** Mean

**SD:** Standard Deviation

**SPSS**: Statistical Package for the Social Sciences

**SS**: Selection Score

**FASSGC-74:** Framework to Assess social sustainability within gated communities 74 indicators.

**FASSGC-42:** Framework to Assess social sustainability within gated communities 42 key indicators.

**FASSGC-45:** Framework to Assess social sustainability within gated communities 45 final indicators.

# ABSTRACT

Full Name : Yazan Mohammad Jameel Alkofahi

Thesis Title : Assessing Social Sustainability within gated communities in Saudi Arabia

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**Keywords:** Social sustainability; Gated communities; Saudi Arabia; Assessment framework; Sustainability indicators; Urban planning

Social sustainability remains one of the least operationalized dimensions of sustainable development in the built environment, particularly within gated residential communities in Saudi Arabia. This thesis addresses a clear gap in the literature: although 23 assessment approaches were systematically reviewed, comprising 19 academic social sustainability frameworks and 4 neighbourhood-scale assessment tools, only three studies explicitly addressed social sustainability within gated communities, and no widely adopted, context-sensitive assessment instrument was identified for the Saudi context. This shortage of gated-community-specific tools reveals the fragmented and underdeveloped state of current measurement efforts and underscores the need for a contextualized framework tailored to Saudi Arabia.

To address this gap, the study adopted a mixed-method research design that integrated an in-depth literature review, content analysis, and a two-round Delphi technique. The literature review established the conceptual foundations of social sustainability in gated communities and identified a broad pool of candidate indicators. These were then examined through content analysis of the selected frameworks and tools, followed by systematic filtering based on conceptual relevance and contextual suitability to the Saudi setting. The preliminary

framework was subsequently refined and validated through two rounds of expert review involving specialists in urban planning, architecture, and development.

The study resulted in a validated contextualized assessment framework for social sustainability in Saudi gated communities and in Arab Region. The finalized framework comprises five core categories: community cohesion and social interaction; safety and security; livability and quality of place; participatory governance, equity and empowerment; and external relations and integration. These are organized into 18 sub-categories and 45 indicators that collectively capture both the internal social dynamics of gated communities and their relationship with the wider urban context. The framework was rigorously supported by expert consensus and demonstrated strong internal consistency, with an overall Cronbach's alpha of 0.86.

This thesis contributes to knowledge by translating the abstract concept of social sustainability into a practical, empirically grounded, and context-sensitive assessment instrument tailored to Saudi Arabia. It provides planners, developers, and policymakers with a systematic tool to evaluate existing and future gated communities, identify strengths and weaknesses, and guide targeted interventions that enhance social well-being, inclusiveness, and quality of life. In doing so, the study supports broader efforts to align residential development with the ambitions of Saudi Vision 2030 and the creation of more socially sustainable communities.

# ملخص الرسالة

**الاسم الكامل**: يزن محمد جميل الكوفحي

**عنوان الرسالة**: تقييم الاستدامة الاجتماعية داخل المجمعات السكنية المغلقة في المملكة العربية السعودية
**التخصص:** العمارة

**تاريخ الدرجة العلمية**: 1447 ذي القعدة

**الكلمات المفتاحية:** الاستدامة الاجتماعية؛ المجتمعات السكنية المسوّرة؛ المملكة العربية السعودية؛ إطار التقييم؛ مؤشرات الاستدامة؛ التخطيط الحضري

تُعَدّ الاستدامة الاجتماعية من أقل أبعاد التنمية المستدامة تحويلًا إلى أدوات قياس عملية داخل البيئة العمرانية، ولا سيما في المجتمعات السكنية المسوّرة في المملكة العربية السعودية. وتعالج هذه الرسالة فجوةً واضحة في الأدبيات؛ فعلى الرغم من مراجعة 23 إطارًا وأداة تقييم بصورة منهجية، شملت 19 إطارًا أكاديميًا للاستدامة الاجتماعية و4 أدوات تقييم على مستوى الأحياء، فإن ثلاث دراسات فقط تناولت الاستدامة الاجتماعية صراحةً في سياق المجتمعات السكنية المسوّرة، كما لم يتم العثور على أداة تقييم معتمدة على نطاق واسع ومراعية للسياق السعودي. ويكشف هذا النقص في الأدوات المتخصصة بالمجتمعات المسوّرة عن الطبيعة المجزأة وغير المتطورة لجهود القياس الحالية، ويؤكد الحاجة إلى تطوير إطار تقييمي مُكيَّف مع السياق المحلي في المملكة العربية السعودية.

ولمعالجة هذه الفجوة، اعتمدت الدراسة على منهجية بحثية متعددة الأساليب دمجت بين المراجعة المتعمقة للأدبيات، وتحليل المحتوى، وتطبيق أسلوب دلفي على جولتين. وقد أسهمت مراجعة الأدبيات في بناء الأساس المفاهيمي للاستدامة الاجتماعية في المجتمعات المسوّرة، وفي تحديد مجموعة واسعة من المؤشرات الأولية. ثم خضعت هذه المؤشرات لتحليل محتوى للأطر والأدوات المختارة، تلاه تنقيح منهجي استنادًا إلى مدى ارتباطها بالمفهوم وملاءمتها للسياق السعودي. وبعد ذلك، جرى تطوير الإطار الأولي ومراجعته والتحقق منه من خلال جولتين من تقييم الخبراء المتخصصين في التخطيط العمراني والعمارة والتطوير.

وأسفرت الدراسة عن تطوير إطار تقييمي مُكيَّف ومُتحقَّق منه لقياس الاستدامة الاجتماعية في المجتمعات السكنية المسوّرة في السعودية. ويتكوّن الإطار النهائي من خمسة محاور رئيسة هي: التماسك الاجتماعي والتفاعل الاجتماعي، والأمان والسلامة، وقابلية العيش وجودة المكان، والحوكمة التشاركية والإنصاف والتمكين، والعلاقات الخارجية والاندماج. وتندرج تحت هذه المحاور 18 فئة فرعية و45 مؤشرًا تغطي بصورة شاملة الديناميكيات الاجتماعية داخل المجتمعات المسوّرة وعلاقتها بالمحيط الحضري الأوسع. وقد حظي الإطار بدعم قوي من خلال توافق الخبراء، كما أظهر مستوى مرتفعًا من الاتساق الداخلي، إذ بلغ معامل كرونباخ ألفا الكلي 0.86.

وتتمثل مساهمة هذه الرسالة في تحويل مفهوم الاستدامة الاجتماعية من طرحٍ نظري مجرد إلى أداة تقييم عملية، ومسنودة تجريبيًا، وحساسة للسياق المحلي في المملكة العربية السعودية. كما توفّر الدراسة للمخططين والمطورين وصنّاع القرار أداةً منهجية لتقييم المجتمعات السكنية المسوّرة القائمة والمستقبلية، وتحديد جوانب القوة والقصور فيها، وتوجيه التدخلات المستهدفة التي تعزز الرفاه الاجتماعي، والشمول، وجودة الحياة. وبهذا، تسهم الدراسة في دعم الجهود الأوسع الرامية إلى مواءمة التطوير السكني مع مستهدفات رؤية السعودية 2030 وبناء مجتمعات أكثر استدامةً على المستوى الاجتماعي.

# CHAPTER 1

# INTRODUCTION

This study developed and validated a contextualized assessment framework for evaluating social sustainability within gated communities in the Kingdom of Saudi Arabia (KSA). The need for such a framework arose from a clear gap in the literature: although 23 assessment approaches were reviewed, only a very limited number explicitly addressed social sustainability in gated communities, and no widely adopted, context-sensitive instrument was available for the Saudi context. In this thesis, the term framework refers to a structured set of social sustainability indicators organized into relevant categories and sub-categories. The finalized framework is tailored to the socio-cultural and urban context of KSA and comprises five main categories, 18 sub-categories, and 45 validated indicators, providing a systematic tool for assessing the social sustainability of gated communities in Saudi Arabia.

The concept of sustainability has been widely discussed in environmental and economic categories, but comparatively less attention has been paid to its social dimension (Abed *et al*., 2022). Social sustainability is now recognized as a key component of sustainable development, as reflected in global agendas like the Sustainable Development Goals (Ali *et al*., 2019). It focuses on meeting basic human needs, improving and maintaining both present and future well-being, and reducing social inequalities (Littig and Griessler, 2005). Additionally, social sustainability concerns how individuals, communities, and societies interact and function cohesively (Abed *et al*., 2022). It plays a significant role in creating liveable communities and ensuring high-quality living conditions for all (Khamis *et al*., 2023). In essence, a socially

sustainable community is one that fosters inclusion, equity, and a good quality of life, now and for future generations.

Gated communities enclosed residential areas with restricted access are becoming increasingly popular in many parts of the world, including Saudi Arabia, due to the sense of security and exclusivity they provide to residents. The idea of gated living is not new; historically, human settlements often featured defensive walls or controlled entry points to protect inhabitants and regulate access (Alqahtany, 2021). Modern gated communities typically have perimeter walls or fences, guarded gates, and security personnel or surveillance systems to maintain a safe, controlled environment (Roitman, 2010; Alqahtany, 2021). They often include private amenities and foster a distinct community identity, which can enhance personal safety as well as a feeling of belonging among residents (Roitman, 2010). One definition describes a gated community as a housing development that prioritizes physical security measures such as gates, fences, closed-circuit cameras, and entry checkpoints to create an exclusive residential enclave (Alqahtany, 2021).

Gated communities have become a common form of residential development in the Gulf Cooperation Council (GCC) countries. In fact, historical and cultural research shows that the concept in this region has roots going back decades, even if the terminology is modern (Alqahtany, 2021). The modern proliferation of gated compounds in the Gulf began in the mid-20th century: when Western oil companies started operations in the Arabian Peninsula in the 1930s, an influx of foreign professionals created demand for housing in the host countries. In Saudi Arabia, the government responded by requiring any foreign company with more than 50 expatriate employees to provide housing for its workers (Glasze and Alkhayyal, 2002). This led to the development of self-contained residential compounds that offered a lifestyle like what foreign workers were accustomed to in their home countries. For instance, gated

compounds in Saudi Arabia were designed so that within their walls, residents (often expatriates) could engage in daily activities with relative freedom and a sense of normalcy, while outside the gates they would observe the local customs and laws of the Kingdom (Alqahtany, 2021). Over time, such compounds have also become popular among some Saudis and other residents, not just expatriates, as a housing choice for the security, amenities, and prestige they offer.

In recent years, scholars and urban planners have turned their attention to the social sustainability of gated communities and their impact on the broader urban environment. Research suggests that social sustainability is an increasingly important aspect of gated community development (Abed et al., 2022). For example, a study in Amman, Jordan compared social sustainability indicators in a conventional (non-gated) neighbourhood versus those in gated communities, examining factors such as personal relationships, support networks, civic engagement, safety levels, and shared values and norms (Abed et al., 2022). The results indicated that the larger, "mega" gated communities tended to perform well in fostering strong personal relationships, robust social networks, and active civic engagement among their residents (Abed et al., 2022). These findings imply that, within their walls, gated communities can cultivate a sense of community and social support that might even surpass that of open neighbourhoods in certain respects. Social networks in such communities offer important links between individuals, which reinforces community participation and social cohesion. According to (Bramley, 2009), socially sustainable communities are those where people actively participate in society, feel a sense of belonging or stake in their community, and have equitable access to the community's benefits. In this regard, strong social ties and community engagement in gated communities could be seen as positive indicators of social sustainability. However, it is also critical to consider the flip side social exclusion. (Bramley, 2009) notes that social exclusion is a distinct concern, emphasizing the need to ensure everyone

has access to opportunities and services. While gated communities might strengthen bonds on the inside, they can inadvertently contribute to social exclusion on a city-wide scale if not integrated well, by segregating residents from the surrounding urban fabric or by highlighting disparities in access to resources.

People choose to live in gated communities for a variety of reasons. Studies have found that residents often seek out gated developments for enhanced security, a preferred lifestyle, and the prestige associated with these enclaves (Salem, 2022). In some cases, cultural factors also motivate the choice of living in a gated community such as the desire for a housing style that accommodates cultural or religious preferences within a controlled setting (Salem, 2022). These motivations underscore a complex relationship between the appeal of gated communities and their social consequences. On one hand, gated communities can provide high-quality living conditions and a strong sense of community for their inhabitants. On the other hand, urban scholars caution that the proliferation of walled-off communities should not come at the expense of social integration in the wider city. Gated developments, if poorly planned, could lead to social fragmentation or exacerbate segregation by creating enclaves of privilege or homogeneity. As (Mahgoub and Khalfani, 2012) observe, the challenge and responsibility is to ensure that gated communities contribute positively to the broader urban fabric rather than isolating themselves from it. This means addressing issues such as connectivity with surrounding neighbourhoods, inclusive access to services, and the overall sustainability of these developments in social terms.

Given the rising prevalence of gated communities in Saudi Arabia and the importance of nurturing their social sustainability, this research is both timely and significant. Hence, the present study adopted a multi-method approach to develop a contextualized assessment framework for social sustainability in Saudi Arabian gated communities. This approach

included an in-depth literature review of the literature to ground the framework in existing theory and global best practices, a content analysis of selected studies to identify potential social sustainability indicators, and a panel of experts (through a structured Delphi technique) to refine and validate the framework. The outcome of this study is a finalized assessment framework for measuring social sustainability within gated communities. This assessment framework is tailored to the context of KSA's gated communities. This framework **is** intended to help planners, developers, and policymakers evaluate and enhance the social sustainability of existing and future gated community projects, ensuring that these developments support not only secure and high-quality living environments but also the well-being and cohesion of society at large.

## 1.1 Research Problem

Social sustainability is a key aspect of architecture and planning. It supports the integration of social groups and promotes an inclusive society. By ensuring equitable access to necessities such as housing and employment, it helps prevent the marginalization of vulnerable groups. Ensuring social sustainability of neighbourhoods and communities improves the overall quality of life and fosters a vibrant society. This view of social sustainability emphasizes how crucial it is to establish conditions that allow socially and culturally diverse groups to live in harmony with one another. In the face of urbanization and globalization, social integration is essential for the overall growth of any community, and such environments foster it (Koning, 2001). A study conducted in Cairo shows the environmental benefits of sustainable building approaches, such as reduced resource depletion and lower carbon emissions, as well as increases in people's quality of life due to proximity to green spaces and reduced pollution (Alagamy, 2023).

In Saudi Arabia, policy and practice have made notable progress in addressing environmental and economic dimensions of sustainability, and sustainability principles are increasingly reflected in planning agendas and development initiatives. However, the social dimension remains comparatively underdeveloped in both assessment and application, particularly at the neighbourhood scale and especially within gated communities. Despite the growing prevalence of gated communities in the Kingdom, existing assessment tools remain insufficient for capturing their social sustainability because most available frameworks were developed for general urban or neighbourhood contexts and do not adequately reflect the socio-cultural, spatial, and governance characteristics of gated communities in Saudi Arabia.

This gap is further reinforced by the limited state of the literature. Although this study systematically reviewed 23 assessment approaches, including 19 academic social sustainability frameworks and 4 neighbourhood-scale assessment tools, only a very limited number of studies explicitly addressed social sustainability within gated communities, and no widely adopted, context-sensitive assessment instrument was identified for the Saudi context. As a result, planners, developers, policymakers, and other stakeholders lack a systematic and locally appropriate means to determine whether a gated community is socially sustainable, to compare developments, or to guide targeted improvements. This absence of a contextualized framework represents a significant knowledge and practice gap, particularly in light of Saudi Vision 2030 and its emphasis on improving urban quality of life and creating more vibrant and inclusive communities.

Hence, major research questions in this study included:

1 What frameworks and tools have been used internationally to assess social sustainability in cities, neighborhoods, and gated communities?

2 What contextualized and locally appropriate assessment framework can be developed for assessing social sustainability within gated communities in Saudi Arabia?

## 1.2. Objectives of the study

The study developed an assessment framework to assess social sustainability within gated communities in Saudi Arabia based on a well-established, contextualized Framework. Hence, the main objectives of this study were to:

1. Identify the range of potential frameworks and tools used in existing studies to assess social sustainability in cities, neighbourhoods, and gated communities, through an in-depth review of the literature.
2. Identify and develop an initial contextualized social sustainability assessment framework for gated communities in KSA, consisting of a set of indicators grouped into relevant categories and sub-categories.
3. Review, refine, and validate the proposed contextualized framework through a Delphi technique with a panel of experts, thereby finalizing the framework.

## 1.3. Significance of Study

The overarching goal of social sustainability is to deliver a better quality of life by designing projects and places that reflect human preferences and are sensitive to diverse needs. Accordingly, this study identified key areas, aspects, and dimensions of social sustainability and examined their relationship with gated communities, both generally and specifically within Saudi Arabia. Preliminary literature review indicates a lack of research focusing specifically on social sustainability in Saudi Arabia, as most existing studies emphasized environmental and economic dimensions of sustainability.

This lack of focus is a critical oversight, given that social factors are central to architecture and the built environment. By concentrating on these social dimensions, the present study helped in filling that gap and aligned with Saudi Vision 2030. Under this national strategy, the government prioritized developing high-quality neighbourhoods and enhancing the urban quality of life for citizens.

The significance of this study extended beyond immediate architectural and policy implications. It provided a valuable academic resource for future researchers interested in social sustainability, particularly within gated communities in the Saudi Arabian context. Furthermore, the study established a clear, context-specific framework comprising various indicators and their categories, and subcategories that can serve as a primary tool for assessing social sustainability in these communities. This framework served as a foundational reference for future research and practice. Ultimately, the work advances the discourse on sustainable community planning by emphasizing the inclusion of Saudi Arabia's distinctive cultural and social dynamics and ensuring that these planning efforts align with the objectives of Saudi Vision 2030.

## 1.4. Scope and Limitations of the Study

The study developed a contextualized framework that reflects the specific needs of Saudi Arabian context to assess the social sustainability in gated communities. Hence, the study set limitations that defined and affected the scope of the study were as follows:

1 The study's primary objective was to create a framework for assessing social sustainability in gated communities in Saudi Arabia. This narrows the focus of the study to the social pillar.

2 The finalized framework is tailored specifically to the context of the Kingdom of Saudi Arabia. Therefore, Although the framework is

specifically tailored to the Saudi context, it may also serve as a useful reference and adaptable foundation for other Gulf and Arab regions that share similar socio-cultural norms, residential patterns, and planning conditions

3 The study's contextualized framework is based on feedback from Saudi professionals and experts, which may introduce some subjectivity into the selection and refinement of the social sustainability criteria.

## 1.5. Thesis Structure

This thesis was organized into the following chapters as depicted in Figure 1.

**Chapter 1: Introduction,** which introduced the study, providing the background and context of social sustainability and gated communities. It outlines the research problems, objectives, and significance of the study, scope and limitations of the study.

**Chapter 2: In-Depth Literature Review** provided an extensive review of the relevant literature and studies. It covered the background of social sustainability, including various definitions and key indicators, along with their categories and sub-categories. The chapter also reviewed existing social sustainability frameworks and examined several neighbourhood-scale sustainability rating systems such as LEED-ND, LEED for Communities, BREEAM Communities, and Saudi Arabia's Mostadam. Additionally, it discussed the definition and attributes of gated communities and how these relate to social sustainability, particularly in the context of Saudi Arabia

**Chapter 3: Methodology** presented the methodological framework of the study. It described the data collection methods, which included an in-depth literature review, content analysis, and a Delphi technique conducted with a panel of experts.

**Chapter 4: Results and Discussion** presented the results of the study and discussed them. It reported the outcomes of analyzing the collected quantitative and qualitative data, highlighting key patterns and insights.

**Chapter 5: Conclusion** examined the implications of the results and offered recommendations for assessing the social sustainability of gated communities in the Saudi context, while also suggesting directions for future research.

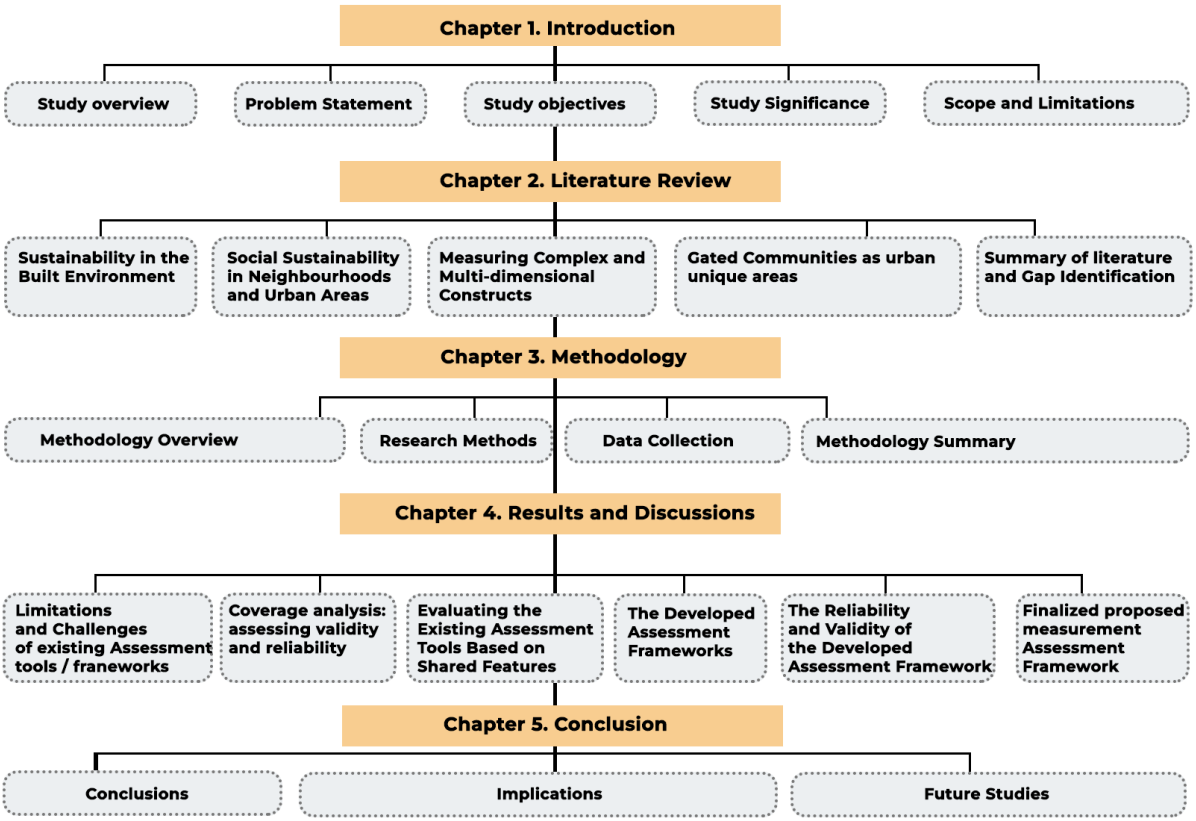


**Figure 1**: Thesis Structure.

# CHAPTER 2

# LITERATURE REVIEW

This chapter provided a comprehensive review of literature relevant to social sustainability in gated communities, establishing a theoretical foundation for the study and identifying gaps. It covered the conceptual foundations of sustainability (with emphasis on the social dimension), with specific focus of social sustainability in Neighbourhoods. It also examined the attributes and Dimensions of Social Sustainability in Urban Areas and the assessment frameworks and tools for evaluating social sustainability. The chapter also examined gated communities, including their definitions, types, and motivations, followed by the context of the Gulf Cooperation Council (GCC) and Saudi Arabia (KSA). It concluded with a synthesis of key insights and identification of research gaps.

## 2.1. Sustainability in the Built Environment

Sustainability in the built environment is commonly framed around three interrelated pillars: environmental, economic, and social sustainability. The concept gained prominence with the *Brundtland Report* (WCED, 1987), which defined sustainable development as "development that meets the needs of the present generations without compromising the ability of future generations to meet their own needs." This definition underlines the ethical imperative to balance present demands with long-term environmental protection and societal welfare.

The literature highlights that sustainability in the built environment, particularly at the micro level (e.g., the building scale), is primarily composed of three core dimensions: environmental, social, and economic sustainability (Elkington, 1997; Littig and Griessler,

2005). However, when sustainability is examined at the macro level, including neighbourhoods, urban areas, regions, and cities, scholars increasingly argue for the inclusion of a fourth dimension: institutional sustainability (Spangenberg, 2002; UN-Habitat, 2016). Figure 2 depicts the core dimensions of sustainability in the built environment: (a) micro-environments and (b) macro-environments.

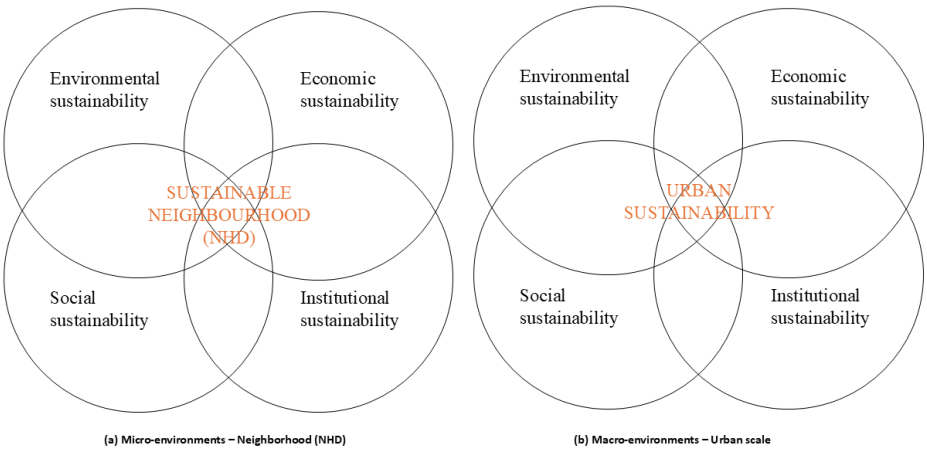


***Figure 2:*** *Core dimensions of sustainability in the built environment at micro and macro environments.*

This additional dimension addresses governance structures, policy frameworks, regulatory mechanisms, and decision-making processes that enable sustainable development to be effectively planned, implemented, and maintained over time.

This expanded framework emphasizes the interconnected relationship between economic growth, environmental protection, social well-being, and institutional capacity. In practical terms, sustainability involves maintaining and improving living standards for both current and future generations by enhancing economic, social, environmental, and institutional conditions simultaneously (Sharifi, 2016). Meeting human needs therefore requires more than an ecologically stable environment; it also necessitates effective governance systems, inclusive

planning processes, and institutional coordination that support equitable and resilient development outcomes.

While sustainability is fundamentally concerned with the relationship between human society and the natural environment, the social dimension of sustainability has historically received less attention in both research and practice. Early sustainable development debates, particularly during the late twentieth century, tended to prioritize environmental protection and economic growth, often marginalizing social considerations (Vallance et al., 2011). Although social sustainability was increasingly discussed during the 1990s, it was only around the year 2000 that it was explicitly acknowledged as the "third pillar" of sustainable development, and for a long time it remained the least developed and least operationalized of the three dimensions.

Researchers note that the intangible, qualitative, and context-dependent nature of social sustainability makes it particularly difficult to define, measure, and implement, which partly explains why it lagged the environmental and economic pillars (Shirazi and Keivani, 2019). Unlike environmental indicators such as carbon emissions or economic indicators such as income levels, social outcomes such as community cohesion, sense of belonging, and quality of life are often subjective, locally specific, and value laden. This lack of standardized metrics has placed social sustainability at a disadvantage within sustainability frameworks, leading to its frequent underrepresentation in policy and implementation strategies. Some scholars describe social sustainability as a "two-sided" concept encompassing both objective conditions (e.g., access to services and infrastructure) and subjective perceptions (e.g., well-being and satisfaction), further complicating its operationalization (Shirazi and Keivani, 2019).

Despite these challenges, there is growing recognition that social sustainability is essential for achieving truly sustainable development. (Littig and Griessler, 2005) argue that

sustainability fundamentally involves managing the relationship between human society and the natural ecosystem in a way that avoids destabilizing either system. From this perspective, social sustainability mediates the society–nature relationship by addressing issues such as equity, justice, participation, and social inclusion. Neglecting social well-being can therefore undermine environmental initiatives, just as environmental degradation can exacerbate social inequalities.

Contemporary urban development trends reinforce this interdependence. Rapid urbanization and expansion since the late nineteenth century have raised concerns regarding livability, community cohesion, and social equity. By the late 1990s, it became increasingly evident that community sustainability was at risk if social factors were overlooked (UN-Habitat, 2016). Recent studies confirm that ignoring social sustainability can lead to unsustainable outcomes even when projects are environmentally efficient or economically viable. Consequently, contemporary sustainability frameworks increasingly seek to integrate social, environmental, economic, and institutional considerations, particularly at the neighbourhood and urban scales, to ensure balanced and resilient development.

### 2.2. Social Sustainability in Neighbourhoods and Urban Areas

Social sustainability focuses on the human and community aspect of sustainable development. It plays a significant role in creating high-quality, well-planned neighbourhoods and liveable cities that promote residents' well-being and enrich their daily lives. A socially sustainable city is essentially a liveable city one that meets the needs of its current residents without hindering future generations' ability to meet their own needs. In such a city, the social environment (community networks, culture, safety, inclusiveness) works in harmony with the physical environment to support both collective well-being and individual growth. For example, (Khamis et al., 2023) emphasize that social sustainability in urban communities

enhances liveability by fostering communication, cultural development, and human interaction in public spaces. Similarly, (Azam and Hamdy, 2022) note that a city's liveability is inherently tied to its sustainability: a city that fulfils present social needs (while planning for future needs) creates a long-term healthy environment for all members of the community. In short, social and physical elements must synergize to support community well-being, which in turn helps individuals to thrive. This focus on human well-being is crucial because social sustainability directly influences community resilience, social justice, and overall quality of life (Vallance, et al., 2011).

Despite increasing interest, there is still no universally accepted definition of social sustainability. The complexity and multi-dimensional nature of social sustainability have led to a variety of interpretations and even some confusion in literature. Most researchers, however, converge on a set of core themes or parameters used to characterize and assess social sustainability. A broad review by (Ghahramanpouri et al, 2013) found that definitions of social sustainability commonly include aspects such as social equity, the satisfaction of basic human needs, well-being, quality of life, social interaction, community cohesion and inclusion, sense of community, and sense of place. In essence, social sustainability can be described as the quality of social interactions and relationships within a community (and between society and nature) as mediated by human needs and activities. It concerns how people live together, how they meet their needs, and how they experience quality of life in each environment. The concept is normative in that it embodies goals that societies strive for (e.g. equity, justice, inclusion), and analytically in that it examines the social structures and mechanisms needed to achieve those goals. For instance, (Littig and Griessler, 2005) frame social sustainability as both a normative ideal (articulating what a just and healthy society should look like) and an analytical tool (understanding how social structures, institutions, and work-life patterns contribute to or hinder that ideal).

Several scholars have offered definitions to capture these ideas. (Yiftachel and Hedgcock, 1993) defined a socially sustainable city as *"the continuing ability of a city to function as a long-term viable setting for human interaction, communication, and cultural development,"* characterized by a sense of belonging, solidarity, and vitality among its residents. In a similar vein, (Polèse and Stren, 2000) described social sustainability (particularly in urban environments) as *"development that is compatible with the harmonious evolution of civil society, fostering an environment conducive to the cohabitation of culturally and socially diverse groups, while at the same time encouraging social integration, with improvements in the quality of life for all segments of the population"*. This definition underlines that socially sustainable development should facilitate inclusive communities' places where diversity is embraced, social ties are strong, and everyone's quality of life is improving. (Bramley et al. 2006) similarly suggested that social sustainability is a development that fosters an environment conducive to social integration and improves quality of life. In other words, it aligns with the evolution of civil society by enabling diverse social groups to coexist, participate in community life, and share in the benefits of development.

Other researchers emphasize well-being and participation. For example, (Woodcraft et al., 2012) define social sustainability as *"a process for creating sustainable, successful places that promote well-being, by understanding what people need from the places they live and work."* This perspective combines the design of the physical realm with the design of the social world providing infrastructure for social and cultural life, social amenities, systems for citizen engagement, and space for people and communities to evolve.

Likewise, (Woodcraft, 2015) describes it as designing places that reflect people's needs and promote health and well-being, essentially proposing a framework to measure and improve a wide range of factors that influence quality of life and community strength. (Abed, 2016)

notes that social sustainability, as one pillar of sustainable development, addresses pressing social issues such as inequality, displacement, and poor quality of life.

By tackling these issues, social sustainability efforts aim to promote a healthier, more equitable and satisfying lifestyle for people (Ali et al., 2019). In addition, (M. Lami and Mecca, 2021) emphasize that social sustainability can be seen as a mix of traditional social principles (e.g. adequate housing, health, basic needs, equity and social justice) combined with newer concepts like happiness, quality of life, and sense of place all with the goal of improving human well-being and addressing not just physical needs but also psychological and cultural needs.

In short, social sustainability involves both providing essential services and opportunities (education, healthcare, housing, safety, participation in decision-making, etc.) and nurturing intangible qualities (community identity, trust, inclusion, sense of belonging). It does not exist in isolation, either; it is deeply interconnected with environmental and economic sustainability. For example, urban projects with an environmental focus (such as sustainable transport or green buildings) often have social aims as well like creating inclusive public spaces that encourage social interaction or ensuring all groups have access to amenities. Sustainable urban design thus seeks not only to reduce carbon footprints but also to build neighbourhoods that are inclusive, accessible, and vibrant, illustrating how the three pillars support each other (Woodcraft, 2012).

Notably, some authors distinguish between viewing social sustainability as an outcome versus as a process (Ali et al, 2019). As an outcome, it refers to the end-state goals we want communities to achieve, for example, high social cohesion, low crime, equal opportunities, and high quality of life. As a process, it refers to the principles and practices that lead to those outcomes such as inclusive planning, community engagement, equitable policy-making, and long-term stewardship of social conditions. Both perspectives are important: defining clearly

desired outcomes helps set targets and indicators, while focusing on process emphasizes the ongoing efforts and governance required to maintain and improve social conditions over time. A wide range of definitions for social sustainability are found in literature. A concise example of definitions for social sustainability is summarized in Table 1.

This study defined social sustainability as a continuous process of creating and maintaining communities that promote well-being, equity, and inclusion, while ensuring a harmonious balance between social, economic, and environmental dimensions. This concept prioritizes meeting present human needs such as health, education, housing, safety, and cultural expression without compromising the resources and opportunities available to future generations. It encompasses principles of fairness, livability, and resilience, striving for equitable access to resources and an improved quality of life for all members of society. A socially sustainable community is one where diverse group live in harmony, social ties are strong, and individuals can participate actively in community life and decision-making. It also means strengthening the connections between society and the natural environment (for instance, through public green spaces and environmental stewardship), so that human well-being goes hand in hand with environmental health. In summary, social sustainability in this context is about enabling all individuals to thrive, feel a sense of belonging, and contribute to their community now and in the future.

***Table 1:*** *Examples of Definitions for Social sustainability in literature*

| **Definitions** | **Author** | **Year** |
|---|---|---|
| Social sustainability is a quality of societies. It signifies the nature society relationship as shaped by human needs, social justice, and participation in societal development. It is both a normative and analytical concept. | Littig & Griessler | 2005 |

| | | |
|---|---|---|
| A socially sustainable city functions as a viable setting for human interaction, communication, and cultural development, underpinned by a sense of belonging, safety, and participation. | Yiftachel & Hedgcock | 1993 |
| Social sustainability refers to development compatible with the harmonious evolution of civil society, promoting cohabitation of diverse groups and improving quality of life for all. | Polèse & Stren | 2000 |
| Social sustainability is a process for creating thriving, inclusive places by understanding and addressing people's needs from the environments in which they live and work. | Woodcraft et al | 2012 |
| It comprises principles such as housing and health, basic needs, equity, social justice, happiness, quality of life, and sense of place, with the goal of improving human well-being. | Lami & Mecca | 2021 |
| A mix of objective and subjective factors, social sustainability includes liveability, participation, safety, identity, and social interaction at the neighbourhood scale. | Shirazi & Keivani | 2019 |
| Social sustainability supports a healthy and satisfying lifestyle while tackling issues such as displacement, poor quality of life, and inequality. | Abed, A | 2016 |
| It can be understood either as an outcome (equity, cohesion, quality of life) or a process (inclusion, empowerment, long-term planning). | Ali, Betawi & Alqudah | 2019 |
| Social sustainability emphasizes equity, access, well-being, and community resilience, linking social justice with environmental and economic health. | Desiderio & García-Herrero | 2021 |
| A socially sustainable neighbourhood supports the well-being of current and future generations by strengthening social capital, encouraging participation, and fostering a sense of place. | Ghahramanpouri, Lamit & Sedaghatnia | 2013 |

In the context of this study, the above conceptual understanding established that social sustainability is multi-dimensional, encompassing various aspects of community life. The next section discussed measuring complex and multi-dimensional constructs of social sustainability and their attributes.

## 2.3 Measuring Complex and Multi-dimensional Constructs

Several sustainability rating tools and indices have been developed using similar procedures of defining categories with corresponding indicators, as depicted in Figure 3. For example, the LEED green building rating system initially focused on six environmental sustainability categories (Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, Indoor Environmental Quality, and Innovation in Design), with a seventh category for Regional Priority added in a later version. Each category contains specific credits or measures that projects can attain. Likewise, BREEAM another widely used assessment method valuates performance across nine categories covering broad sustainability themes: Energy, Water, Materials, Waste, Transport, Land Use & Ecology, Pollution, Health & Wellbeing, and Management. Although these tools are largely environment-focused, they illustrate the principle of organizing an assessment into categories and indicators.

Dividing a complex construct like sustainability (including its social component) into structured categories and subcategories allows practitioners and decision-makers to better manage and track performance. In fact, sustainability indicators and rating frameworks are often described as decision-support tools that help interpret complex information and guide efficient decision-making. By structuring social sustainability into clear categories and measurable indicators, planners and project managers can more easily identify priority areas, allocate resources, and monitor outcomes in the planning, execution, and operation of projects. This structured approach ultimately facilitates more informed and transparent decisions in promoting social sustainability.

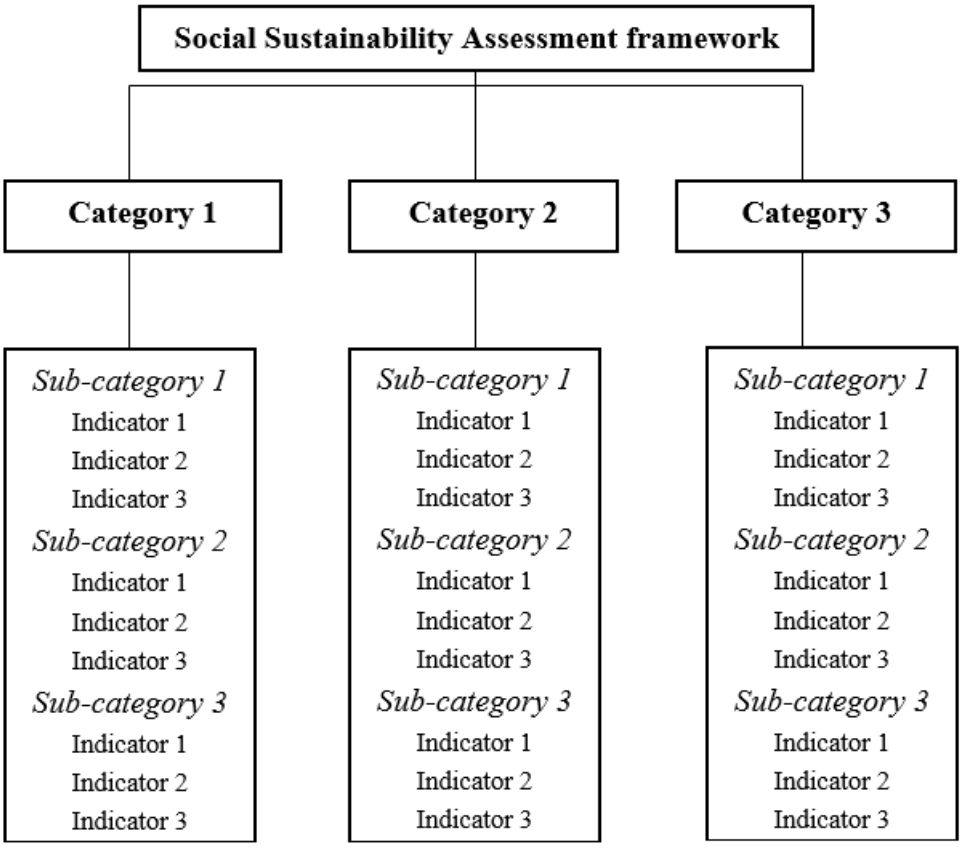


***Figure 3:*** *Typical hierarchical structure of tools to assess complex, multidimensional constructs.*

### 2.3.1 Attributes and Dimensions of Social Sustainability in Urban Areas

Developing a social sustainability framework requires translating broad concepts into measurable components. In general, categories represent broad social themes or dimensions (often aligned with key objectives or values), sub-categories break down those themes into more specific facets, and indicators are the concrete measures or metrics used to evaluate each sub-category. For example, place attachment could serve as a category of social sustainability, with sub-categories such as community identity and sense of belonging, and specific indicators like survey questions asking residents how well they "fit into" their neighbourhood or whether they would be sorry to leave it. This tiered structure is common in social sustainability assessment frameworks as it helps organize complex social concepts into observable and evaluable elements.

Literature on sustainable communities has identified several key aspects or dimensions of social sustainability. These dimensions can be thought of as core categories that capture the social health of a community. The following sub-sections discuss several major aspects social cohesion, safety and security, sense of belonging and community identity, accessibility and inclusion, equity and social justice, community participation and civic engagement, and community resilience including their definitions, significance, and how they manifest in (or are impacted by) gated community environments.

**1 Social Cohesion**

Social cohesion generally refers to the strength of relationships and the sense of solidarity among members of a community. In recent literature, it is defined as "the degree of interconnectedness and solidarity among societal groups," often manifested in individuals' attitudes of trust and behaviours of mutual support (Jiang et al., 2024). Researchers emphasize that cohesive communities are marked by frequent neighbourly interaction, shared values, mutual trust, and support networks (Jiang et al., 2024). These elements are commonly used as measurable dimensions of cohesion for example, familiarity with neighbours, levels of trust, availability of support, harmony, and shared norms have all been employed as indicators in neighbourhood studies (Jiang et al., 2024).

Within gated communities, the impact on social cohesion can be paradoxical. On one hand, the homogeneous socio-economic makeup and proximity of residents can foster strong bonding social capital residents often form tight personal relationships and networks with each other. A recent study in Amman found that large "mega" gated communities scored higher on indicators like personal relationships and social network support compared to non-gated neighbourhoods, likely due to the ample shared spaces and facilities that encourage interaction (Abed et al., 2022). This suggests that, when well-designed, gated developments can cultivate

an inward-facing cohesion among their residents. On the other hand, gating may reduce bridging social capital (links with the broader society). Research in Cairo noted that residents of gated suburbs often do not prioritize social interaction beyond necessity an online survey showed that many were largely satisfied with isolation, reporting neutral effects of neighbourly interaction on their quality of life (Khamis et al., 2023). The insulated nature of these enclaves means people may feel little incentive to engage beyond their immediate circle, which can lead to a fragmented social fabric at the city scale.

In sum, social cohesion in gated communities tends to be strong internally when supported by design and community programs, but the exclusivity of these developments can simultaneously weaken broader societal cohesion by limiting residents' exposure to, and trust in, "outsiders." Achieving a balance fostering close-knit internal bonds without completely walling off residents from the larger urban community is a key challenge identified in recent studies. Researchers often call for design interventions (e.g. inclusive common spaces, community events open to neighbours) to mitigate the isolating effects of gating while preserving internal cohesion (Abed et al., 2022; Khamis et al., 2023). Ultimately, social cohesion in the context of gated communities is now measured not only by looking at the strength of internal ties but also by considering how those communities relate to the wider urban society, reflecting a more nuanced understanding of this aspect of social sustainability.

**2 Safety and Security**

Safety and security are often the primary motivations for the establishment of gated communities. In the context of social sustainability, this aspect encompasses both objective safety (e.g. low crime rates, effective policing) and residents' subjective perceptions of security (feeling safe from crime or harm) in their living environment. Gated communities by design seek to enhance security through physical measures: private perimeter walls, controlled entry

points, surveillance systems, and security personnel are standard features aimed at crime prevention (Alqahtany, 2021). Indeed, some empirical evidence supports the effectiveness of such measures: for instance, studies have found that burglary rates can be lower in gated neighbourhoods compared to open ones, owing to the deterrence of opportunistic outsiders (Addington and Rennison, 2015; Crime and Justice Alliance., 2020). Residents often report a greater day-to-day peace of mind knowing that vehicle traffic and strangers are limited, which contributes to a heightened sense of security and was historically a selling point of these developments (Asfour, 2022).

However, recent literature reveals that the safety benefits of gating are not so clear-cut. Paradoxically, the *feeling* of safety can be ambivalent or even undermined within gated enclaves. (Salem, 2022) observes that the very presence of formidable gates and guards can reinforce a fear of the outside world an "us vs. them" mentality leading some residents to feel insecure or anxious when confronted with anyone or anything beyond their walls. In other words, gating may instil a perception that danger lurks outside, thus heightening mistrust and fear of "outsiders." Empirical research in Beijing supports the notion that gating alone does not guarantee greater personal safety. (Zhang et al., 2020) examined gated rural villages around Beijing and found that simply enclosing a community did not significantly improve residents *perceived* safety compared to more open communities. Interestingly, what did improve residents' sense of security in that study were the associated facilities and services (such as better street lighting, organized community patrols, or infrastructure upgrades) that often accompany gated community development. This indicates that it may be the quality of the environment and management rather than the gates per se that most affect how safe people feel.

Gated communities can also shift the mode of safety provision: moving from traditional informal surveillance (neighbours watching out for each other) to a more formal, managed

security regime (Zhang et al, 2020). While crime prevention remains a core objective, scholars caution that over-reliance on physical barriers can lead to a false sense of security. If internal social ties are weak, residents might be less prepared to respond to security issues. Moreover, by restricting public access, gated compounds can simply displace crime or social problems to other parts of the city rather than solving them. From a social sustainability perspective, the goal is to achieve real and equitable safety: this means not only protecting the privileged behind gates but also ensuring security strategies do not worsen city-wide injustice (e.g. by denying public space to certain groups in the name of security). Recent debates emphasize "safety for all" for example, (Lata, 2022) argues that when gated communities block off parks or streets, they effectively create differentiated citizenship where poorer outsiders lose access to vital public spaces. Such practices, often justified by security concerns, raise ethical questions about the right to the city. In response, urban sustainability frameworks call for designs that promote safety through inclusive measures (improved lighting, active public realms, community policing) without resorting exclusively to fortressing.

In summary, safety and security in gated communities must be evaluated in terms of both their internal benefits (lower crime, residents' peace of mind) and their external impacts on social equity and urban cohesion. Recent studies underscore that a truly socially sustainable approach to safety goes beyond gates it builds trust, encourages community engagement in safety efforts, and considers the well-being of the broader community (Salem, 2022; Zhang et al., 2020; Lata, 2022).

**3 Sense of Belonging and Community Identity**

A sense of belonging refers to residents' feeling of attachment, acceptance, and identification with their community, while community identity denotes the shared character and values that distinguish one community from others. These concepts are fundamental to

social sustainability because they influence residential satisfaction and well-being. Gated communities are often explicitly marketed as offering a strong sense of community and an exclusive identity. Indeed, the very genesis of many gated developments was tied to creating a distinct enclave wherein residents "belong" to a select group. As (Jacob and Chander, 2020) note in their study from India, gated communities were established with the purpose of fostering a sense of belonging and well-being among residents, underpinned by shared amenities and lifestyles aimed at bonding the community. The objectives for this aspect in gated settings typically include high neighbourhood pride, mutual recognition among residents (e.g. greeting neighbours by name), and the cultivation of a common identity or culture within the gates (often reinforced through community newsletters, events, or even architectural themes).

Recent empirical work offers insights into how well gated communities deliver on these belonging and identity goals. On one hand, the controlled environment and homogeneity can indeed heighten residents' identification with their neighbourhood. Residents often describe feeling "at home" and proud of their community's prestige or aesthetics, factors which can translate into a stronger local identity than in more transient, open neighbourhoods. Shared symbols like a community logo, a distinctive gatehouse, or even just the renowned name of the estate can further reinforce this collective identity. For example, a study in China by (Jin, 2023) examined urban residential compounds (Xiaoyu) and found that residents' sense of community was influenced by governance structures and shared experiences. Interestingly, that study revealed an active homeowners' association (HOA) was negatively associated with sense of community, while fair representation in decision-making was positively associated with community identity (Jin, 2023). This counter-intuitive finding suggests that a heavy-handed or contentious HOA can undermine feelings of belonging, whereas inclusive governance (residents feeling their voices are heard) strengthens communal identity. In other words, it is

not the mere existence of a gate or a committee that creates belonging, but the quality of social interactions and empowerment within the community.

On the other hand, simply living behind gates doesn't automatically yield a close-knit community. (Olivia et al., 2019) observed in mixed-income gated complexes that social interaction across different groups was minimal people tended to stick to those of similar background, limiting the development of a broader community identity. In such cases, multiple "micro-communities" can exist within one compound, and a unified identity fails to materialize beyond surface-level symbols. This underscores that sense of belonging is a *social* construct, not a physical one: gated developments can facilitate it by providing venues and security, but genuine belonging arises from inclusive social relations (Jin, 2023). Recognizing this, recent gated community projects have started placing more emphasis on community-building programs for instance, organizing festivals, sports leagues, or interest-based clubs for residents specifically to bolster interpersonal familiarity and a feeling of membership. These initiatives align with findings that place attachment (an emotional bond to the place and people) is a key component of community resilience and long-term sustainability. Place attachment and neighbourhood identity, meanwhile, have been shown to mediate wellbeing and participation (Lewicka, 2011).

In Saudi Arabia and the Gulf, many expatriate-oriented compounds historically cultivated a strong internal culture (sometimes even a pseudo- "brand" of lifestyle), which gave residents a profound sense of belonging within those walls. However, critics point out that this inward-focused identity can exacerbate social polarization: residents may identify so strongly with their gated community that they feel little connection to the city or nation beyond, potentially eroding broader civic identity. To measure sense of belonging, researchers commonly use surveys asking residents about their agreement with statements like "I feel like

I am part of a community" or "I would be sorry to leave this neighbourhood," as well as behavioural indicators (e.g. participation in community events, length of residency). High scores on such measures within gated communities indicate success in this aspect, but scholars like (Salem, 2022) caution that if a sense of belonging is predicated on excluding others, it may have problematic side effects. Therefore, the contemporary discourse suggests that an ideal socially sustainable gated community would foster a strong sense of belonging for its residents while remaining welcoming and connected to the wider city, rather than insular. Strategies such as intercultural programming, community service projects involving neighbouring areas, or simply maintaining porous boundaries for visitors can help align the community identity of gated enclaves with inclusive values (Salem, 2022; Jin, 2023). The literature post-2020 thus calls for rethinking how exclusivity is balanced with inclusivity in defining community identity behind the gates.

**4 Accessibility and Inclusion**

Accessibility and inclusion in a community context refer to the extent to which all people, regardless of their physical abilities, economic status, or social background, can access and benefit from the community's spaces and opportunities. This includes physical accessibility (e.g. barrier-free design for the disabled, open connectivity of roads and paths) as well as social inclusion (welcoming of diverse groups, availability of affordable housing or public facilities, and integration with the wider city). In sustainable neighbourhood frameworks, these are key to ensuring equity a truly sustainable community "works for everyone" by being inclusive and removing barriers to participation. Access and connectivity are tied to travel behaviour and opportunity structures (Cervero and Kockelman, 1997; Handy, 2002).

Gated communities, by their very nature, pose challenges to accessibility and inclusion. Physical accessibility is intentionally restricted: the perimeter walls and security checkpoints control entry, meaning that outsiders often including service providers, visitors, or the public cannot freely access the streets, parks, or amenities inside. From one perspective, this controlled access provides privacy and safety for residents. However, it also means that facilities which might otherwise serve a broader population (parks, playgrounds, shops) become exclusive goods. For example, if a city's only green space is within a private compound, non-residents are effectively barred from using it. Urban planners have criticized this as a privatization of space that undermines inclusive city principles (Amin and Graham, 1997; Madanipour., 2020). In recent years, some governments have started pushing back against such exclusivity. Notably, China issued guidelines to open older gated communities to improve urban connectivity and public space access, arguing that a network of dead-end enclaves hurts city-wide inclusion (Si et al., 2025).

The social inclusion aspect is equally problematic. Gated developments typically cater to middle- and upper-income groups, which can reinforce socio-economic segregation. Marginalized groups whether poorer households, migrant workers, or sometimes racial/ethnic minorities are often absent within the gates, either by design or due to high costs. Over time, this can create pockets of privilege separated from pockets of deprivation. Recent scholarly critiques highlight that this dynamic is at odds with social sustainability goals of inclusion and equity. (Lata, 2022). ethnographic study in Dhaka poignantly showed how a gated community's presence excluded the adjacent slum dwellers from what used to be public space, effectively denying them access to streets and parks that were vital for their livelihood activities. The local homeowners' association, in cooperation with authorities, actively worked to keep the slum residents out "in the name of security," thereby reproducing spatial inequality (Lata, 2022). This illustrates how gating can institutionalize exclusion: the very rules that create

an inclusive atmosphere for insiders (shared codes of conduct, controlled entry) may simultaneously exclude and marginalize outsiders.

To assess inclusion within gated settings, researchers look at factors like demographic diversity among residents, the presence of inclusive amenities (e.g. wheelchair access, community centres that cater to different age groups and genders), and how open or closed the community is to interaction with its surroundings. Some newer gated communities have tried to improve on this front by, for instance, including on-site affordable housing units or allowing limited public use of certain facilities (such as hosting a weekend farmer's market open to the public). These efforts remain rare, however. A more common approach is internal inclusion ensuring that all residents (women, the elderly, children, people with disabilities) feel included in community life. For example, a socially sustainable gated compound might provide accessible walking paths, playgrounds and senior centres, and organize events that bridge cultural gaps among residents. While this addresses internal inclusion, the external inclusion issues the relationship with wider society is harder to reconcile with the exclusive model.

As scholars note, gated enclaves challenge the ideal of the "open city" where encounters with diversity are part of daily life (Salem, 2022). Gating reduces those encounters, potentially breeding misunderstanding or prejudice between inside and outside groups. Recent literature (Hammad et al., 2025) suggests that planners and policymakers need to mitigate the isolating effects of gated communities by ensuring they do not become islands of privilege. This could involve requiring pedestrian passages through large, gated projects, integrating public services (like transit stops or schools) that serve both residents and non-residents, or mandating community outreach and engagement programs. In summary, from a social sustainability lens, accessibility and inclusion remain two of the toughest aspects for gated communities to fulfil. Measurements of success here go beyond the compound's internal features to ask: Does this

development contribute to an inclusive city, or does it wall off resources and opportunities? The post-2020 scholarship is increasingly calling for creative solutions to make gated communities more permeable and just, so that the benefits they offer (safety, amenities, quality of life) do not come at the expense of equity and inclusion in the broader urban context (Lata, 2022).

**5 Equity and Social Justice**

Accessibility Equity and social justice in community sustainability refer to fairness in distribution of resources, opportunities, and burdens among different groups, and the upholding of rights and dignity for all residents. An equitable, just community is one where no group is systematically disadvantaged and where development does not exacerbate societal inequalities. When examining gated communities through this lens, a critical question arises: do gated developments contribute to a more just urban environment, or do they deepen divides? The consensus in recent literature leans toward the latter many scholars argue that gated communities embody and reinforce social inequalities, even as they provide comfortable living for some.

By their very design, gated enclaves create a boundary between insiders (who typically are wealthier and enjoy high-quality services inside) and outsiders (who may be less affluent and are excluded from those private services and spaces). This spatial segregation often mirrors and amplifies socio-economic segregation. For example, in the Middle East context, (Hammad et al., 2025) note that gated communities represent a trend of luxury and exclusivity for affluent groups, with benefits (security, clean environment, amenities) limited to those inside the walls. The proliferation of such enclaves, they argue, leads to urban areas fragmented into zones of haves and have-nots, raising questions of social justice beyond the compound.

One major equity concern is the privatization of public goods. Facilities that in an open city might be public parks, community centres, even streets become private assets accessible only to residents. This means well-resourced gated neighbourhoods can enjoy lush green parks and recreational facilities, while nearby public neighbourhoods might suffer from lack of investment. The unequal access to amenities can fuel resentment and a sense of injustice. Gated communities also can influence public resource allocation; for instance, they might opt out of relying on municipal services (having private security, waste management, etc.), which in some cases diverts political attention and funding away from improving public services citywide. Social justice scholars highlight that this "club good" model undermines solidarity: wealthier residents essentially buy their own superior services and may feel less obligation to support citywide improvements (Roitman and Recio, 2020). Moreover, gated enclaves can sometimes leverage their influence to shape local policies in their Favor for example, lobbying for road closures or ordinances that protect their quiet environment with less regard for impacts on non-resident populations.

Recent studies have illuminated these dynamics. In Dhaka, as mentioned above, (Lata, 2022) found that a gated community's homeowners worked with local authorities to exclude slum dwellers from adjacent areas, an action that reproduced class-based exclusion under a veneer of "security". Such cases show how private governance in gated communities (like HOAs) can extend power beyond the gates in ways that raise equity concerns. On a broader scale, the rise of gated communities is sometimes seen as a failure of the public sector to provide security and services for all. When middle-class and elite groups retreat into enclaves, it can indicate that they've lost faith in public solutions and instead seek private ones (secure housing, private utilities, etc.). This withdrawal can weaken the public realm; urbanist commentators worry about a "secession of the successful," where those with means isolate themselves and become less invested in the common good (Atkinson and Ho, 2019).

Measuring equity and justice in the context of gated communities is complex. It often involves qualitative assessments of perceptions (do residents and outsiders feel the situation is fair?) and quantitative measures of segregation or service disparities (e.g. comparing access to green space, school quality, safety, between gated vs. non-gated areas). Some studies use indices of dissimilarity or isolation to quantify how separated gated community residents are from others in terms of daily experiences. High segregation indices or stark contrasts in infrastructure quality can signal equity issues. From a justice standpoint, considerations include whether gated communities contribute to "the right to the city" the idea that all urban inhabitants should have a voice in how the city's spaces are used. If large swathes of urban land turn semi-private, are we undermining democratic urban participation? Planners and researchers post-2020 have been grappling with these questions.

Solutions proposed to enhance social justice even with gated communities present include ensuring some public amenities are included or adjacent to gated projects, requiring developers to contribute to affordable housing or local improvements ("inclusionary zoning"), and fostering dialogues between gated community residents and surrounding communities to reduce mistrust. Equity, in essence, demands that gated communities be analysed not just in isolation by their internal liveability, but by their impacts on urban society at large. The literature increasingly calls for a re-framing: rather than simply condemning gated communities, cities should find ways to bridge the gap. For example, can the high-quality infrastructure of a gated compound be extended to benefit nearby neighbourhoods? Can residents of gated enclaves be encouraged to participate in district-wide civic initiatives? These questions tie into the next aspect of participation and engagement.

In conclusion, social justice in gated communities remains a contentious issue while these enclaves may offer short-term equity within (i.e. among their own residents everyone

enjoys good services), they often do so at the potential expense of equity between communities. Contemporary scholarly voices (Hammad et al., 2025; Lata., 2022) urge that addressing this requires policy interventions that ensure gated developments do not operate as autonomous bubbles but contribute to the wider goals of fairness and inclusivity in the urban fabric. This is a significant challenge for sustainable development in cities where gating is prevalent.

## 6 Community Participation and Civic Engagement

Community participation and civic engagement encompass the involvement of residents in the life of their community and in the broader civic affairs of society. This can range from informal neighbourly cooperation and volunteering to formal membership in committees or associations, attending community meetings, and engagement with local government or citywide causes. High levels of participation are seen as a hallmark of socially sustainable communities because they indicate empowered residents, social capital formation, and collective efficacy in addressing issues.

In gated communities, participation often takes a particular shape. Internally, residents may engage through Homeowners' Associations (HOAs) or equivalent bodies that manage the community. These associations give residents a venue to voice concerns, set community rules, or organize events, thus potentially fostering a form of localized civic life. Many gated communities also encourage resident-led clubs or activities (such as sports teams, gardening clubs, holiday celebrations), which can enhance engagement and strengthen bonds among neighbours. For instance, (Asfour, 2022) notes that some gated compounds actively promote a close-knit atmosphere by organizing social events and maintaining shared facilities, which can boost residents' satisfaction and sense of involvement.

Recent empirical findings on civic engagement in gated vs. non-gated settings are intriguing. (Abed et al., 2022) investigated social sustainability indicators in Amman and

measured civic engagement by looking at residents' participation in community improvement efforts and activities (e.g. volunteering, attending meetings). They found that the large, gated community in their study showed higher levels of civic engagement on average than the open neighbourhood, with the mega-gated development scoring best, the mini-gated next, and the conventional community the lowest (Abed et al., 2022). One interpretation is that the presence of formal structures (like community centres or HOAs) and the homogeneity of interests in gated communities can mobilize residents to take part in local initiatives for example, organizing a cleanup day, or collaborating to advocate for services. The controlled scale of a gated enclave might make people feel a greater sense of ownership and efficacy; thus, they are more willing to engage in its governance.

However, this engagement is often inward-focused. The same study and others note that while gated community residents may be active within their enclave, they tend to be less involved in wider civic and political activities beyond the gates (Abed et al., 2022). For instance, they might be less likely to participate in city council forums or neighbourhood coalitions that include other communities, focusing their energy instead on their private community matters. This raises the concept of civic isolation: if affluent groups are only participating in privatized governance (the HOA) and not in public democratic processes, the broader society could lose out on their input and support, and conversely, those residents might disengage from issues affecting the city beyond their walls. Measuring civic engagement in a gated context thus requires looking at multiple scales internal participation rates (attendance at meetings, voting in HOA elections, volunteer groups formed, etc.) and external civic behaviours (voter turnout in public elections, involvement in citywide charities or events, etc.). A socially sustainable community ideally scores well on both.

Yet, evidence from places like suburban Cairo (Khamis et al., 2023) suggests that many gated community dwellers exhibit apathy towards interaction and collective action outside their immediate sphere. In Khamis et al.'s survey, residents rarely considered social interaction important, reflecting a preference for privacy over community engagement. This could translate to lower participation in anything beyond what directly benefits their household or community. Another aspect is how inclusive the participation within gated communities is. Who gets to participate in decision-making? Studies have pointed out that power dynamics in HOAs can sometimes marginalize less influential residents (for example, renters vs. owners, or minority groups within the community). True social sustainability would require that all resident voices including women, youth, and possibly domestic workers if they reside on-site have avenues for input. Some new gated developments in 2020+ have experimented with more participatory planning (e.g. involving future residents in design decisions or setting up community liaison committees that interact with city officials). These efforts aim to counter the criticism that gated communities encourage NIMBYism and isolation by keeping residents civically engaged in positive ways.

The operationalization of civic engagement in research often uses surveys with items like "How often do you participate in community meetings or events?" or "Have you worked with others in your neighbourhood to do or fix something in the last year?" as well as counting membership in groups. (Abed et al., 2022) defined civic engagement in their study as involvement in community associations/activities and volunteering to shape the community's future, and they quantitatively showed significant differences between community types on this factor. The fact that community type explained over a quarter of the variance in engagement (with gated communities on top) suggests design and management matter for participation (Abed et al., 2022).

In practice, gated communities can enhance internal civic life by providing dedicated spaces (like clubhouses or meeting halls) and communication channels (bulletins, community apps) for residents to collaborate. However, to enhance overall social sustainability, experts argue that these communities should also serve as a bridge to external civic engagement rather than a wall. This might mean partnering with nearby neighbourhoods on common issues (e.g. coordinating on broader area security or environmental initiatives) or inviting surrounding residents to join in certain events, thus slowly building trust and cooperation across the divide. In summary, community participation in gated communities is a double-edged sword: internally it can be quite vibrant even exceeding that of comparable ungated areas due to structured management and a shared interest in maintaining the enclave. Yet, it risks being myopic, confining social capital within the gates. Recent scholarly work from 2020 onward emphasizes nurturing a culture of engagement that does not stop at the gate encouraging gated community residents to also see themselves as citizens of the larger city. This is seen as crucial for long-term sustainability, ensuring that gated enclaves contribute positively to civil society rather than draining energy into exclusive, self-contained governance (Khamis et al., 2023; Abed et al., 2022).

**7 Community Resilience**

Community resilience refers to the ability of a community to withstand, adapt to, and recover from adversities such as natural disasters, economic shocks, or public health crises. It involves social, institutional, and infrastructural capacities for example, neighbours helping each other during emergencies, effective leadership and communication in a crisis, and the availability of resources to bounce back. In the context of social sustainability, resilience has become an increasingly pertinent aspect, especially considering events like the COVID-19 pandemic. A resilient community is often characterized by strong social networks, trust,

collective efficacy (a shared belief in the community's ability to act together), and flexibility in the face of change.

Recent research has started to explore how gated communities fare in terms of resilience. One might hypothesize that the tight-knit nature of some gated communities and their controlled environment could either help or hinder resilience. On one hand, gated communities usually have clearer organizational structures (such as an HOA or management office) which can coordinate responses during emergencies (for instance, disseminating information or pooling resources). The presence of security and maintenance staff on-site provides an immediate workforce for urgent tasks. Additionally, residents of gated enclaves often share socio-economic status, which might make collective decision-making smoother in some respects (though it could also mean a lack of certain skills or perspectives). On the other hand, the insularity of gated communities might limit the external support networks they can draw upon, and a mentality of self-sufficiency might prevail over seeking help from outside or cooperating with broader municipal efforts.

(Yadav's, 2025) conducted a comparative study in India provides some of the first empirical data on this topic. (Yadav's, 2025) examined gated and non-gated neighbourhoods in the city of Gurugram during the COVID-19 pandemic to assess their community resilience. Using the Conjoint Community Resilience Assessment Measure (CCRAM), the study evaluated key dimensions of resilience: leadership, where effective community leaders or committees guide crisis response; preparedness, indicating how well the community had planned or can organize resources; place attachment, reflecting residents' emotional bond and commitment to helping the community; social trust, the trust among neighbours; and collective efficacy, the confidence that together they can overcome challenges (Yadav's, 2025). The findings highlighted that certain socio-demographic factors (like longer duration of residence,

higher education levels, and income) were positively associated with perceived community resilience across both gated and open communities (Yadav's, 2025). This suggests that a stable, well-resourced population tends to feel more capable of handling crises.

Importantly, those conditions often apply to gated community residents (who tend to be more educated and higher income on average). While Yadav's study indicated generally that community type alone did not automatically guarantee higher resilience, it opens the discussion on what unique strengths or weaknesses gated communities might have. For example, one could infer that a gated community with a strong residents' committee might excel in the leadership dimension coordinating lockdown protocols or delivering supplies internally during the pandemic perhaps more so than a loosely organized urban neighbourhood. Indeed, there were anecdotal reports during COVID-19 of gated complexes arranging their own quarantine facilities or community grocery deliveries, showcasing self-organizing capacity. Place attachment in gated communities can be high (people invested in their enclave's welfare), which theoretically bolsters willingness to cooperate in tough times.

However, an alternate view is that gated communities, if too isolated, may lack adaptive diversity. Resilience can benefit from diverse connections (bridging ties to other communities, varied skill sets among members, etc.). A homogeneous gated group might, for instance, have plenty of financial resources but few people with practical emergency skills, or might be overlooked in citywide relief efforts because they are presumed to be self-sufficient. Another study from the pandemic era (Yadav's, 2025) also points out that social trust is crucial and trust can be a double-edged sword behind gates. Internally, trust might be high among neighbours who know each other, which is good for mutual aid. Yet, if there is mistrust towards outsiders (e.g., hesitance to allow delivery personnel or health workers in), that could impede crisis response.

Operationalizing resilience in research often involves surveys where residents rate confidence in handling hypothetical emergencies or recall how their community coped with past shocks. It can also involve objective indicators like the presence of emergency plans or the speed of recovery after a disaster. In the context of gated communities, an operational question is: do gates and private management lead to faster recovery (because of autonomy and resources) or slower recovery (due to less outside support and smaller networks)? The literature is just beginning to document this. One pertinent observation is that resilient communities are learning communities, they adapt by learning from each event. If gated communities remain inward-looking, they might not share lessons or learn from the experiences of other neighbourhoods, which is a missed opportunity. Conversely, if a gated community has strong links with city agencies (for example, a good relationship with local police, hospitals, or municipal councils), it could leverage those in a crisis, acting as a resilience hub for the area.

Post-2020, scholars like (Sharifi, 2021) have integrated community resilience into the sustainability discourse, urging that aspects like social cohesion, inclusion, and equity (discussed above) are intertwined with resilience. In a gated community, this means that improving social ties, ensuring inclusiveness, and fairness will also enhance its resilience to shocks by building trust and cooperation. Thus, ironically, the very challenges gated communities face (like potential social isolation) if addressed, could turn into resilience strengths (connectedness and resource sharing). In conclusion, community resilience in gated communities is an evolving field of study. Early indications (Yadav, 2025) suggest that while gated communities have certain built-in advantages (organization, resources) that can aid resilience, they must guard against isolation and cultivate trust and collaboration both internally and externally to truly be resilient. As cities worldwide prepare for future crises be it climate-related or other understanding how gated enclaves can participate in collective resilience strategies is increasingly important. Ensuring these communities are not just physically walled

off but also integrated into the social resilience networks of the city will be a key objective for urban sustainability planners going forward.

In summary, the social sustainability of communities is a multidimensional construct that encompasses a range of aspects such as cohesion and security to inclusion, equity, participation, and resilience each of which can be operationalized through specific indicators as depicted in figure 4. The discussion above highlights how these dimensions manifest, particularly within gated residential settings. Building on this understanding, the next section reviews existing frameworks and tools that have been used to assess social sustainability, to see how they incorporate these dimensions and what they offer for evaluating social sustainability within gated communities.

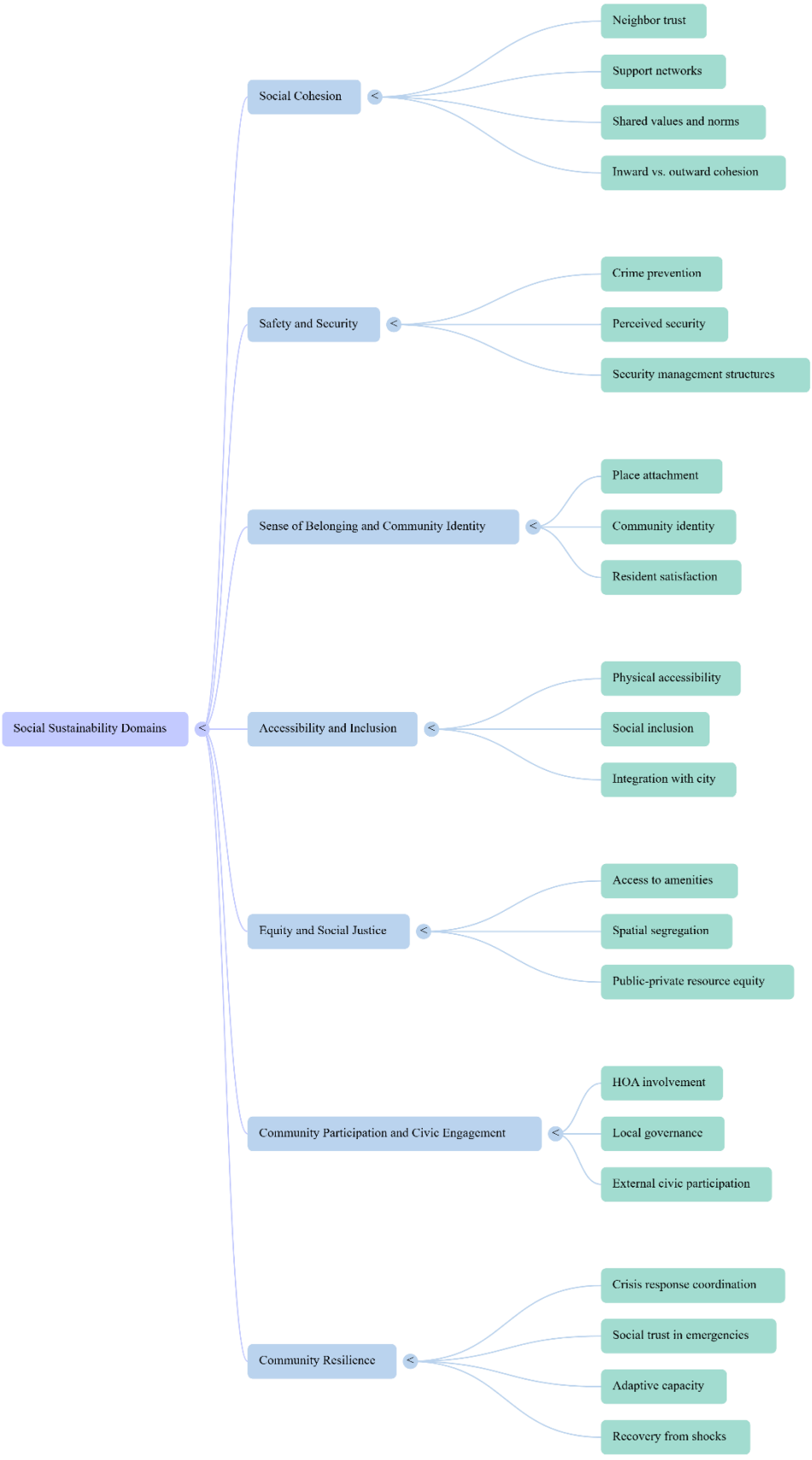


***Figure 4:*** *Outline of main dimensions of Social Sustainability*

### 2.3.2 Social Sustainability Assessment Tools and Frameworks

Developing a social sustainability assessment framework requires defining appropriate categories, subcategories, and indicators that capture the social dimension of sustainability. *Categories* represent broad social themes or objectives (often measured by multiple variables), while *indicators* are the specific measures or questions used to evaluate each category. For example, *sense of attachment* (or place attachment) can serve as a category of social sustainability, assessed through survey indicators that gauge residents' feelings of belonging e.g. asking how well individuals feel they "fit into" their community or how much they have in common with others. This hierarchical structure of categories, sub-categories and indicators is common in social sustainability frameworks; for instance, one study on freight transport social sustainability divided its framework into three levels (enablers, indicators, and sub-indicators) to systematically capture each aspect. (Colantonio, 2009) notes that in recent years there has been a shift from traditional "hard" social metrics (like employment or income levels) to more "soft," qualitative themes such as happiness, social cohesion, and sense of place, necessitating new indicators to measure these aspects. In other words, contemporary frameworks increasingly include fewer tangible factors (e.g. well-being, social inclusion, community identity) alongside classic measures of equity and basic needs. Adopting a comprehensive set of social sustainability indicators and grouping them into logical categories helps ensure that all relevant social aspects are evaluated.

### 2.3.3 Tools and Frameworks to Assess/Measure Social Sustainability

This study evaluated the capabilities of a sample of existing social sustainability assessment frameworks and neighbourhood (NHD) assessment instruments to measure the various dimensions of the social sustainability construct by examining their categories, subcategories, and indicators. To achieve this, the research followed a structured and

systematic review process, progressing through tool identification, selection, indicator extraction, and consolidation. For example, (Koke and Moehler, 2019) conducted two systematic reviews to develop a conceptual framework for earned green value management, which served as the theoretical foundation for a new project management tool designed to track sustainability goals. First, an extensive literature search was conducted to identify established frameworks relevant to gated and private residential developments, as well as general neighbourhood-scale sustainability tools. The search strategy, implemented in Scopus, used a two-tiered set of keywords as described in Table 2 and Figure 5, the core collection of Scopus was searched in the first step with primary search strings of ("gated community*" OR "private community*" OR "closed community*" OR "Urban development*" OR "Neighbourhood community*" OR "Urban planning"), paired with social dimension terms ("social sustainability" OR "social factors" OR "social interaction*" OR "social impact"). (Woodcraft, 2012), for example, highlights the need to understand how social sustainability is translated into decisions about the material and social fabric of cities, which reinforces why our search needed to capture frameworks bridging social factors with urban development contexts.

***Table 2:*** *Search Strings in Scopus*

| Search Engine | Type | Search Strings |
|---|---|---|
| **Scopus** | Primary | "Gated community*" OR "private community*" OR "closed community*" OR "Urban development*" OR "Neighbourhood community*" OR "Urban planning". |
| | Secondary | "Social sustainability" OR "social factors" OR "social interaction*" OR "social impact". |

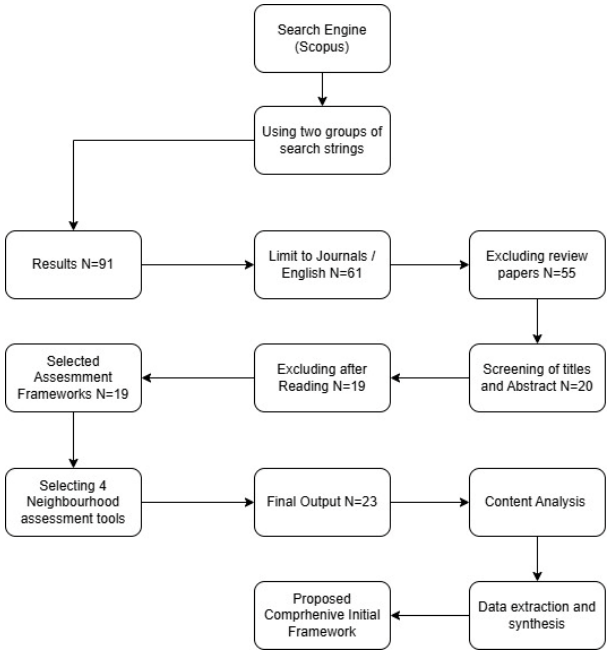


***Figure 5:*** *Process of Selecting Frameworks*

Through this comprehensive search and screening process, 23 assessment instruments were selected for detailed analysis. These comprised 4 formal neighbourhood sustainability rating tools (applied at the city or community scale) and 19 social sustainability frameworks proposed in the academic literature (often tailored to aspects of urban or community development). This selection captures a broad cross-section of approaches from well-known neighbourhood assessment standards to research-based frameworks enabling a thorough comparison. (Notably, similar reviews have been undertaken by other researchers; for instance, (Sharifi and Murayama, 2013) reviewed seven neighbourhood sustainability assessment tools from different regions illustrating the value of comparing multiple instruments.

After identification and selection, a structured content analysis was carried out to extract every social sustainability category, sub-category, and direct measurement (indicator) from each framework. These were then consolidated and benchmarked against a common reference to understand coverage and overlaps. Table 3 summarized the indicators and their parent categories/sub-categories across the selected frameworks and tools. In total, the 23

instruments contained a wide range of social sustainability indicators from as few as 8 indicators in some tools to as many as 77 in others, reflecting different emphases and scopes.

The analysis showed that certain social themes appear repeatedly: for instance, almost all frameworks include indicators related to community cohesion, safety, participation, and access to services, although the terminology and grouping can vary. Some frameworks emphasize physical aspects of community (e.g. urban design, density, public space) as part of social sustainability, while others focus more on social relations and well-being.

Overall, the review of existing frameworks/tools revealed that common social sustainability categories include things like social networks and interaction, community engagement, safety/security, sense of belonging/attachment, equity and inclusion, access to amenities, and quality of the living environment. Sub-categories often break these down further (for example, “participation” may include both civic participation and social volunteerism; “safety” may include objective crime rates and subjective fear of crime; “access to services” might distinguish between access to education, healthcare, green space, etc.). The specific indicators under each sub-category range from subjective survey questions (e.g. satisfaction with neighbourhood, trust in neighbours) to objective metrics (e.g. number of community facilities, crime statistics, demographic diversity indexes).

It is evident that while there is no single standardized framework for social sustainability, there is significant overlap in the dimensions considered important. In the context of this thesis, the insights from these existing frameworks were used to inform the development of a tailored assessment framework for gated communities in Saudi Arabia. By consolidating indicators from multiple sources (see Table 3 for a comprehensive list) and then refining them through expert input, the aim was to ensure that the proposed framework is both grounded in global best practices and sensitive to local context.

***Table 3**: Indicators and their parent categories and subcategories of the selected frameworks / tools.*

| Framework / Tool | No Social Indicators | Categories | Sub-categories |
|---|---|---|---|
| GCSSI | 29 | 1 Personal Relationship, 2 Social network support, 3 Civic engagement, 4 Safety and Security, 5 Shared Values and norms | NA |
| USSI | 27 | 1 Social Equity, 2 Sustainability of Community | 1)Accessibility to services, employment, green space; 2) Education and training; 3) Employment opportunities; 4) Decent housing; 5) Public/community facilities; 6) Social justice (inter/intra-generational); 7) Fair distribution of income; 8) Social inclusion / eradication of exclusion; 9) Mixed tenure (social mix); 10) Social order / absence of discrimination; 11) Health, quality of life, and well-being; 12) Local environmental quality and amenity; 13) Attractive public realm; 14) Sustainable and walkable urban design; 15) Social interaction / social networks; 16) Social capital; 17) Sense of community and belonging; 18) Community cohesion; 19) Cultural traditions; 20) Participation and local democracy; 21) Active community organizations; 22) Participation in collective groups and networks; 23) Residential stability (low turnover); 24) Community stability; 25) Pride / sense of place; 26) Urbanity (civic culture and urban identity); 27) Safety and security. |
| UFSAF | 40 | 1 Sustainability of Community,2 Social Equity, 3 Characteristics of Urban Form | 1) Social Networks; 2) Neighbourhood as a place to live in; 3) Safety; 4) Residential Stability; 5) Sense of Belonging; 6) Access to services; 7) Open Spaces and parks; 8) transportation Availability; 9) Job Accessibility; 10) Density; 11) Housing Type; 12) Building Height Land Use Accessibility. |
| GCSSF | 36 | 1 Neighbouring | 1) Social Networking Interaction; 2) Participation; 3) Safety and Security; 4) Quality of Neighbourhood; 5) Sense of Attachment. |
| TSSF | 77 | 1 Neighbourhood, 2 Neighbouring, 3 Neighbours | 1) Density; 2) Mixed Land Use; 3) Urban Pattern and connectivity; 4) Building Typology; 5) Qualities of Centre; 6) Access to facilities; 7) Social Networking Interaction; 8) Participation; 9) Safety and Security; 10) Quality of Neighbourhood; 11) Sense of Attachment; 12) Quality of Home; 13) Social Mix. |
| SLPF | 23 | 1 Social and Cultural Life, 2 Amenities and infrastructure, 3 Voice and Influence | 1)Sense of Belonging and Local identity; 2) Social Interaction and Networks; 3) Feeling of Safety; 4) Quality of Life; 5) Community Space; 6) Transport Links; 7) Distinctive character; 8) Local Integration; 9) Street Layout; 10) Adaptable Spaces; 11) Ability to influence; 12) Willingness to act. |
| CFSS | 14 | 1 Equity, 2 Safety, 3 Eco-presumption, 4 Sustainable Urban Forms | 1)Adaptation measures; 2) Urban Vulnerability Matrix (UVM); 3) Recognition; 4) Redistribution; 5) Participation (parity of participation); 6) Mitigation measures; 7) Compactness; 8) Mixed land uses; 9) Diversity; 10) Clean energy; 11) Passive solar design; 12) Greening; 13) Sustainable Transport; 14) Renewal and utilization. |
| NSA | 8 | 1 Social | 1)Access to public transport; 2) Access to education; 3) Access to local services; 4) Access to recreational space; 5) Access to community centres; 6) Access to emergency services; 7) Crime prevention and safety; 8) Traffic calming. |
| IMTM | 34 | 1 Density, 2 Accessibility, 3 Mobility, 4 Integration, 5 Choice & Diversity, 6 Mixed-use, 7 Environmental Quality, 8 Safety, 9 Security, 10 Social capital | 1) Population density; 2) Urban compactness; 3) Walkability; 4) Bike ability; 5) Services and facilities are accessible for everyone; 6) Availability of accessible and cost-effective public transport; 7) Restrained private car traffic; 8) Decentralized provision of services; 9) Transit oriented development (TOD); 10) External spatial connectivity; 11) Internal spatial connectivity; 12) Mutual support (services); 13) high-quality services, housing types; 14) Mixed land-use; 15) Quality open spaces; 16) Multi-purpose trips; 17) Physical comfort; 18) Psychological comfort; 19) Thermal comfort; 20) Visual comfort; 21) Avoiding urban sprawl; 22) Calmed road traffic; 23) Inclusive safety measures; 24) Safe and integrated network for pedestrians; 25) Safe and integrated network for cyclists; 26) Safe access to public transport nodes; 27) Avoiding dead-end streets; 28) Encouraged urban surveillance; 29) Dwelling units occupied mostly by owners; 30) Rent/property price (social stratum); 31) Social gathering nodes; 32) People encountering (through walking); 33) Distinctive urban design and high-quality services and facilities; 34) Community participation (increases trust). |
| NSRF | 70 | 1 Socio-economic wellbeing, 2 Interaction & engagement, 3 Physical & mental health, 4 Sense of belonging, 5 Sustainable behaviours | 1) Access to quality transit; 2) Housing affordability; 3) Transportation affordability; 4) Micro-climate/outdoor environment; 5) Access services and amenities; 6) Local parking; 7) Traffic load; 8) Employment opportunities; 9) Pedestrian network; 10) Alternative transport options; 11) Access to grocery stores; 12) Navigation and way finding; 13) Quality of building stock; 14) Levels of walkways/spaces; 15) Shading of passages; 16) Compact/mixed-use development; 17) Civic/community engagement; 18) Open/gathering spaces; 19) Public realm/interaction; 20) Design quality/aesthetics; 21) Safe and appealing streets; 22) Walkable streets; 23) Connected and open community; 24) Access to recreational facilities; 25) Street furniture; 26) Availability of seats; 27) Noise pollution; 28) Light pollution; 29) Air quality and hygiene; 30) Community well-being; 31) Design for the differently abled; 32) Civil and human rights; 33) Public health in design; 34) Neighbourhood schools; 35) Design for the elderly; 36) Training and skills; 37) Economic distributional equity/impact; 38) Culture and identity; 39) Historic conservation and heritage; 40) Communal diversity; 41) People stability/displacement; 42) Crime rate; 43) Walkable cultural institutions; 44) Neighbouring Green spaces; 45) Environmental justice; 46) Sustainable buildings; 47) Rainwater harvesting; 48) Conservation of habitat; 49) Waste reduction/treatment; 50) Land-use optimization; 51) Eco-friendly |

| | | | |
|---|---|---|---|
| | | | transportation; 52) Efficient lighting; 53) Water efficient landscaping; 54) Sustainability awareness; 55) Sustainability regulations. |
| PST | 14 | 1 Just accessibility, 2 social robustness | 1)Moving around public transport; 2) Traffic & parking / environmentally friendly travel; 3) Streets and spaces; 4) Natural space; 5) Play and recreation; 6) Facilities and services; 7) Work and local economy; 8) Housing and community social interaction; 9) Identity and belonging; 10) Feeling safe; 11) Care and maintenance; 12) Influence and sense of control. |
| ISSA | 34 | 1 Social Equity, 2 Environmental Awareness, 3 Social Cohesion, 4 Health & Safety, 4 Accessibility & Satisfaction, 5 Cultural value | 1)Equity of process; 2) Fair distribution; 3) Environmental awareness & sensibility; 4) Ecological literacy; 5) Social Programs; 6) Social interaction; 7) Safety measures; 8) Health & Indoor Environmental Quality (IEQ); 9) Health & IEQ; 10) Ease of accessibility; 11) Satisfaction level / local identity. |
| CISS | 40 | 1 Population, 2 Accessibility, 3 Education & Skills, 4 Health, 5 Housing, 6 Safety, 7 Belonging, 8 Participation, 9 Social capital & social cohesion | 1)Balance Distribution Poverty Prevention; 2) Provision of Employment Opportunities; 3) Ensuring Productivity in Employment; 4) Gender Equality; 5) Equality of Access to Social Infrastructure; 6) Equality of Access to Social Infrastructure; 7) Raising literacy and education levels; 8) Raising literacy and education levels; 9) Participation in Vocational Education; 10) Participation in Talent Development Educations; 11) Adequacy of Health Services; 12) Housing Capacity; 13) Physical Condition of Housing; 14) Security in Public spaces and Private; 15) Social and Spatial Belonging; 16) Urban Image Awareness; 17) Awareness of Conservation of Heritage Values; 18) Participation in Country and Local Government; 19) Participation in the Planning Process; 20) Transparency in Works; 21) Social Development; 22) Social Interaction; 23) Diversity and Cultural Integration. |
| ANPS | 13 | 1 Psychological criterion, 2 social criteria | 1)Affection & intimacy; 2) Belonging and loyalty; 3) Decent living; 4) Privacy; 5) Rest; 6) Safety; 7) Equality and justice; 8) Freedom & community participation; 9) Homogeneity & interdependence; 10) Respect cultural diversity; 11) Security; 12) Social interaction social protection. |
| SBToolIPT | 15 | 1 Comfort of outdoor areas, 2 Safety, 3 Amenities, 4 Mobility, 5 Local & cultural identity | 1)Air quality; 2) Outdoor thermal comfort; 3) Acoustic pollution; 4) Light pollution; 5) Safety in the streets; 6) Natural and technological risk; 7) Proximity to services; 8) Entertainment equipment; 9) Local production of food; 10) public transportation; 11) Pedestrian accessibility; 12) Cycle paths network; 13) Public spaces; 14) Heritage valuation and landscapes; 15) Integration and social inclusion. |
| SUCCEED-ND | 27 | 1 Community/culture, 2 Education/empowerment, 3 Health, 4 Equity, 5 Security | 1)Sustainable behaviours; 2) Involvement demographics; 3) Social inclusive communities; 4) Connected communities; 5) Local context; 6) Community cohesion; 7) Local social vitality (local Housing authority, supranational assistance organization (United Nations)); 8) Local lifestyle (Embracing it, integrating it – e.g., grounding place, local gardens, playgrounds, saga Spots); 9) Schools; 10) Facilities; 11) Health and safety courses; 12) Workshops; 13) Awareness schemes; 14) Clinics; 15) Medical facilities; 16) Access to services; 17) Gymnasium Halls; 18) Equity/fairness; 19) Enquiry-based design; 20) Public participation; 21) Services; 22) Amenity/well-being; 23) Neighbourhood safety; 24) Crime prevention; 25) Police stations; 26) Risk Management; 27) Securing the areas. |
| UHU2SAT | 21 | 1 Human comfort, 2 Urban mobility, 3 Social Cohesion, 4 Health & safety | 1)Micro-climate: Hygrothermal comfort on site; 2) Heat island effect: Hygrothermal comfort off site; 3) Lighting design; 4) Lighting pollution control; 5) Noise intrusion control; 6) Connected pedestrian networks; 7) Emissions-free vehicles network; 8) Public transport network; 9) Multi-modal transport networks; 10) Sustainable parking; 11) Inclusive design; 12) Commercial facilities nearby; 13) Green infrastructure & mental restoration; 14) Recreation facilities; 15) Crime prevention; 16) Hazardous materials; 17) Plants management control; 18) Tobacco-free space; 19) Maintenance protocol management; 20) Water disposal facilities; 21) Evacuation plan. |
| SIA | 15 | 1 Accessibilities, 2 Neighbourhood/community considerations | 1)Access to employment opportunities; 2) Access to public transportation; 3) Access to educational institutions; 4) Access to health care services; 5) Access to childcare; 6) Access to open green public space; 7) Distance to the city centre; 8) Access to leisure facilities; 9) Access to shops; 10) Car parking capacity; 11) Safety (crime rate); 12) Community cohesion; 13) Privacy; 14) Neighbourhood reputation; 15) Population density. |
| SNCC | 13 | 1 Amenities & infrastructure, 2 Social & cultural life, 3 Voice & influence | 1)Provision of community space; 2) Transport links (public transport accessibility); 3) Public space; 4) Street layout; 5) Active frontage's; 6) Positive Local Identity; 7) Relationships with neighbours; 8) Feeling of safety; 9) Community facilities; 10) Perceptions of ability to influence; 11) Willingness to act. |
| MOSTADAM-AC | 13 | 1 Community Wellbeing 2 Region & Culture | CC-01 Local Amenities CC-02 Provision of Parking CC-03 Walkable Public Realm CC-04 Bicycle Network CC-05 Public Transportation CW-01 Outdoor Comfort CW-02 Active Communities CW-03 Provision of Open Space CW-04 Access for All CW-05 Safe Communities RC-01 Community Gathering Space RC-02 Regional Heritage RC-03 Thriving Economy |
| BREEAM-COM | 17 | 1 Social & Economic Well-Being | SE 01 – Economic impact SE 02 – Demographic needs and priorities SE 03 – Flood risk assessment SE 04 – Noise pollution SE 05 – Housing provision SE 06 – Delivery of services, facilities and amenities SE 07 – Public realm SE 08 – Microclimate SE 09 – Utilities SE 10 – Adapting to climate change SE 11 – Green infrastructure SE 12 – Local parking SE 13 – Flood risk management SE 14 – Local vernacular SE 15 – Inclusive design SE 16 – Light pollution SE 17 – Training and skills |
| LEED-CI-COM | 10 | 1 Transportation and Lanuse 2 Quality of Life | 1)Provision of community space; 2) Transport links (public transport accessibility); 3) Public space; 4) Street layout; 5) Active frontage's; 6) Positive Local Identity; 7) Relationships with neighbours; 8) Feeling of safety; 9) Community facilities; 10) Perceptions of ability to influence; 11) Willingness to act. |

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|---|---|---|---|
| LEED-ND | 15 | 1 Neighbourhood Pattern & Design | 1Walkable Streets; 2) Compact Development; 3) Mixed-Use Neighbourhoods; 4) Housing Types & Affordability; 5) Reduced Parking Footprint; 6) Connected & Open Community; 7) Transit Facilities; 8) Transportation Demand Management; 9) Access to Civic & Public Space; 10) Access to Recreation Facilities; 11) Visit ability & Universal Design; 12) Community Outreach & Involvement; 13) Local Food Production; 14) Tree-Lined & Shaded Streetscapes; 15) Neighbourhood Schools. |

In Summary, numerous tools exist to assess community-level social sustainability, and they provide a valuable starting point. However, none are perfectly suited to the unique context of Saudi Arabian gated communities. This gap in context-specific assessment approaches motivates the next stages of this research, after first understanding the nature of gated communities themselves and the regional context in which they operate.

### 2.4 Gated Communities as urban unique areas

The focus of this study was social sustainability within gated therefore, this section explained what gated communities are and described their key attributes, types, and the motivations behind their development and appeal. Understanding the phenomenon of gated communities is crucial, as it sets the stage for examining how social sustainability is affected in these environments.

#### 2.4.1 The Gated Communities Phenomenon

The term 'gated communities' refers to residential enclaves characterized by restricted access, privatized spaces, and controlled entrances. According to (Grant and Mittelsteadt, 2004), a gated community can be defined as *"residential areas with restricted access in which normally public spaces are privatized. They are security developments with designated perimeters usually walls or fences and controlled entrances intended to prevent penetration by non-residents. They include new developments and older areas retrofitted with gates and fences, and they are found from the inner cities to the exurbs and from the richest neighbourhoods to the poorest."* This definition highlights key physical features (walls, fences, gates) and the privatization of what would typically be public space. Proponents argue that gating can deliver safety, order, and high-quality shared facilities; critics contend that it may

fragment urban fabrics, externalize costs, and entrench social divisions (Atkinson and Blandy, 2005; Blakely and Snyder, 1997; Bramley and Power, 2009; Caldeira, 2000; Kohn, 2004; Low, 2003; McKenzie, 1994).

There is no universal consensus on the definition of gated communities, and various terms are often used interchangeably for this phenomenon. These include *"gated enclaves," "enclosed neighbourhoods," "residential compounds,"* or *"housing complexes,"* among others (Mahgoub and Khalfani, 2012). (Bowers and Manzi, 2006) even use the term *"fortified enclave"* to describe a broader range of secured spaces extending the concept to places like university campuses, shopping malls, or office parks that exhibit similar controlled-access characteristics. Another important aspect often noted is the social homogeneity within gated communities. (Roitman, 2010), emphasized that gated enclaves tend to foster social homogeneity among residents. This homogeneity is maintained through mechanisms like high land/housing prices and homeowner fees, which effectively filter the resident profile by income (and often by ethnicity or lifestyle), resulting in internally uniform social groupings within the gates (Roitman, 2010).

Despite their wall's, gated communities are not completely isolated from the surrounding city. (Amin and Graham, 1997) argue that *"no physically bounded community can ever completely withdraw from the city which surrounds it. No place, even a high-security prison, is ever relationally isolated completely from its surroundings. The relational ties and connections that gated communities have with the rest of the city... merely change services."* This means that gated enclaves still depend on broader urban networks (such as city infrastructure, markets, schools, and hospitals) and cannot function as entirely self-sufficient islands. Nonetheless, social exclusivity and segmentation remain defining features of gated communities (Roitman, 2010). On the one hand, gated developments clearly demarcate social

boundaries, symbolically and physically separating different social classes and potentially contributing to urban fragmentation (Balcaite and Krupickaite, 2018). On the other hand, these enclaves can generate functional interactions with the outside community: for instance, they often provide employment opportunities (e.g. domestic work, maintenance, security jobs) for lower-income residents from surrounding areas, fostering a degree of economic interdependency (Balcaite and Krupickaite, 2018).

Multiple studies have noted that security and fear of crime are major driving forces behind the proliferation of gated communities. Beyond physical barriers, gating is a powerful socio-symbolic practice that produces "splintering urbanism" (Graham and Marvin, 2001) and fosters a "culture of fear" (Ellin, 1997), where security becomes a commodity. GCs have also been situated within broader “fortress” and security urbanism, marked by privatized, surveyed, and access-controlled spaces (Davis, 1990; Graham, 2010). Comparative studies document how the model travels and mutates across regions: South Africa (Landman, 2004; Jürgens and Landman, 2006), Latin America (Coy and Pöhler, 2002; Thuillier, 2005; Svampa, 2001), the Middle East/North Africa (Glasze, Webster, and Frantz, 2006; Elsheshtawy, 2008), Europe/North America (Le Goix, 2005; Atkinson and Flint, 2004), and East/Southeast Asia (Pow, 2009; Wu, 2005; Lees, 2018) linking GCs to state policies, market-making, and middle-class aspirations. Private residential governance research likewise frames homeowners’ associations (HOAs) as quasi-local governments that regulate space, behaviour, and service provision (Nelson, 2005; McKenzie, 2011). (Atkinson and Blandy, 2005) observe that the rise of gated developments is, in part, a response to residents’ fear of crime and desire for safety. In their definition, gated communities are housing projects with restricted public access and legal agreements (covenants) that require inhabitants to follow a common code of conduct and share responsibility for managing common areas (Atkinson and Blandy, 2005).

This implies that life inside the enclave is governed by agreed rules and a form of private governance by the homeowners. Similarly, (Bowers and Manzi, 2006) describe Gated Residential Developments as master-planned neighbourhoods separated from their surroundings by perimeter fences or walls, with entrances controlled by security personnel, gates, or electronic systems. Residents and developers often promote these communities by offering a sense of safety, privacy, and order that might be lacking in open neighbourhoods. In fact, some proponents argue that gated communities represent a search for like-minded communities: residents intentionally seek out neighbours who share similar values, lifestyles, and expectations (Atkinson and Blandy, 2005). Other scholars emphasize the goal of creating safe, high-quality urban environments; for example, in Egypt the development of gated compounds was an effort to attract residents to better living conditions by providing extensive services, leisure amenities, and a higher quality of life (Alagamy, 2023). Likewise, (Shamsudin *et al.* 2017) notes that the gated community concept directly responds to safety and security concerns to enhance the well-being of families in urban areas. Table 4 summarized the definitions of gated community as proposed by multiple authors.

***Table 4:*** *Sample of gated communities' definition in literature*

| **Definitions** | **Author** | **Year** |
|---|---|---|
| Residential areas with restricted access in which formerly public spaces are privatized; enclosed by walls/fences with controlled entrances to exclude non-residents. | Grant & Mittelsteadt | 2004 |
| Secured or "fortified" enclaves characterized by controlled entry; the term can also encompass campuses, malls, and office parks with similar access control. | Bowers & Manzi | 2006 |

| | | |
|---|---|---|
| Gated communities foster social homogeneity through high entry costs and fees; amenities and rules filter residents by income/lifestyle. | Caldeira (as discussed by Roitman) | 2000/2010 |
| No enclave is fully isolated from its urban surroundings; relational ties to the broader city persist despite physical barriers. | Amin & Graham | 1997 |
| Housing projects with restricted public access governed by covenants/codes of conduct and shared management responsibilities. | Atkinson & Blandy | 2005 |
| Master-planned neighbourhoods bounded by walls/fences; entry controlled by security staff, gates, or electronic systems. | Bowers & Manzi | 2006 |
| Gated communities are promoted as safe, high-quality residential environments offering privacy, order, and service-rich amenities. | Alagamy | 2023 |
| A residential concept responding directly to safety/security concerns to enhance family well-being. | Shamsudin, Shamsudin, & Zainal | 2017 |
| Physical boundaries (walls, gates) deter casual intrusion and may reduce certain crimes; boundaries also shape identity, privacy, and access. | Grant & Mittelsteadt; Wei | 2004; 2016 |

### 2.4.2 Typologies and Motivations

Over time, various typologies of gated communities have been identified, reflecting different resident motivations and lifestyle orientations. In the United States context, researchers commonly distinguish three broad types of gated communities (Grant and Mittelsteadt, 2004; Le Goix, 2006; Mahgoub and Khalfani, 2012):

1. Lifestyle communities: enclaves that offer resort-like amenities and communal facilities (such as golf courses, clubs, or sports centers) to residents. These communities attract individuals who prioritize shared activities, leisure, and a particular lifestyle when choosing a home. Residents are drawn by the promise of convenience and

recreational opportunities on-site, and they tend to form common interests or age groups (Grant and Mittelsteadt, 2004). For example, retirement villages or golf estates with gates fall in this category.

2. Prestige communities: high-status residential areas where the gating is aimed at providing exclusivity, status, and privacy. These elite enclaves often feature luxury housing and symbolize prestige or distinction. Residents of prestige communities value the privacy and symbolism of the gate, seeing it as a marker of status that sets them apart. The emphasis is on image, exclusivity, and maintaining property values, rather than on shared activities (Le Goix, 2006). These areas appeal to those seeking a secure environment that also confers social prestige.
3. Security-zone communities: neighbourhoods where gating is primarily driven by concerns over safety and protection from external threats. These are often found in or near urban areas perceived as unsafe or in cities facing high crime rates and social challenges. Residents choose these communities foremost to feel secure, installing features like high walls, CCTV surveillance, and guarded entrances. The gated arrangement here reflects residents' fears and is a direct reaction to crime or disorder in the surrounding city (Grant and Mittelsteadt, 2004).

This typology underscores that different gated developments emerge from different priorities whether leisure, status, or safety. In some contexts, scholars have noted that gated communities initially catered only to the very wealthy, but later spread to middle-class populations (Roitman, 2010). These newer middle-class gated enclaves may be less opulent, offering more modest amenities, but they still adopt the gated format to provide a degree of security and exclusivity for their residents (Roitman, 2010). (Shenjing, 2013) offers another perspective by categorizing gated communities into two overarching groups: those that actively

drive segregation (creating new social divides by excluding others) versus those that are more a reflection of pre-existing divides (i.e. they manifest existing segregations in society in physical form). This view highlights the complex two-way relationship between gated enclaves and urban segregation gated communities can both result from, and contribute to, wider patterns of social separation.

Proponents of gated communities often claim that these enclaves foster a sense of community or belonging among like-minded residents. (Jacob and Chander, 2020) note that the very aim of many gated housing projects is to cultivate a feeling of belonging and neighbourliness, which they attempt to gauge through measures of residential satisfaction (i.e. whether residents feel their housing and neighbourhood needs are met). Shared facilities such as clubhouses, parks, or sports courts are intended to encourage interaction among residents, potentially strengthening community bonds (Roitman, 2010). However, the reality of social relations in gated settings is debated. Some studies suggest that simply living behind the same walls does not guarantee a strong community spirit. Physical separation from the broader city may even undermine wider social ties. (Low, 2003) observed that the creation of walled enclaves can breed a sense of "us versus them," where outsiders are viewed as alien or potentially threatening a mentality that can erode the openness and trust that underlie true community feeling. Physical barriers like walls and guard gates become symbols of wealth and security, rather than facilitators of social cohesion. In fact, the proximity of residents in a homogeneous gated enclave can sometimes lead to unmediated proximity a superficial closeness that does not necessarily translate into deep social bonds. For these reasons, some commentators argue that the term "gated community" is a misnomer and carries misleading sociological connotations. They suggest using the term "gated residential development" instead, to describe the form without implying the presence of community spirit (since the sense of community inside such enclaves is not a given).

Critics further point out several social downsides associated with gated communities. By privatizing streets and open spaces, gated developments may exacerbate social frictions, for example, disputes over street closures or public access that arise when what used to be public realm is fenced off (Low, 2003). The exclusivity of these areas creates a clear sense of "otherness": those living outside may perceive gated residents as elitist or distant, while residents inside may develop negative stereotypes about the outside world (Low, 2003). Gating has also been implicated in the fragmentation of urban geography, as cities become patchworks of isolated enclaves. (Mahgoub and Khalfani, 2012) note that by their very nature walled, secured, and inward-oriented gated communities contribute to the physical and social fragmentation of cities. (Roitman, 2010) similarly argues that the design of gated enclaves *intentionally* creates social segregation, offering environments of homogeneity that attract people seeking insulation from the diverse interactions of the broader city. Importantly, the security promise of gated living can be double-edged: while residents move in seeking safety, studies have found that fear can persist or even be heightened. Moreover (Low, 2003), conducted a study that found that people often choose to live in gated projects to feel safe, yet they may continue to experience a sense of fear or anxiety about the outside world, suggesting that high walls do not necessarily address deeper social insecurities.

Nevertheless, there is evidence that gating can reduce certain types of crime. (Wei, 2016) notes that the most prominent physical characteristic of a gated community is its secured perimeter of walls, fences, and controlled entry, which does help in deterring casual intrusions and may contribute to lower crime rates compared to open Neighbourhoods. In line with this, (Grant and Mittelsteadt, 2004) observed that communities with clearly defined boundaries and limited, less-permeable street networks tend to experience fewer opportunistic crimes than those with open access. The boundaries around these developments serve multiple functions: they provide visual screening and privacy for residents, clearly demarcate property lines, and

limit outsiders' access. Some boundaries are relatively low or permeable, while others are tall, opaque, and forbidding. In some cases, walls and fences can help shape a community's identity and residents' sense of personal security; in other cases, they can provoke fear or resentment in onlookers and neighbours.

People choose to live in gated communities for a variety of reasons. Studies have found that residents often seek out gated developments for enhanced security, a preferred lifestyle, and the prestige associated with these enclaves (Salem, 2022). In some cases, cultural factors also motivate the choice of a gated community such as the desire for a housing style that accommodates cultural or religious preferences within a controlled setting (Salem, 2022).

These motivations underscore a complex relationship between the appeal of gated communities and their social consequences. On one hand, gated communities can provide high-quality living conditions and a strong sense of community for their inhabitants. On the other hand, urban scholars caution that the proliferation of walled-off communities should not come at the expense of social integration in the wider city. Gated developments, if poorly planned, could lead to social fragmentation or exacerbate segregation by creating enclaves of privilege or homogeneity. As (Mahgoub and Khalfani, 2012) observe, the challenge and responsibility are to ensure that gated communities contribute positively to the broader urban fabric rather than isolating themselves from it. This means addressing issues such as connectivity with surrounding neighbourhoods, inclusive access to services, and the overall social sustainability of these developments.

### 2.4.3 Gated Communities in the KSA and GCC context

Gated communities are now a global phenomenon, present in cities and suburbs worldwide, and the Gulf region is no exception. In many Arab countries especially the Gulf Cooperation Council (GCC) states gated residential compounds have become common, often

seen as a marker of prestige and offering a high degree of privacy (Alqahtany, 2021). The rapid urbanization and economic growth of the Gulf states since the mid-20th century provided fertile ground for the emergence of these enclaves. In fact, the development of gated communities in Saudi Arabia can be traced back to the discovery of oil in the late 1930s (Asfour, 2022). As the oil industry expanded and Western oil companies began operations in the Kingdom, large numbers of foreign (particularly Western) experts moved to Saudi Arabia for work. This influx especially pronounced in the oil-rich Eastern Province (home to Aramco's headquarters in Dhahran/Dammam) created a high demand for residential compounds that could accommodate expatriates (Alqahtany, 2021).

Over the decades, the Arabian Gulf region has become one of the most urbanized in the world, attracting international workers across all sectors (Salem, 2022). By the 1990s, economic liberalization and market-driven development in these countries accelerated social stratification, and master-planned gated compounds began to proliferate as a preferred housing option for middle and upper classes (Mahgoub and Khalfani, 2012). Historical and cultural analyses note that the idea of walled residential quarters is not entirely new to the region traditional Middle Eastern cities often had quarters or family compounds that were insular in nature (Mahgoub and Khalfani, 2012). However, the contemporary form of gated communities in the GCC has some unique drivers. One subtype in the Gulf (especially Saudi Arabia) is the expatriate compound, which is designed to provide foreign workers and their families a lifestyle like what they are accustomed to in their home countries, within the confines of the compound. (Mahgoub and Khalfani, 2012) describe how these expatriate enclaves create a strict boundary separating insiders from the host society: inside the gates, residents can live in a more liberal or international manner (for example, dress codes or social norms are relaxed to match Western expectations), whereas outside the gates, local laws and cultural norms must be observed. Many expatriates find it difficult to adjust to the conservative public environment,

so they prefer to reside in compounds where they have the freedom to live as they would back home. In essence, the compound wall in these cases demarcates not just a physical space but a cultural space. According to a recent study, as much as one-third of Saudi Arabia's total population now lives in some form of gated community (Asfour, 2022), underscoring how prevalent this residential pattern has become.

Within Saudi Arabia, not all gated communities are the same. (Glasze and Alkhayyal, 2002) identify a spectrum of compounds catering to different groups of foreign workers, as well as to local families. Specifically, compounds for expatriates in Saudi Arabia can be classified into three broad categories:

1. Labor compounds for low-income workers: These are basic housing facilities (often on the outskirts of cities or near industrial sites) for unskilled or semi-skilled laborers. They typically consist of simple dormitory-style or prefabricated units with very limited amenities, primarily intended to provide affordable shelter for single migrant workers. Security is present but minimal, and the lifestyle is very basic (Glasze and Alkhayyal, 2002).
2. Mid-range compounds for technical staff: Aimed at single or unmarried semi-professionals and technicians, these compounds offer modest apartment-style accommodation. They usually have some basic communal facilities, but fewer amenities or services compared to high-end compounds. The environment is more utilitarian, serving as convenient and safe housing for employees such as technicians, nurses, or schoolteachers from abroad (Glasze and Alkhayyal, 2002).
3. High-end compounds for professionals and families: These are extensive, well-appointed gated communities designed for expatriate professionals (often Westerners) and their families. Such compounds feature strict security measures and offer a wide

array of amenities for example, swimming pools, gyms, restaurants, supermarkets, schools, and recreation clubs on the premises. They are typically lushly landscaped and maintained, providing a self-contained "Western style" suburbia within Saudi cities. Only residents and approved guests may enter, ensuring privacy and cultural separation from the surrounding city (Glasze and Alkhayyal, 2002).

In addition to expatriate-focused enclaves, Saudi cities also have gated developments that cater to the local population. Based on case studies in Riyadh, (Glasze and Alkhayyal, 2002) describe two notable types of gated housing arrangements among Saudis. Extended family compounds are one such type, essentially a cluster of several villas or houses occupied by members of an extended family and enclosed by a single perimeter wall. These compounds revive the traditional pattern of Arabian family living: within the shared walls, there are communal open areas for social gatherings, children's play, and family events, while each nuclear family still maintains its own separate house and entrance for privacy. This arrangement offers social advantages by keeping the extended family physically close, and economic advantages through sharing certain facilities (e.g. a common garden or play area) and reducing per-household costs for security and maintenance. It also provides a safe, enclosed environment for children to play, away from external traffic or strangers. The second type is "cultural enclaves" designed mainly for Western expatriates (as noted above), which in the context of Riyadh serve to allow foreigners a comfortable lifestyle shielded from the strict social norms outside. These Westernized compounds stand in contrast to their surroundings inside, residents enjoy norms of dress, entertainment, and social interaction that would not be publicly acceptable in Saudi society (such as mixed-gender recreational facilities or, in some cases, the private consumption of alcohol). High security at the gates ensures that these cultural boundaries are maintained. Interestingly, the separation of foreigners into these enclaves mirrors historical socio-spatial practices in some Middle Eastern cities, where different cultural

or religious communities lived in distinct quarters with minimal interaction. In modern Saudi Arabia, this pattern allows diverse cultural groups (locals and various expatriates) to coexist in the city with relatively few points of friction, since much of their daily lives occur in parallel worlds inside their respective “gated” communities.

Overall, gated communities in Saudi Arabia and the Gulf serve multiple purposes: they offer secure and comfortable housing for affluent nationals and expatriates, they enable the preservation of cultural norms (or the freedom from them, in the case of expatriate enclaves), and they are seen as status symbols in rapidly modernizing urban landscapes. However, as these enclaves become more common, they also raise questions about social division and urban integration in the region issues we explore through the lens of social sustainability in the next section.

### 2.4.4 Social-Sustainability in Gated Communities

Social sustainability in the context of residential developments refers to how well those environments support the well-being of individuals and the community, by promoting inclusion, equality, and access to resources for all residents. In examining gated communities, it is crucial to consider whether their design and management foster a socially sustainable living environment or hinder it (Desiderio and García-Herrero, 2021). Researchers have raised concerns that gated communities, by their very nature, pose several social challenges. Social sustainability at the neighbourhood scale concerns the durability of social relations, institutions, and everyday practices that allow diverse residents to live well together over time (Colantonio and Dixon, 2011; Dempsey et al., 2011; Murphy, 2012; Vallance et al., 2011). It spans cohesion and trust, participation and governance, equity and inclusion, perceived and actual safety, access to amenities and services, mobility and connectivity, place attachment and

identity, and overall wellbeing (Colantonio and Dixon, 2011; Dempsey et al., 2011; Eizenberg and Jabareen, 2017; Missimer et al., 2017; Murphy, 2012; Vallance et al., 2011).

Critically, it involves a process of negotiation and often conflict, where the "social" is a terrain of competing values and power relations, not merely a set of harmonious outcomes (Musterd and Ostendorf, 2013). Scholars emphasize that these constructs are conceptually contested and operate at multiple scales, making careful definition and operationalization crucial (Forrest and Kearns, 2001; Chan, To, and Chan, 2006; Schiefer and van der Noll, 2017). For instance, (Salem, 2022) highlights that gating has been associated with feelings of exclusion and fear of others (the “outsiders”), heightened perceptions of insecurity (paradoxically, even among those inside the gates), erosion of the broader social fabric, and a diminished sense of wider community among residents. Since gated communities often house a significant segment of the middle and upper classes, their social effects are far-reaching influencing urban policies and the dynamics of society at large (Alqahtany, 2021). Local and central government decision-makers cannot ignore these enclaves, as their popularity has implications for urban planning, service provision, and social equity in the city. In the Saudi Arabian context, these concerns are especially pertinent given the nation’s Vision 2030 goal of fostering a vibrant, inclusive society and improving quality of life.

One central critique is that the security and privacy achieved within gated communities come at the cost of reduced engagement with the larger community. Residents may feel safe and bonded with immediate neighbours of similar socio-economic status, but this can lead to a more fragmented society in which people have limited interactions outside their “bubble” (Roitman, 2010).

The strong sense of security and exclusivity can reinforce social segregation, as interactions tend to be concentrated among those who share the same lifestyle or class, while

contact with diverse groups diminishes. In many countries, gated communities have been proposed or adopted as a modern urban solution to various social, economic, and security pressures (Alqahtany, 2021). They offer an attractive package of private amenities recreational facilities, shopping centers, landscaped parks, even schools or theaters all within a secured perimeter. This self-contained model means residents have less need to venture into public spaces in the city, potentially reducing their participation in the wider urban community. (Roitman, 2010) argues that because gated communities are designed to be privatized and inward-looking, they inherently encourage social segregation: people inside enjoy homogeneity and insulation, which limits exposure to the diversity of urban life.

At the same time, human desires for belonging, well-being, and community are very much present among gated community residents. Developers often market these enclaves as offering a superior quality of life and a close-knit community feel. (Jacob and Chander, 2020) note that many such developments strive to create a sense of belonging among residents, underpinned by the idea that satisfaction with one's residential environment (safety, comfort, neighbourly relations) will be high behind the gates. However, empirical studies suggest that genuine social integration within gated communities can be limited. (Olivia et al., 2019) found in their research on mixed-income gated communities that social interaction across different economic strata was minimal; most socializing took place among people of the same income or social group. The presence of diverse income groups within the same walled estate did not automatically lead to mingling or cohesion in fact, lifestyle differences tended to keep groups apart even if they were neighbour. As a result, overall social cohesion in such gated settings was low. This indicates that simply enclosing people in a shared residential complex does not guarantee meaningful social mixing, especially if there are underlying class or cultural differences.

Another aspect of social sustainability is the availability of inclusive public spaces that encourage civic interaction and equal access. Amin and (Graham, 1997) argue that public spaces are crucial for social justice: they provide venues where diverse groups can interact, develop a sense of belonging to a larger community, and practice civic engagement. Gated communities, by restricting access to outsiders and privatizing amenities, limit the role of truly public space. Streets, parks, and recreational facilities inside the gates are only for residents and their guests, which means they do not serve the broader population of the city. This restricted access can be seen as a barrier to achieving wider social sustainability objectives because it reduces opportunities for different segments of society to meet and understand one another. In cities with many gated enclaves, the cumulative effect is a kind of social balkanization pockets of privilege separated from other areas, with little interaction between them.

It is worth noting that gated communities are not entirely negative in their social impact; they can also contribute in certain positive ways, especially economically. These developments often create employment opportunities for people living outside the gates, such as jobs for security guards, maintenance staff, domestic workers, gardeners, and retail employees in on-site shops (Olivia et al., 2019). In some cases, the establishment of a large, gated community can stimulate improvements in local infrastructure (roads, electricity, water supply) and lead to the development of nearby markets, supermarkets, or services to cater to the community, which can also be used by surrounding neighbourhoods (Balcaite and Krupickaite, 2018). Thus, gated communities can act as catalysts for certain types of local economic development and integration, even while they foster exclusivity in a social sense. (Balcaite and Krupickaite, 2018) acknowledge that through these economic linkages and daily wage-labor relations, gated enclaves do maintain a form of connection with the wider urban society, potentially improving livelihoods for some lower-income individuals in adjacent areas.

From the residents' perspective, the decision to live in a gated community often involves weighing pros and cons. (Asfour, 2022) explains that people gravitate toward gated enclaves to obtain benefits such as enhanced security and privacy, a distinguished lifestyle with ample amenities, and even an element of prestige or reputation that comes from living in a "desirable" development. There are also practical advantages frequently cited: gated communities tend to ensure regular maintenance of the neighbourhood, enforce rules that keep the area clean and orderly, and sometimes foster a sense of community through organized events or shared facilities, all of which contribute to residential satisfaction.

However, these advantages are accompanied by notable disadvantages. Housing costs in gated communities are usually higher than in comparable non-gated areas, not only due to the premium on desirability but also because residents may bear monthly fees for security and upkeep of facilities. There may be strict regulations that some find onerous (for example, rules on parking, home appearance, or pet ownership) which can limit personal freedoms. Moreover, the very design that limits outside access can also reduce residents' mobility and freedom to roam compared to an open neighbourhood one cannot simply drive through any gate or take a shortcut across the community if not permitted. Visitors face screening, and residents must adhere to the compound's schedules and rules for using amenities or common spaces (Asfour, 2022).

In sum, while gated communities can improve personal safety and comfort for their residents, they also raise concerns about social equity and cohesion at the city scale. The sense of security and exclusivity enjoyed by the few may inadvertently contribute to greater polarization and mistrust among the broader population. Addressing these social sustainability challenges requires careful consideration by urban planners and policymakers, to balance the legitimate desires of individuals for security and quality of life with the need to promote

inclusive, integrated communities in the urban fabric. Table 5 below summarizes the key challenges of social sustainability associated with gated communities, as identified in the literature:

***Table 5:*** *Unique Aspects of social sustainability within gated community*

| **Unique Aspects of social sustainability in gated communities** | **Author** | **Year** |
|---|---|---|
| Privatization of streets/open space can heighten social frictions, create "otherness," and reinforce an insider–outsider divide. | Low | 2003 |
| Physical design intentionally promotes social segregation and homogeneity; enclaves attract those seeking insulation from diverse interactions. | Roitman | 2010 |
| Gated neighbourhoods contribute to urban fragmentation and spatial separation driven by security and financial logics. | Mahgoub & Khalfani | 2012 |
| Despite walls, fear of crime may persist among residents; gating does not resolve deeper social insecurities. | Low | 2003 |
| Boundaries and restricted access can reduce opportunities for inclusive public life and civic mixing. | Amin & Graham | 1997 |
| Cross-class interaction is limited in mixed-income gated developments; most socializing remains within similar income groups, lowering cohesion. | Olivia, Adianto, & Gabe | 2019 |
| Economic linkages exist gated developments create jobs for nearby low-income residents and can spur local services/markets. | Balcaite & Krupickaite; Olivia, Adianto, & Gabe | 2018; 2019 |
| Residents weigh benefits (security, maintenance, amenities, prestige) against downsides (higher costs, rules, constrained mobility). | Asfour | 2022 |

| | | |
|---|---|---|
| Physical barriers (walls/gates) can deter opportunistic crime and reduce permeability, improving some safety metrics. | Wei; Grant & Mittelsteadt | 2004; 2016 |

### 2.4.5 Measuring and Assessing Social sustainability in Gated communities

Only a very limited number of studies have attempted to develop tools and frameworks for assessing social sustainability in gated residential developments. In fact, there is currently no widely adopted framework tailored to this context, and only a few research efforts have specifically produced gated-community social sustainability assessment frameworks (Abed et al., 2022; Abdelhafez et al., 2025; Khamis et al., 2023). These rare examples underscore the nascent state of this field most existing social sustainability measures were designed for general urban or neighbourhood settings, not the unique conditions of gated communities. The scarcity of gated community-specific assessment tools thus highlights a significant gap in the literature, indicating that further work is needed to address the social sustainability of these exclusive developments.

## 2.5 Summary of literature and Gap Identification

The literature reviewed in this chapter illustrated that while social sustainability is recognized as a crucial pillar of sustainable development, its implementation and assessment in urban environments particularly within gated communities remain complex and context dependent. Key conceptual foundations were established, highlighting that social sustainability encompasses multiple dimensions such as cohesion, safety, inclusion, equity, participation, and resilience. These dimensions can be operationalized through categories and indicators, and numerous frameworks and tools have been developed globally to measure them. However, existing frameworks, as reviewed, are often generic or tailored to different contexts and may not directly address the unique characteristics of gated communities in Saudi Arabia.

The review of gated communities showed that these developments, by design, create exclusive spaces with distinct social dynamics. Globally, gated communities can be categorized by their primary purpose (lifestyle, prestige, or security), and they appeal to residents for various reasons including safety, quality of life, and social status. In the GCC and Saudi Arabia, gated compounds have historic roots and contemporary prevalence, serving both expatriate and local populations. They fulfill certain cultural and security needs but also mirror and potentially magnify social stratification. The social sustainability challenges identified such as reduced social integration with the wider city, potential for social exclusion, privatization of public space, and internal homogeneity are particularly salient in the Saudi context, where rapid urbanization and modernization are national priorities. Saudi Vision 2030, for instance, emphasizes creating a vibrant society and improving urban livability, which implicitly calls for addressing issues of social cohesion and inclusion in all neighbourhoods, gated or otherwise.

Despite the growing presence of gated communities in Saudi Arabia, the literature lacks a clear, context-sensitive framework for assessing their social sustainability. Most existing studies and assessment tools have been developed in Western or generic urban contexts and focus on broad sustainability criteria. Moreover, as noted in the introduction, past research in Saudi Arabia has often emphasized environmental and economic sustainability over the social dimension. This is a critical oversight, given that social factors such as sense of community, cultural adequacy, and equity are central to the long-term success of residential developments. The absence of a tailored assessment framework means that planners and decision-makers have limited guidance on how to evaluate or improve the social sustainability of gated communities in the Kingdom.

In synthesizing the literature, it becomes evident that a major gap exists at the intersection of social sustainability assessment and gated community development in KSA.

While general principles and indicators of social sustainability are known, they need to be organized into a framework that reflects local cultural norms, values, and the specific ways in which gated communities operate in Saudi cities. For example, the importance of cultural compatibility within expatriate compounds, the role of extended family compounds among locals, or the specific security concerns in Saudi urban areas are all contextual factors that an assessment framework must consider. Additionally, engagement with Saudi urban experts (as indicated by the study's methodology) suggested that there may be unique indicators or weights that differ from international models.

In summary, the literature review has laid the groundwork by identifying what constitutes social sustainability in communities and what challenges gated communities present. It has also shown that while many frameworks exist, none are fully adequate for the Saudi gated community context. Building on the gaps identified in the preceding sections, the development of the proposed assessment framework in this study draws on a broad yet carefully filtered body of existing knowledge. In total, 23 assessment approaches were systematically reviewed and analysed, comprising nineteen academic social sustainability frameworks and four neighbourhood-scale sustainability assessment tools. These instruments span diverse disciplinary backgrounds, geographic contexts, and methodological traditions, including urban planning, sustainability science, architecture, and social policy. While most of these frameworks were originally developed for general urban neighbourhoods or city-scale applications, they collectively provide a rich foundation of social sustainability categories, sub-categories, and indicators that are relevant to residential environments more broadly (Dempsey et al., 2011; Woodcraft, 2015; Shirazi and Keivani, 2019; Eizenberg and Jabareen, 2017). However, only a very small subset of the reviewed approaches explicitly addressed gated communities, reinforcing the fragmented and limited nature of existing measurement efforts in this specific context (Abed et al., 2022; Khamis et al., 2023). Consequently, the present study

adopted a synthesis-driven approach, leveraging the collective strengths of these 23 frameworks and tools while critically adapting and re-structuring their indicators to reflect the distinctive social, spatial, and governance characteristics of gated communities in Saudi Arabia. This comprehensive yet selective grounding ensured that the proposed framework was both theoretically robust and empirically informed, while responding directly to the documented absence of a context-sensitive assessment tool for social sustainability in gated residential developments. This research developed a context-appropriate social sustainability assessment framework for gated communities in Saudi Arabia, drawing on global best practices but calibrated to local realities. In doing so, it aimed to fill a critical knowledge and practice gap, providing Saudi urban planners and stakeholders with a tool to evaluate and enhance the social sustainability of these increasingly common developments.

# CHAPTER 3

# METHODOLOGY

Building on the gaps identified in Chapter 2, this chapter explained the methodology designed to develop the assessment framework. The chapter outlined the research design and methods employed to develop a contextualized social sustainability assessment framework for gated communities in Saudi Arabia. The primary aim of the study was to identify and validate a comprehensive set of social sustainability indicators tailored to the Saudi gated community context. To achieve this aim, a multi-method (mixed methods) approach was adopted, integrating qualitative and quantitative techniques in three sequential phases. A multi-method design was deemed necessary because the complexity of social sustainability, especially in a culturally specific setting, required triangulating insights from diverse sources. By combining an in-depth literature review, a content analysis of existing frameworks, and an expert panel review (with a structured Delphi technique), the research leveraged the strengths of each method. This triangulation ensured that the emerging framework was theoretically grounded, empirically robust, and contextually validated. The following sections detail each phase of the methodology, beginning with an overview of the research design and then elaborating on the procedures and outcomes of the literature review, content analysis, and expert validation phases.

## 3.1 Methodology Overview

This study aimed to develop an assessment framework for evaluating social sustainability in gated communities within the Kingdom of Saudi Arabia (KSA). To achieve

this aim, a multi-method research design was adopted to ensure a comprehensive and robust evaluation. Social sustainability is a multifaceted concept that spans various disciplines and understanding it in the context of gated communities required integrating multiple approaches.

Relying on a single research method can introduce biases and limit the generalizability of findings. By contrast, a multi-method (mixed methods) approach combines the broad generalizability of quantitative data with the deep contextual insights of qualitative data. Using multiple methods also enables triangulation, which enhances the validity of results by cross-verifying findings from different sources. Researchers have long advocated triangulation as a strategy to neutralize the biases inherent in any single method (Jick, 1979). In practice, combining methods strengthens the findings and provides greater insight into social phenomena than using a single method alone. Furthermore, recent studies confirmed that a multi-method research approach offers a broader and more complete perspective on complex research problems. Considering these advantages, the study's methodology was designed to capitalize on the strengths of multiple methods while compensating for their individual limitations.

Overview of the Research Design: The research was carried out in three main phases, each corresponding to a specific method, to address the study objectives in a systematic way. These phases were as follows:

1. **In-Depth Literature Review:** An in-depth literature review was conducted to identify potential social sustainability dimensions, indicators, and frameworks relevant to gated communities and urban settings (with particular attention to the Saudi context) and real-world neighbourhood assessment tools. This provided the theoretical foundation and a preliminary pool of indicators for the framework.

2. **Content Analysis:** A detailed content analysis was performed on the collected indicators (using data compiled from literature and real-world neighbourhood assessment tools) to synthesize a comprehensive initial social sustainability assessment framework. In this phase, the indicators were organized into categories and sub-categories, duplicates were merged, and a quantitative analysis was done (e.g., frequency counts) to select the most relevant indicators for the framework.
3. **Delphi Technique (Two Rounds):** the initial contextualized framework (categories, sub-categories, and selected unique indicators) was reviewed, refined, and validated using a two-round Delphi technique. Round 1 involved 50 experts, who evaluated the indicators for importance and clarity and suggested modifications. Based on Round 1 analysis and controlled feedback, round 2 involved 30 experts who re-evaluated (re-rated) the revised indicators to confirm consensus and finalize the framework.

Figure 6 illustrated the methodology used to conduct this study; it shows the various phases of the research, the research methods used in each phase, and the research activities in each phase mapped to the objectives.

Each phase built upon the results of the previous phase, and together these methods provided a well-rounded approach to developing the social sustainability assessment framework.

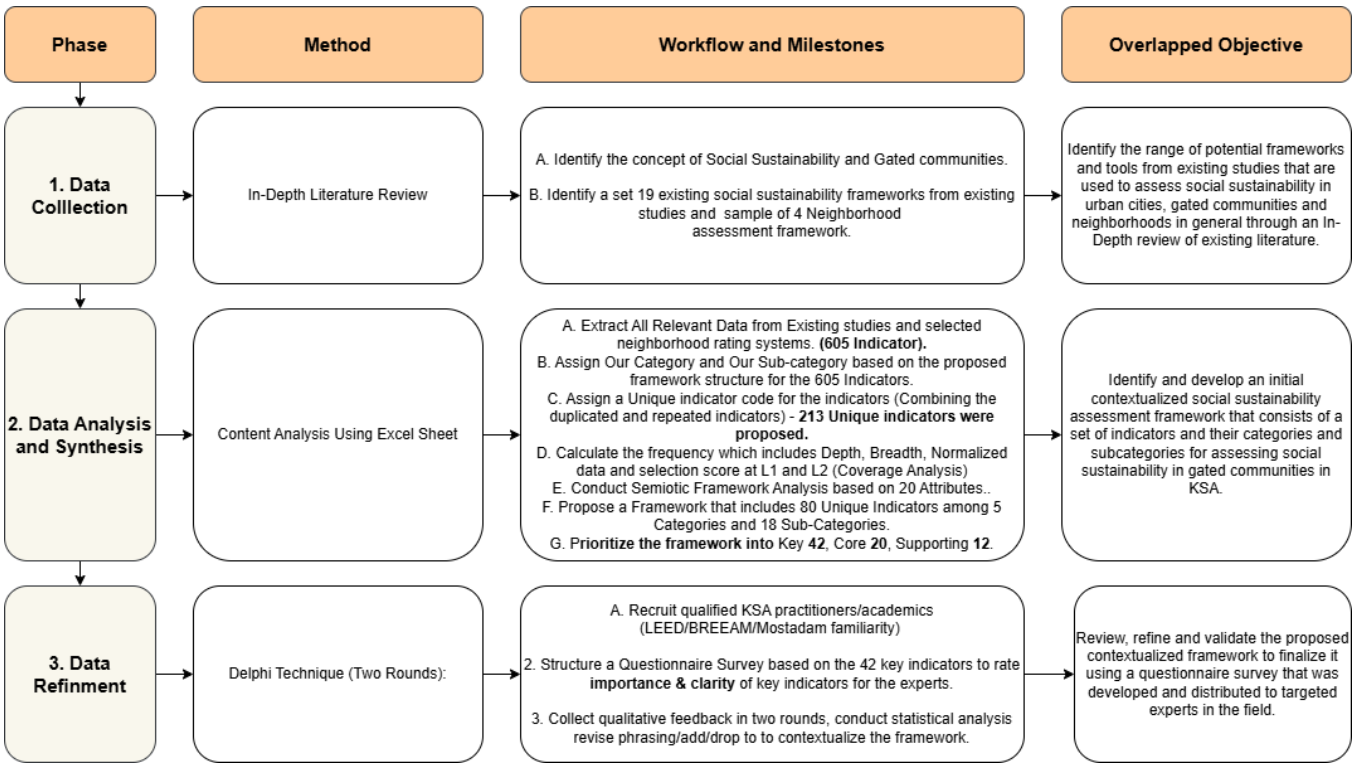


***Figure 6:*** *Methodology of the Study*

## 3.2 Research Methods

The following are the research methods applied in each phase of the study.

### 3.2.1. Review of Literature

In the first phase of the methodology, an in-depth literature review was conducted to establish a solid theoretical foundation for the framework. This review gathered secondary data on social sustainability concepts and existing assessment frameworks, serving multiple purposes: it helped conceptualize social sustainability for this study and provided a comprehensive list of potential indicators. In particular, the review focused on two main activities aligned with the study objectives:

- **Conceptualizing Social Sustainability in Gated Communities:** The literature review first examined how social sustainability is defined and conceptualized in the context of gated communities, focusing on its key attributes and dimensions. This involved surveying urban studies and sustainable development literature to identify the main aspects of social sustainability relevant to residential communities (e.g., quality of life, social equity, community cohesion, safety, participation, and sense of belonging). Prior studies and theoretical frameworks dealing with social sustainability at the neighbourhood level, including research specifically addressing gated communities, were analysed to outline common themes and sub-dimensions. This clarified the conceptual understanding of social sustainability that would underpin the framework, ensuring that the definition used in this study encompasses the critical social factors highlighted in existing literature.
- **Identifying Existing Social Sustainability Assessment Frameworks**: The second key task was to identify and review existing frameworks and tools used to assess social sustainability, to gather a pool of relevant indicators and best practices. The review covered three categories of assessment approaches: (i) frameworks dedicated specifically to evaluating social sustainability in gated communities; (ii) tools and frameworks for assessing social sustainability in neighbourhoods and urban areas more generally (not exclusive to gated communities); and (iii) broader sustainability assessment frameworks that include a substantial set of social sustainability indicators. This included examining academic assessment models as well as established neighbourhood/community rating systems. For example, international sustainability frameworks such as LEED for Neighbourhood Development (LEED-ND), LEED for Cities and Communities, BREEAM Communities, and Mostadam (the Saudi community sustainability rating system) were reviewed to understand which social

criteria they incorporate and how these criteria are categorized. By comparing and compiling these various sources, the literature review assembled a wide range of potential social sustainability indicators and dimensions relevant to gated communities.

**Grounding of CSSAF categories:** To avoid treating the Comprehensive Social Sustainability Assessment Framework (CSSAF) as an ad hoc checklist, the Level 1 categories were grounded through an explicit crosswalk between instrument-derived category labels and a consolidated set of social sustainability pillars. During the content-analysis and consolidation workflow, (category labels used across the reviewed instruments were compiled, cleaned, and harmonized to resolve variation in terminology (e.g., overlapping labels for access, mobility, connectivity, participation, or safety). These harmonized "L-1" labels were then mapped into higher-order categories based on semantic equivalence and the primary construct each label operationalizes at neighbourhood scale.

This grounding step yielded five recurring pillars that consistently organize the heterogeneous instrument categories: (1) Community Cohesion and Social Interaction, (2) Safety, Security, and Perceived Control, (3) Liveability and Quality of Place, (4) Participatory Governance, Equity, and Empowerment, and (5) External Relations and Integration.

Figure 7 visualized the resulting crosswalk as a network, showing how instrument category labels connect to the five CSSAF pillars and highlighting categories that attract a broader and more diverse set of categories. Table 1 then summarizes the conceptual intent of each pillar and clarifies the kinds of neighbourhood constructs typically operationalized under each domain. Figure 7 presented a network visualization of the L-1 category crosswalk used to ground the five CSSAF pillars.

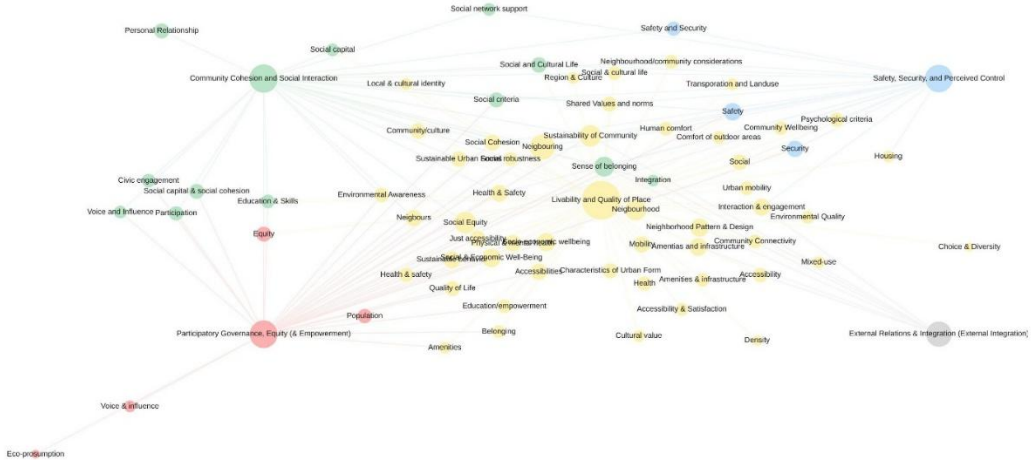


*Figure 7: Network visualization of CSSAF category grounding (L-1 category crosswalk).*

The same crosswalk procedure was applied at the sub-category level (L-2). Instrument-derived sub-category labels (L-2 Variable) were cleaned and harmonized, then mapped to consolidated CSSAF sub-categories (Our Sub-Category of indicators) using semantic equivalence and construct intent. This yielded 18 CSSAF sub-categories nested under the five Level 1 pillars. Figure 8 visualized this L-2 grounding as a network linking instrument sub-category labels to CSSAF sub-categories, where node size reflects frequency across instruments and link thickness reflects how often each mapping occurs. This visualization complements the L-1 grounding by showing which sub-categories are consistently operationalized and which remain fragmented across instruments.

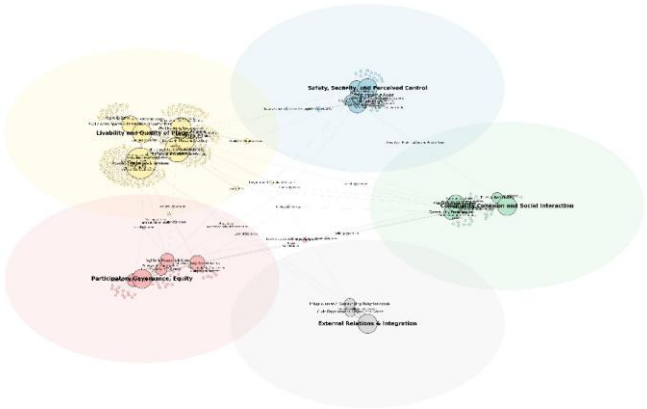


***Figure 8:*** *Network visualization of CSSAF sub-category (L-2) grounding.*

Table 6 summarized how each CSSAF category maps commonly measured neighbourhood constructs and the kinds of indicators typically used to operate them. This grounding step clarifies the conceptual intent of each category before the subsequent measurement-theory interpretation of coverage breadth and depth.

***Table 6:*** *Theoretical grounding of CSSAF Level 1 categories (conceptual categories)*

| CSSAF categories | Conceptual scope in neighbourhood assessment |
|---|---|
| Community cohesion and social interaction | Captures the social fabric of neighbourhood life: social networks and ties, participation, inclusion/belonging, trust and reciprocity. |
| Safety, security, and perceived control | Addresses both objective and perceived safety, including exposure to hazards/crime, comfort using public space, and perceived agency/control in the neighbourhood. |
| Liveability and quality of place | Represents everyday conditions supporting wellbeing: access to amenities/services, public open space and interaction opportunities, and housing quality/affordability. |
| Participatory governance, equity, and empowerment | Covers procedural and distributive equity: opportunities to participate in decision-making, transparency/accountability, and fair access to opportunities and services. |
| External relations and integration | Captures the neighbourhood's outward connectedness: permeability, integration with surrounding areas, and civic engagement beyond the immediate neighbourhood boundary. |

Together, the L-1 and L-2 grounding steps establish the conceptual structure needed to treat CSSAF as a measurable framework, which is then aligned with measurement-theory considerations in the following section.

Through these efforts, the literature review generated a broad list of candidate indicators and themes for social sustainability. It also informed the initial comprehensive structure (categories and sub-categories) of the proposed conceptual framework, referred to as the Comprehensive Social Sustainability Assessment Framework (CSSAF**).** by revealing common groupings of indicators in previous studies as depicted in Figure 9, which illustrates the five main categories and eighteen sub-categories derived, restricted and reformed from literature and the selected assessment framework; this proposed structure guided the content analysis. The outcomes of the literature review provided a foundational database of potential social

sustainability criteria which the study could then systematically analyze and refine in the next phase.

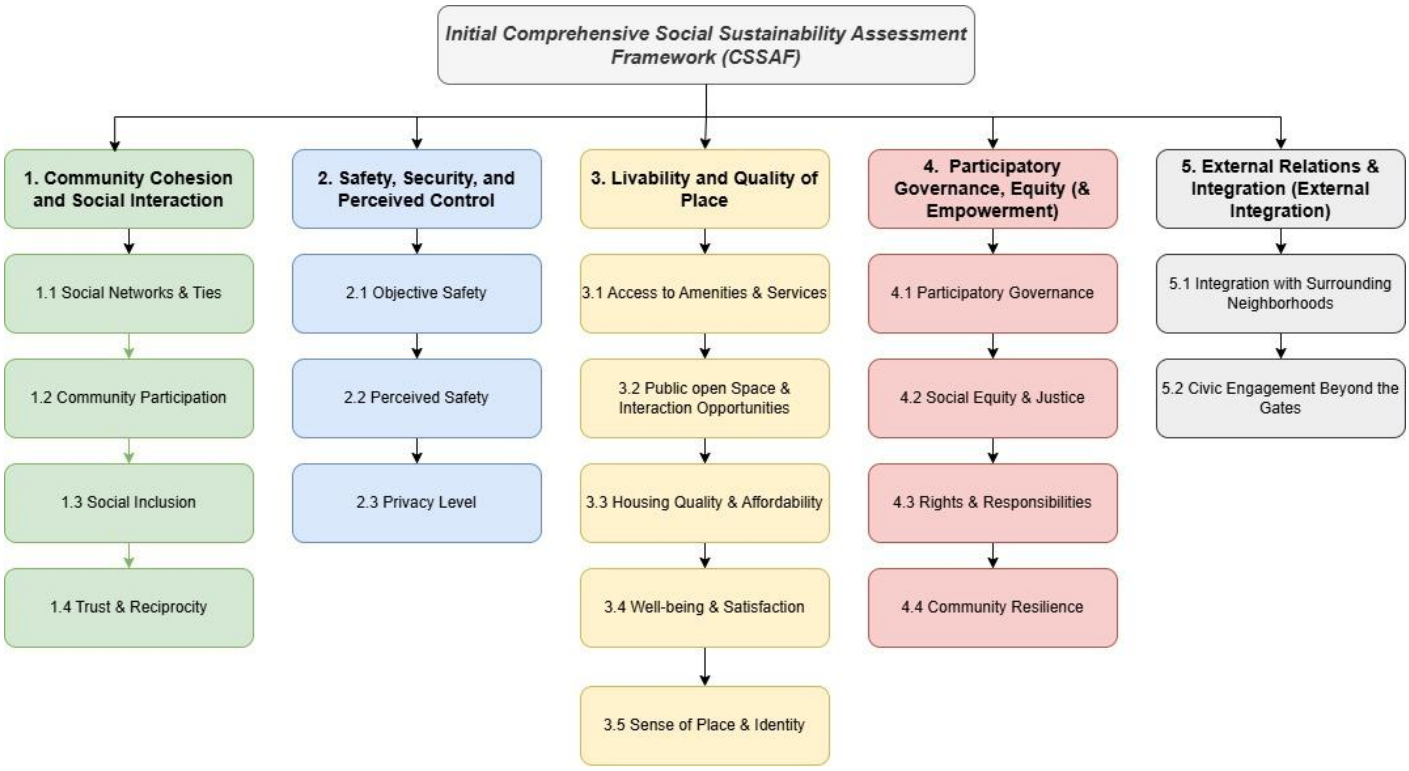


***Figure 9:*** *Proposed Conceptual Framework (Categories and Sub-Categories).*

### 3.2.2 Content Analysis

In the second phase, a comprehensive content analysis of the gathered existing 19 frameworks and 4 neighbourhood assessment tools was conducted. To manage the large volume of data (indicators from multiple sources), Microsoft Excel was used as a tool for organizing and analyzing the content. Using a spreadsheet facilitated the sorting, coding, and frequency analysis of indicators across different sources. The content analysis process comprised several systematic steps, detailed below:

**Data Compilation:** All candidate social sustainability indicators identified from literature and the sample assessment tools were compiled into a master spreadsheet. For each source (each framework or tool reviewed), the relevant data were extracted and recorded, including the framework's category (Level 1 variable), sub-category (Level 2 variable), and

direct measures (Level 3 indicators). Additional details such as each indicator's operational definition, indicator name, question stems, measurement type (e.g., quantitative vs. qualitative; ordinal vs. nominal scale), and any weighting used in the original source were noted when available, as shown in Table 7. This step yielded a combined inventory of 605 indicator entries across all selected 19 existing frameworks and 4 neighbourhood assessment tools. Each of the 605 indicator entries was recorded as one row of extracted data (see Table 7 for the layout of the data extraction spreadsheet).

***Table 7:*** *Layout of the data extraction table*

| Category | Our Category | Sub-category | Our Sub-Category | Unique indicators Code | Name of indicator (Directly Measured Variable) | Operational Definition | Measurement of indicators, Question stems | Measurement Type | Subjective or Objective | Measurement Instrument | Weight if any | Tool / System ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

1. **Categorization:** Each extracted indicator was then mapped onto the study's proposed categorization scheme ("Our Category" and "Our Sub-Category"). Based on insights from the literature, the study defined an initial conceptual hierarchical framework (CSSAF) consisting of 5 main categories (Level 1) and 18 sub-categories (Level 2) for social sustainability in gated communities (as previously depicted in Figure 5). This proposed structure outlines the categories and sub-categories. As indicators from various sources were entered into the combined spreadsheet, the researcher assigned each one to the most appropriate "Our Category" and "Our Sub-Category" in the proposed conceptual framework. This step helped organize diverse indicators under a common structure and ensured that similar measures from different sources were grouped together.
2. **Consolidation of Indicators (Unique Indicators):** After categorization, the full list of indicators was examined thoroughly at Levels 1, 2, and 3, especially the direct measurements, to identify duplicates or overlaps. Many indicators appeared in multiple sources under slightly different names or formulations. These were merged into unique

indicators to avoid redundancy. For example, if several frameworks had an indicator related to “sense of community” or “social cohesion,” these were consolidated into one representative indicator in the spreadsheet. Through this consolidation process, the list was distilled down to 213 unique indicators.

3. **Frequency Analysis:** Quantitative analysis was then performed to evaluate the significance and importance of each unique indicator across the sources. For every indicator, the raw breadth of coverage was calculated (i.e. the number of different frameworks/tools that included that indicator, or an equivalent, in some form) and the raw depth of coverage was determined (i.e. the total frequency count of that indicator’s occurrence across all sources). These metrics provide insight into how widespread and common each social sustainability indicator is in existing literature and tools. Similarly, at the category and sub-category levels, aggregate counts were computed for instance, how many total indicators fell under each category (reflecting that category’s overall representation in the literature), and in how many sources each category or sub-category appeared. These frequency measures were entered into the spreadsheet to create a benchmarking profile of the coverage of social sustainability dimensions in existing frameworks. (The average depth of indicators per category was also calculated for additional insight.).

   CSSAF was used as a common reference structure to map each Instrument coverage. Coverage was assessed at three levels: (i) category level (Level 1), (ii) subcategory level (Level 2), and (iii) operational indicator level (Level 3), including whether operational definitions/prompts were provided. Two diagnostic dimensions were computed: breadth (range of CSSAF elements covered) and depth (number of indicators per element, and the presence of operational specificity). These diagnostics were used to

identify convergence, omissions, and redundancies across instruments, and to compare measurement emphasis between academic indicator sources and certification-oriented rating tools. Table 8 presents the subcategory-level coverage mapping of each instrument against CSSAF.

Coverage evaluation was summarized using two complementary metrics: breadth and depth. Breadth reflects the range of CSSAF categories and subcategories addressed by an instrument and was quantified as the percentage of Level 1 categories and Level 2 subcategories covered. Depth reflects how thoroughly each dimension was operationalized and was assessed by (i) the number of mapped indicators/credits within each CSSAF category/subcategory and (ii) the presence of Level 3 operational specification (definitions, prompts, or evidence requirements). Together, breadth and depth support structured diagnosis of convergence, omissions, and redundancies across instruments, and enable comparison of measurement emphasis between peer-reviewed academic indicator sources and certification-oriented rating tools.

Detailed mapping outputs are reported in Table 8, and depth patterns are summarized by reporting the number of CSSAF categories and subcategories addressed by zero, one, two, or three or more indicators per instrument.

Inter-coder reliability. To assess the robustness of the indicator mapping procedure, a second coding pass was conducted on a random 30% sample of the unique direct-measurement indicators (n = 63 of 213). The second pass was conducted as an AI-assisted independent coding exercise based solely on indicator text and accompanying operational definitions/question stems, without using the primary coding labels during assignment. Agreement between coding passes was assessed using Cohen's kappa for (I) CSSAF category assignment and (ii) CSSAF subcategory assignment, alongside observed percent agreement.

Category-level agreement was substantial ($\kappa = 0.79$; 84.1% agreement), while subcategory-level agreement was moderate-to-substantial ($\kappa = 0.62$; 67.0% agreement), consistent with expected boundary overlap among finer-grained social sustainability constructs. Disagreements were resolved through consensus review and used to refine boundary decision rules prior to finalizing the dataset, with changes documented in an audit trail.

Boundary decision rules (applied consistently in final coding). (1) Indicators reflecting participation in formal decision-making (e.g., planning influence, governance mechanisms, consultation in approvals) were coded as Participatory Governance, whereas indicators reflecting involvement in community life (e.g., volunteering, events, associations) were coded as Community Participation. (2) Indicators reflecting proximity/accessibility to services, facilities, and mobility options were coded as Access to Amenities & Services, whereas indicators describing housing condition, tenure, typology, or affordability were coded as Housing Quality & Affordability. (3) Indicators reflecting distributional fairness and equal opportunity were coded as Social Equity & Justice, whereas indicators describing explicit rights, obligations, protections, or accountability mechanisms were coded as Rights & Responsibilities. (4) Indicators reflecting measured safety conditions were coded as Objective Safety, whereas indicators reflecting felt safety were coded as Perceived Safety.

To quantify convergence between instruments beyond category/subcategory coverage, a pairwise similarity analysis was performed at the indicator level using the consolidated CSSAF indicator set ($n = 213$). First, the crosswalk outputs were converted into a binary instrument–indicator matrix in which each cell indicates whether an instrument contains at least one operational indicator aligned to a given CSSAF indicator (1 = present, 0 = absent). Pairwise overlap between instruments was then computed using Jaccard similarity, defined as the ratio of shared indicators to the union of indicators across the two instruments.

***Table 8:*** *Mapping Instruments according to CSSAF benchmark.*

| Instrument Code | Social Networks & Ties | Community Participation | Social Inclusion | Trust & Reciprocity | Objective Safety | Perceived Safety | Privacy Level | Access to Amenities & Services | Public Open Space & Interaction Opportunities | Housing Quality & Affordability | Well-being & Satisfaction | Sense of Place & Identity | Participatory Governance | Social Equity & Justice | Rights | Community Resilience | Integration with Surrounding Neighborhoods | External Civic Engagement |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P1 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | ✓ | ✓ | ✓ | | ✓ | | | |
| P2 | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| P3 | ✓ | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | | | ✓ | |
| P4 | ✓ | ✓ | | | | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | | | | | |
| P5 | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | |
| P6 | ✓ | ✓ | | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | ✓ | |
| P7 | | ✓ | ✓ | | ✓ | | | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | |
| P8 | | | | | | ✓ | | ✓ | | | | | | | | | | |
| P9 | ✓ | ✓ | | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ | |
| P10 | | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ |
| P11 | | | | | | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | |
| P12 | ✓ | ✓ | | | | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| P13 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| P14 | | ✓ | ✓ | | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | ✓ | | | | |
| P15 | | | ✓ | | ✓ | | | ✓ | | | ✓ | ✓ | | | ✓ | ✓ | | |
| P16 | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | |
| P17 | | | | | ✓ | | | ✓ | | ✓ | ✓ | | | ✓ | | ✓ | | |

| Instrument Code | Social Networks & Ties | Community Participation | Social Inclusion | Trust & Reciprocity | Objective Safety | Perceived Safety | Privacy Level | Access to Amenities & Services | Public Open Space & Interaction Opportunities | Housing Quality & Affordability | Well-being & Satisfaction | Sense of Place & Identity | Participatory Governance | Social Equity & Justice | Rights | Community Resilience | Integration with Surrounding Neighborhoods | External Civic Engagement |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P18 | ✓ | | | | ✓ | ✓ | ✓ | ✓ | | ✓ | | | | ✓ | | | | |
| P19 | ✓ | | | | | ✓ | | ✓ | ✓ | | | ✓ | ✓ | | | | | |
| P20 | | | | | | | ✓ | ✓ | ✓ | | | | | | | | | ✓ |
| P21 | | | | | | | ✓ | | ✓ | | | ✓ | | | ✓ | | | |
| P22 | | | | | ✓ | | | ✓ | ✓ | ✓ | | ✓ | | | | | | |
| P23 | | | | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | |

A structured content analysis was conducted to extract all information relevant to the tool documentation using a standardized analytical template. Coding was mainly deductive and followed a predefined semiotic framework comprising five analytical levels (empiric, syntactic, semantic, pragmatic, and social) and twenty related attributes. These attributes were defined before full coding began and were used as fixed analytical categories. During the initial review, some attribute definitions were refined to improve conceptual clarity, particularly in separating empiric from syntactic levels; however, once coding started, no additional categories were introduced.

For each tool, official technical documentation, methodological reports, and published descriptions were reviewed in full. Data aligned with each attribute was extracted through a consistent template to ensure comparability across tools. Coding was based on explicitly stated documentation, while acknowledging that publicly available sources may not reflect every attribute of the tools. When documentation was unclear or incomplete, classifications were made conservatively and limited to what could be verified.

Descriptive statistics were used to summarize how attributes were distributed across the 23 tools. Quantification was applied only to clarify comparative trends identified through qualitative classification. Semiotic analysis guided the interpretive stage of the study by providing a structured logic for examining each tool as a layered sign system. Divergence was assessed by mapping tool attributes across the five semiotic levels and identifying patterned variation within and between levels. This diagnostic step is explanatory: it does not assume divergence is inherently negative or evaluate tools as better or worse. Instead, it differentiates between justified variation shaped by disciplinary or governance contexts and irrational divergence that results from implicit or inconsistent commitments across levels.

Overall, the analysis integrates structured attribute extraction with theory-informed interpretation. Semiotics serves as the methodological foundation of the study, offering a unified framework that connects measurement metrics, conceptual meaning, intended use, and institutional embedding. By positioning social sustainability assessment tools within this multi-level structure, the methodology supports systematic comparison while maintaining contextual specificity.

4. **Indicator Selection Criteria:** To systematically derive a manageable set of indicators for the new framework, the study employed a rigorous three-step selection process that integrated quantitative scoring with qualitative evaluation. First, a quantitative scoring method was applied to rank each category and sub-category based on its representation in the collected data. The proportion of all indicators (605 total) falling under each main category was calculated and normalized to obtain a normalized depth (Dc) for that category, while the proportion of sources that included each category was normalized to obtain a normalized breadth (Bc) (Figure 10). These normalization formulas (for both categories and sub-categories) ensured that each category's depth and breadth values ranged from 0 to 1 and summed to 1 across all categories. Similarly, depth and breadth were normalized for each sub-category (Figure 11).

$$Bc = \frac{Raw\ Breadth\ for\ each\ cateogry}{Total\ Raw\ breadth\ for\ Categories}\ Dc = \frac{Raw\ Depth\ for\ each\ cateogry}{Total\ Raw\ Depth\ for\ Categories}$$

***Figure 10****: Normalization Formula for Breadth and depth at category level*

$$Bs = \frac{Raw\ Breadth\ for\ each\ Sub-categorgy}{Total\ Raw\ Breadth\ for\ Sub-categories}\ Dc = \frac{Raw\ Depth\ for\ each\ Sub-category}{Total\ Raw\ Depth\ for\ Sub-categories}$$

***Figure 11:*** *Normalization Formula for Breadth and depth at Sub-Category Level*

Next, a preliminary selection score (SS) was computed for each category as the geometric mean of its normalized depth and breadth (Figure 12). This composite score

captured both how frequently a category's indicators appeared in the sources and how widely that category was covered across different frameworks, reflecting its overall prominence.

$$Ss = \sqrt{(Bc \times Dc)}$$

***Figure 12**: Selection Score for Category level formula*

For sub-categories, an analogous formula was used to calculate selection scores, linking each sub-category's normalized depth and breadth with its parent category's score to ensure a fair distribution of importance at the sub-category level (Figure 13). After computing these scores, all category and sub-category scores were normalized again to convert them into relative weights (percentages) that sum to 1.

$$Ss = \sqrt{(B_c \times B_s) \times (D_c \times D_s)}$$

***Figure 13:** Selection Score Formula for Sub-category level*

Based on these weighted scores and a review of existing frameworks, the study targeted approximately 80 indicators for inclusion in the framework. This target was chosen to keep the framework practical in size while remaining comparable to established assessment tools (for context, the largest reviewed framework contained 77 indicators). The indicator "slots" were then allocated to the five main categories in proportion to each category's normalized selection weight, so that no important dimension was underrepresented. In other words, categories heavily emphasized in prior studies were allotted a larger number of indicators, and those less emphasized received fewer.

Within each category, sub-category selection scores guided the prioritization of specific indicators, ensuring that the highest-ranked indicators in each sub-topic were chosen

first. Guided by these quantitative rankings, the researcher assembled a preliminary list of the top 80 unique indicators out of the 213 candidates. Indicators with the highest depth and breadth (i.e. those most frequently and widely cited across sources) were given priority, as they were considered the most critical and well-recognized measures of social sustainability.

In the second step, each of the 80 candidate indicators underwent a qualitative relevance assessment. For every indicator, the researcher evaluated its relevance to the core concept of social sustainability on a scale from 1 to 10, as well as its specific relevance to the Saudi Arabian gated community context on a scale from 1 to 10. these two qualitative criteria were integrated as part of the selection framework. If an indicator scored poorly on either the conceptual relevance or the contextual relevance criterion, it was either revised for clarity/context or removed from the list. Through this qualitative screening, the list was narrowed down from 80 to a final set of 74 indicators, ensuring that each remaining indicator was both important in principle and appropriate for the Saudi context (see Table 9).

***Table 9:*** *Second and third Selection Criteria*

| **Selection Criteria** | | | **Exclude** | **Include** |
|---|---|---|---|---|
| **Relevant to Region** | **Relevant to Construct** | | | |

The final 74 indicators spanned all 5 main categories and 18 sub-categories of the conceptual framework (CSSAF), comprising a three-level structure of categories (Level 1), sub-categories (Level 2), and direct measurement indicators (Level 3 question items). To emphasize their relative importance, the 74 indicators were further classified into three tiers: key indicators (42 indicators with the highest frequencies, considered most critical), supplementary (20 indicators of secondary importance), and supporting indicators (the remaining 12 indicators that provide additional insight). This prioritization reflected that while

all selected indicators were valuable, the key indicators carried the most weight because they corresponded to issues most frequently emphasized in the literature. Overall, this three-step selection procedure reinforced methodological rigor by combining quantitative evidence with qualitative expert judgment, ensuring that the final indicator set was empirically grounded, conceptually sound, and contextually relevant.

### 3.2.3 Delphi Technique: Expert Validation in Two Rounds

In the third phase, the study employed a two-round Delphi technique to review, refine, and validate the proposed initial contextualized social sustainability framework. The purpose of this phase was to leverage local expertise to ensure that the framework's categories and indicators were valid, clear, and contextually appropriate for gated communities in Saudi Arabia. Delphi was selected because it provides an iterative, structured process to build expert consensus through multiple rounds and controlled feedback. Expert evaluation is a crucial step for establishing content validity and tailoring the framework to real-world conditions. As Creswell (2014) and others note, gathering feedback from knowledgeable practitioners and academics helps align research outcomes with professional standards and local realities.

Delphi Panel Composition and Rounds: A panel of Saudi experts (80 experts) in relevant fields was convened. These experts were purposefully selected based on the following criteria:

- Proven expertise in architecture, urban planning, or related disciplines, with a focus on community development or sustainability.
- Familiarity with social sustainability concepts, preferably as part of their professional experience or research interests.
- A strong academic or professional track record (e.g., advanced degrees, relevant publications) indicating depth of knowledge in sustainable design or social aspects of urban development.

- Practical experience with housing or community projects in Saudi Arabia (to provide insight into the local gated community context).
- Saudi nationality (or extensive work experience in KSA), to ensure that they understand the cultural and societal context this was important for context-specific relevance.
- Additional qualifications such as professional certifications in sustainability or planning (for example, being a LEED Accredited Professional (LEED-AP), or having certification in BREEAM Communities or Mostadam Community rating systems). Such credentials indicate that an expert is well-versed in sustainability assessment frameworks and would be adept at evaluating the proposed criteria.

1. **Procedure: In Round 1**, a structured Delphi survey was distributed electronically (via Google Forms). Experts rated the importance and clarity of each proposed key indicator on a 7-point Likert scale and provided qualitative comments (additions, deletions, rewording). This questionnaire was designed to collect both quantitative and qualitative feedback. It presented the initial contextualized framework (the Measurement Model) structure, which included 5 main categories and 18 sub-categories, along with a list of 42 proposed key indicators. Experts were asked to rate the importance and clarity of each key indicator using the Likert scale (where 1 represented extremely unimportant and 7 represented extremely important) and to suggest modifications or additions if necessary. They were also prompted with open-ended questions to gather suggestions on improving categories or identifying any missing social sustainability issues relevant to gated communities. The survey link was shared via email and professional networks (including LinkedIn) to maximize responses. In Round 2, the revised Delphi survey was sent to 30experts, who re-rated the indicators that didn't meet the threshold (and any borderline items) to confirm the stability of judgments and finalize consensus.

A two-round Delphi technique was used to collect primary data and build expert consensus, as it enabled the systematic collection of quantitative ratings and qualitative feedback within a relatively short time. In this study, an online Delphi questionnaire (administered via Google Forms) was developed and used to contextualize and validate the initial framework and to finalize the contextualized indicator set. The Delphi instrument was designed to gather expert input on the framework's categories and indicators, and the same structured form was used for all participants within each round. The questionnaire included 7-point Likert-scale rating items, multiple-choice questions, and open-ended (comment) questions. It consisted of six main sections (see Appendix A). The first three questions (Q1–Q3) collected participant profile information relevant to the study (e.g., background, expertise, and experience). In Question 4 (Q4), experts were asked to rate the importance (and clarity, where applicable) of the 42 key indicators, which were presented under their respective category headings and stated as direct measurement items (question stems). At the end of each category, experts were invited to provide optional written feedback, including suggestions to retain, revise, add, merge, or remove indicators. The final two questions asked experts to evaluate the adequacy of the overall categories/sub-categories and to propose any additional categories, sub-categories, or direct measurement indicators. Following Round 1, the results were synthesized and used to revise the framework, and a Round 2 Delphi was then conducted with a smaller expert group to confirm consensus and to re-rate some indicators.

2. **Validation and Refinement:** The two-round Delphi process was used to refine and validate the proposed framework. Round 1 expert input (n = 50) was analysed to assess the relevance, clarity, and completeness of the indicators. Indicators that experts identified as irrelevant or of low importance in the Saudi gated community context were revised or removed. Where experts indicated that certain aspects of social sustainability were under-represented, new indicators were added or existing ones were rephrased to

improve coverage. Indicator wording was refined based on qualitative comments to ensure clarity and measurability in practice. The hierarchical structure of the framework (categories and sub-categories) was also reviewed, with experts confirming whether the organization of indicators was logical and consistent with professional understandings of social sustainability in residential communities. Following this refinement, a second Delphi round (n = 30) was conducted to re-assess the revised framework and to confirm expert consensus on the retained indicators and structure. Feedback from Round 2 demonstrated stability of judgments and agreement across key dimensions, leading to the finalization of the 42 key indicators with additional indicators. The outcome of this phase was a contextualized social sustainability assessment framework for gated communities in Saudi Arabia, validated through iterative expert consensus and confirmed to be both theoretically grounded in the literature and practically relevant to the local context.

### 3.3 Data Collection

This study's data collection and analysis procedures addressed two complementary sources of information: (1) a content analysis of literature- and framework-derived social sustainability indicators (compiled in an Excel dataset), and (2) an expert validation via a two-round Delphi study (via Google Forms) that collected Likert-scale ratings on the indicators' importance and clarity. The analysis was conducted using Microsoft Excel (for organizing indicators and computing frequencies) and IBM SPSS Statistics (for statistical analysis of Delphi responses, including reliability testing and consensus analysis). Descriptive statistics (mean, median, frequencies, standard deviation, and IQD) were obtained to summarize the data.

### 3.3.1 Analysis of Literature-Derived Indicators (Excel Dataset)

For the literature-derived indicator dataset, the research team organized and synthesized all unique social sustainability indicators identified from the literature review and existing frameworks, categorizing them into a hierarchical structure (main categories, sub-categories, and specific indicators). This compilation was managed in Excel, with sheets summarizing general source information (GENERAL), the combined list of indicators (COMBINED), frequency counts (FREQUENCY), and the final set of unique indicators with coding (UNIQUE INDICATORS). The analysis of this dataset involved several quantitative steps:

- Overview of Frameworks and Tools: First, Chapter 4 summarized the 23 assessment instruments reviewed (19 academic frameworks + 4 neighbourhood tools) and highlighted their characteristics. This included noting each framework's context (e.g., country or region), development purpose, and scope. For example, the thesis notes the geographic distribution of frameworks (Jordan, Egypt, UK, etc.) and whether they rely on subjective vs. objective indicators. These observations set the stage for comparing frameworks.
- Coverage The coverage analysis evaluated the extent to which each of the examined social sustainability frameworks and neighbourhood assessment instruments addressed the full spectrum of social sustainability indicators established in the comprehensive conceptual social sustainability assessment framework (CSSAF). The CSSAF represents a consolidated typology of distinct, non-overlapping indicators derived from the reviewed frameworks and instruments, reflecting a form of consensus on the essential dimensions and indicators of social sustainability. As such, it served as the base reference (or benchmark) for assessing the comprehensiveness and robustness of each tool's indicator structure. In this analysis, the indicators of each framework and

tool were systematically compared against the categories, sub-categories, and direct measurement indicators defined in the CSSAF. The objective was to determine the degree to which each framework or tool captured, either explicitly or conceptually, the categories, sub-categories, and indicators represented in the comprehensive list. The comparison process was conducted using structured frequency tables in Microsoft Excel, where the 5 main categories and 18 sub-categories of the list were positioned along the left column, and the indicators extracted from the 23 examined instruments occupied the top row. Each indicator from the tools was cross-referenced against the corresponding categories and sub-categories to identify coverage overlaps and omissions. Following this mapping process, each framework and instrument was assessed for its alignment with the comprehensive list, revealing how fully it spanned the dimensions and indicators of social sustainability. The coverage analysis was conducted hierarchically across three levels of measurement: the category level (Level 1), which verified representation of the major thematic categories of social sustainability; the sub-category level (Level 2), which identified inclusion of more specific social attributes within each category; and the indicator level (Level 3), which examined whether the framework or tool specified direct measurement indicators corresponding to the CSSAF. Two primary metrics gauged each tool's comprehensiveness: breadth of coverage and depth of coverage. Breadth of coverage captures the range and diversity of categories and sub-categories included within a framework or tool, with broader coverage indicating higher representativeness across the social sustainability construct. Depth of coverage reflects the degree of detail, specificity, and operational clarity within each covered category or sub-category that is, the extent to which a tool defines direct measurement indicators, operational definitions, and measurement instruments at the indicator (Level 3) level. Together,

these metrics offer a dual perspective on how comprehensively (breadth) and how thoroughly (depth) each framework or tool captures the construct of social sustainability. The resulting evidence provided the basis for evaluating the methodological robustness, internal consistency, and overall validity of the examined assessment systems.

- **Frequency Analysis and Semiotic Framework Analysis:** Using Excel, a frequency count was conducted to determine how often each indicator (and each category of indicators) appeared across the surveyed literature and frameworks. For each source (e.g., each journal paper or framework, labelled P1, P2, etc.), the number of indicators falling under each category was tallied. These counts were then aggregated to obtain the total occurrence of each category and each specific indicator across all sources. Descriptive statistics such as the mean, median, and mode of these counts were also calculated to understand the distribution of indicator occurrences across sources (e.g., the average number of indicators per category per source). This frequency analysis provided a quantitative basis for identifying which social sustainability themes are most emphasized in existing studies.
- **Comparative Analysis:** Next, the study compared the frameworks across several dimensions, such as their field/purpose, scope, geographic focus, and how indicators were developed or derived. The analysis identified, for instance, which frameworks came from urban planning versus sustainability certification, which ones focused specifically on gated communities versus general neighbourhoods, and how their indicators were obtained (literature synthesis, adapted tools, Delphi/AHP, etc.). The results of this comparative analysis were compiled and presented in Chapter 4, from table 12 to table 18 that summarized a comparison between different shared attributes

of the examined 23 instruments that concluded with assessing the reliability and validity for the examined instruments

- **Selection Criteria:** To prioritize indicators for inclusion in the assessment framework, a structured three-stage selection process was implemented. The first criterion involved calculating a Selection Score (SS) for each indicator based on its quantitative representation across existing literature and frameworks. This score combined both the normalized breadth (the proportion of sources in which an indicator or category appeared) and the normalized depth (the total frequency of mentions across all sources), producing a composite score via a geometric mean. Indicators with higher SS values were interpreted as more widely accepted and more frequently emphasized, making them strong candidates for inclusion. This first step ensured that the indicator set was grounded in empirical evidence from prior research.

  The second and third selection criteria involved a qualitative review of each indicator's relevance. Each item was assessed using a 1 to 10 scale for both its conceptual relevance to the construct of social sustainability and its specific relevance to the Saudi Arabian gated community context. These two scales added an expert judgment layer that accounted for both theoretical alignment and local applicability. Indicators scoring low on either conceptual or contextual relevance were flagged for potential revision or removal.

  This integrated selection process blending quantitative scoring with qualitative assessments of construct and contextual relevance resulted in a robust, context-sensitive set of indicators. It ensured that the final framework retained only those measures that were both widely supported in the literature and validated by expert judgment for their conceptual integrity and local applicability.

- **Descriptive Summary:** Finally, the results of the content analysis were summarized. Excel was used to produce summary statistics and tables (as seen in the FREQUENCY sheet) that show, for example, the total number of unique indicators identified (the breadth of the pool) and the contribution of each sustainability category to this pool. The frequency table also provided insights such as the percentage of all indicator instances that fell within each main category. This descriptive summary established a foundational understanding of which social sustainability dimensions are most prominent in existing research, thereby justifying their inclusion in the proposed assessment tool.

Throughout the content analysis phase, Microsoft Excel served as the primary tool for data organization and calculation. Its functions (e.g., COUNTIF, SUM, AVERAGE) were utilized to automate the counting of indicator occurrences and to compute the derived metrics (normalized frequencies and selection scores). The use of Excel ensured transparency in how indicators were aggregated and selected, and it allowed easy visualization of the data (through tables and charts, as needed) to support methodological decisions.

### 3.3.2 Delphi Data Analysis (Likert-Scale Ratings)

The second data source consisted of Delphi Round 1 (n = 50 experts) and Delphi Round 2 (n = 30 experts), administered via Google Forms, to validate the proposed indicators in terms of importance and clarity. Experts rated each indicator on a 7-point Likert scale for importance (1 = not important, 7 = extremely important) and for clarity (1 = not clear, 7 = very clear). Responses were exported to CSV/Excel and then imported into IBM SPSS Statistics for analysis.

- **Reliability Testing (Cronbach's Alpha):** Cronbach's alpha was calculated in SPSS to assess the internal consistency of the rating scales (importance and clarity), including

category-level checks where appropriate. Cronbach's alpha is a measure of internal consistency that indicates how closely related a set of items are as a group (in this case, the set of ratings provided by experts). The study computed separate alpha values for the importance scale and the clarity scale, treating each set of indicator ratings as a group of items measuring an underlying concept (overall perceived importance of indicators, and overall clarity of indicators, respectively). A high Cronbach's alpha (value close to 1.0) indicated that experts' ratings were consistent across different indicators. In contrast, a low alpha might indicate divergent opinions or potential issues with certain items. In accordance with common guidelines, α values of 0.70 or above were considered acceptable for a newly developed scale's internal consistency, while values above 0.80 were considered good. This reliability test helped ensure that the Delphi response data was reliable enough to draw further valid conclusions. If Cronbach's alpha for importance or clarity had turned out low, it would have prompted a closer examination of whether certain experts' responses were inconsistent or whether certain indicators might have been interpreted very differently by different experts.

- **Descriptive Statistics (Median, IQD, Mean, and SD):** For each indicator, descriptive statistics were calculated to summarize expert ratings of importance and clarity across the Delphi rounds. The median (Mdn) was used as the primary measure of central tendency, as is appropriate for ordinal Likert-scale data, while the interquartile deviation (IQD)calculated as the difference between the 75th and 25th percentiles was used to assess the level of dispersion and expert consensus, consistent with established Delphi research practices. Indicators with higher median values and lower IQDs were interpreted as reflecting stronger agreement among experts. In addition, the mean and standard deviation (SD) were calculated to provide complementary information on central tendency and variability, facilitating comparison with prior studies that report

parametric summaries. Indicators were subsequently ranked at both the category level and across the overall initial contextualized framework based on their median values (and mean values, where appropriate), allowing the identification of the most and least important indicators. Frequency distributions of responses were also examined (e.g., the proportion of experts assigning high ratings such as 6 or 7) to further assess patterns of agreement. Together, these statistics provided a comprehensive summary of expert judgment, capturing both the central tendency of expert ratings and the degree of consensus within the Delphi process. Based on these statistics, indicators were ranked within their respective categories as well as across the full set of categories.

- **Descriptive Statistic One-Way ANOVA (Inferential Analysis of Expert Ratings):** To test whether expert background characteristics influenced ratings, a one-way Analysis of Variance (ANOVA) was conducted in SPSS. Grouping variables included profession (e.g., architect, planner, academic/practitioner), sector (public/private/academic), and bands of years of experience (e.g., 0–5, 6–10, 11+). The dependent variables were (a) per-indicator importance scores and (b) composite scores (e.g., mean importance within each main category, and an overall importance composite) to reduce multiple testing. Parallel analyses were performed for clarity scores. Assumption checks preceded ANOVA: (i) normality of residuals (Shapiro–Wilk test, Q–Q plots) and (ii) homogeneity of variances (Levene's test). If assumptions held, standard one-way ANOVA was used with Tukey's HSD for post-hoc comparisons. If homogeneity was violated, Welch's ANOVA was reported with Games–Howell post-hoc tests. If normality was clearly untenable for a comparison, the non-parametric Kruskal–Wallis test was applied with Dunn–Bonferroni pairwise follow-ups. Effect sizes accompanied all tests ($\eta^2$ or $\omega^2$ for ANOVA/Welch; $\varepsilon^2$ or $\eta^2$ alternatives for Kruskal–Wallis), with 95% confidence intervals where available. Final

inferences were drawn once the target sample was reached. To control family-wise error across multiple indicators, two strategies were used: (1) focusing on category-level composites wherever feasible; and (2) applying a false discovery rate (Benjamini–Hochberg) adjustment to p-values when running multiple ANOVAs on individual indicators**.**

- **Pearson Correlation (Quantitative):** For the quantitative data obtained from the Delphi responses, statistical analysis explored the relationships and patterns in experts' ratings of the framework's five main categories. Correlation analysis was conducted to identify how different categories related to each other across the expert responses. By calculating pairwise correlation coefficients (e.g., Pearson's r) between category mean scores, the study could detect whether certain domains tended to be rated similarly by experts. Strong positive correlations would suggest that those categories were capturing related concepts or influencing each other, whereas a lack of correlation (or negative correlation) would indicate that the categories addressed distinct aspects of social sustainability. This approach provided empirical insight into the interconnections among the categories, helping to reveal any redundant measures or unexpected relationships in the framework. Identifying high correlations was analytically valuable because it could signal overlapping content, allowing the researcher to consider consolidating or re-weighting such indicators for a more parsimonious assessment tool. Conversely, uncorrelated or inversely correlated categories highlighted dimensions that stood independently or in tension insights equally important for a comprehensive framework. Overall, the correlation analysis added rigor to the development of the assessment tool by quantitatively validating the structure of the indicators and informing potential refinements based on empirical relationships.

- **Thematic Analysis of Qualitative Feedback (Qualitative)**: In parallel with the quantitative analysis, the research utilized thematic analysis to systematically examine the open-ended qualitative feedback from the Delphi experts. These open-ended questions invited experts to provide suggestions in their own words for example, recommending additional indicators, proposing the removal of less relevant ones, or commenting on the overall framework structure and content. Thematic analysis is a well-established method for analysing qualitative data by identifying recurrent themes or patterns of meaning within textual responses. In this study, all expert comments were reviewed and coded to capture the essence of each suggestion or critique. The researcher first familiarized themselves with the data and generated initial codes for each meaningful piece of feedback. Similar codes were then grouped and refined into broader themes that encapsulated the main ideas emerging from the experts' insights. Essentially, this approach grouped open-ended feedback into patterns or themes to understand the common threads in what experts were saying and why. For instance, multiple experts might independently suggest adding a particular indicator related to "community engagement" these would be coded and later unified under a theme of *Missing Community Engagement Indicators*. Likewise, if several comments questioned the clarity of the framework's categories, they might form a theme around *Framework Structure Clarity*. Through iterative review, themes were defined and named to accurately reflect the experts' collective feedback. Crucially, the analytical value of the thematic analysis lay in how these emergent themes would inform the refinement of the assessment tool. By distilling a wide array of individual suggestions into a manageable set of themes, the research identified which potential modifications carried broad support or addressed common concerns. Themes derived from the experts' qualitative input directly highlighted areas for improvement for example, a theme pointing to a

lack of indicators for Social Inclusion signalled the need to incorporate additional measures covering inclusion in the next iteration of the framework. In this way, the thematic findings served as a bridge between expert experience and framework development. They ensured that the experts' nuanced insights were translated into actionable enhancements. Moreover, the thematic analysis complemented the quantitative results: while correlation and ANOVA analyses quantified patterns in the ratings, the qualitative themes explained why certain aspects might need change or how experts perceived the framework's strengths and weaknesses. By using thematic analysis rigorously (with clear documentation of coding decisions and theme development), the study added credibility to the incorporation of expert feedback. The resulting set of themes covering suggestions to add, remove, or adjust indicators and structural elements was used to guide the refinement of the social sustainability assessment tool, thereby strengthening its content validity and practical relevance before finalizing the framework for gated communities in Saudi Arabia.

In summary, both Excel and SPSS were utilized to conduct a comprehensive analysis of the data collected. Excel facilitated the initial content analysis and indicator selection process (through frequency counts and selection scoring), ensuring that the tool's development was grounded in evidence from literature. SPSS was then used to analyse the Delphi response data, providing statistical rigor in evaluating the tool's reliability and validity. By combining descriptive statistics, reliability metrics (Cronbach's alpha), and consensus measures (median and IQD), the study's methodology established a robust analytical foundation. This ensured that the resulting social sustainability assessment tool for gated communities was not only comprehensive in content (covering indicators identified in prior research) but also empirically validated by expert judgment for clarity and importance. The multi-step data analysis approach

strengthened the credibility of the research findings and the usefulness of the developed tool for future practical applications.

### 3.4 Summary of the Methodology

In summary, this study employed a triangulated, multi-method research design to develop and validate a contextualized social sustainability assessment framework for Saudi Arabian gated communities. Each phase of the methodology contributed essential insights and served to cross-verify the findings of the others. The literature review (Phase 1) established a theoretical and empirical foundation by gathering a broad spectrum of potential indicators from existing knowledge and best practices. The content analysis (Phase 2) provided a quantitative backbone to the framework, narrowing down the indicators through objective criteria and ensuring that the selection was backed by evidence from numerous sources. Finally, the two-round Delphi technique (Phase 3) provided practical validation, confirming contextual relevance and refining indicator wording and structure through iterative expert feedback. Quantitative analysis incorporated reliability testing (Cronbach's alpha) and consensus measures (median and IQD) to support transparent indicator retention and revision decisions.

By integrating these approaches, the research achieved a high degree of rigor and reliability. Methodological triangulation using multiple methods and data sources strengthened the validity of the results, as biases or limitations inherent in one method were mitigated by the others. For instance, literature-derived indicators were vetted against actual usage in prominent frameworks (addressing the gap between theory and practice), and both were subsequently vetted by professionals (addressing contextual appropriateness). This convergence of evidence from academic, empirical, and experiential sources enhances confidence in the final set of indicators. "Triangulation was achieved by analysing the frequency, relevance, and adaptability of indicators across multiple sources for comparison and validation," as one recent

study similarly noted. In our research, the multi-phase design ensured that no important indicator was overlooked and that each chosen indicator was defensible on multiple grounds.

Moreover, the mixed-methods approach improved the reliability of the framework development process. The content analysis introduced quantitative consistency (e.g., through normalization and scoring), and the expert review added inter-subjective agreement, which together reduced the chance that the results were an artifact of a single method or researcher bias. Any individual method might have omitted or misjudged certain indicators, but the combination provided checks and balances. The result was a contextually tailored framework that was both grounded in global sustainability discourse and fine-tuned to local needs.

In conclusion, the methodology described in this chapter enabled the creation of a robust social sustainability indicator framework for gated communities in Saudi Arabia. The subsequent chapters built on this foundation: presenting the developed framework, analysing its application, and discussing its implications. The multi-method approach from literature synthesis to empirical analysis to expert validation was instrumental in ensuring the framework's comprehensiveness, relevance, and credibility. This rigor in methodology directly contributes to the trustworthiness of the research outcomes and their value for future policy and practice. The following chapter presented the results of applying this methodology, including the comparative analysis of frameworks and the development of the finalized contextualized assessment framework.

# CHAPTER 4

# RESULTS AND DISCUSSION

This chapter presented the results and findings of the study on social sustainability in gated communities in Saudi Arabia. In addition to describing the Delphi Technique rounds and ensuring data reliability, the chapter presented findings from the literature-based review and content analysis of 19 existing social sustainability frameworks and 4 neighbourhood assessment tools. It then introduces the development of the proposed initial contextualized social sustainability assessment framework derived from this review. The study employed a two-round Delphi technique (Round 1 with 50 experts and Round 2 with 30 experts) to gather expert insights for further refinement. Descriptive statistics such as mean, median, standard deviation, and interquartile deviation (IQD) were used to summarize the expert survey data, while the survey instrument's reliability was assessed using Cronbach's alpha. Furthermore, analysis of variance (ANOVA) was conducted to test for significant differences among respondent groups, adding inferential depth to the analysis. This chapter is concluded by introducing the finalized version of the proposed measurement assessment framework for assessing social sustainability within gated communities.

## 4.1 The examined frameworks and tools

Tables 10 summarized the examined sample of frameworks and neighbourhood assessment instruments along with their general data. The sample comprises a total of 23 instruments, 19 academic frameworks and 4 neighbourhood assessment instruments, all of which are indicator-based models designed to evaluate social sustainability dimensions.

Table 11 summarizes the analytical sample. Part A lists the 19 peer-reviewed academic indicator sources (I1–I19), including their bibliographic sources, geographic contexts, and indicator counts. Part B summarizes the four neighborhood/community rating tools. Table 3 reports the instrument typology used in this study (Types A–C) to avoid conceptual conflation between conceptual frameworks, empirical indicator applications, and certification-oriented standards.

Role of Type B sources. Type B publications are empirical studies that *apply* or *test* social sustainability indicators rather than proposing validated assessment instruments. In this study, Type B sources were used only as indicator repositories to expand the initial indicator pool; they were not treated as benchmarks, and no validity status was assumed or transferred from these studies to the CSSAF.

***Table 10:*** *Analytical Sample of selected 23 instruments*

| Code | Source Name | Country | No. of Indicators | Type |
|---|---|---|---|---|
| **P1** | Social Sustainability in Gated Communities Versus Conventional Communities: The Case of Amman. (Abed, Mabdeh, & Nasser (2022)) | Jordan | 29 | Type B |
| **P2** | The Social Dimension of Sustainable Development: Defining Urban Social Sustainability. (Dempsey et al. (2011)) | United Kingdom | 27 | Type A |
| **P3** | Effects of urban form on social sustainability: A case study of Irbid, Jordan. (Ali, Betawi, & Alqudah (2019)) | Jordan | 40 | Type B |
| **P4** | Residents' responses to social interactions and social sustainability in gated communities of the Greater Cairo Region. (Khamis et al. (2023)) | Egypt | 36 | Type B |
| **P5** | The triad of social sustainability: Defining and measuring social sustainability of urban neighborhoods. (Shirazi & Keivani (2019)) | United Kingdom | 77 | Type A |
| **P6** | Understanding and measuring social sustainability. (Woodcraft (2015)) | United Kingdom | 23 | Type A |
| **P7** | Social Sustainability: A New Conceptual Framework. (Eizenberg & Jabareen (2017)) | Palestine | 14 | Type A |
| **P8** | Neighborhood Sustainability Assessment: Evaluating Residential Development Sustainability in a Developing Country Context. (Yigitcanlar, Kamruzzaman, & Teriman (2015)) | Malaysia | 8 | Type A |
| **P9** | Assessing the effect of urban form on social sustainability: a proposed 'Integrated Measuring Tools Method' for urban neighborhoods in Dubai. (Alipour & Galal Ahmed (2021)) | United Arab Emirates | 34 | Type B |
| **P10** | Evaluating social sustainability in Jordanian residential neighborhoods: a combined expert-user approach. (Sharif et al. (2022)) | Jordan | 70 | Type A |
| **P11** | Assessing urban social sustainability with the Place Standard Tool: Measurement, findings, and guidance. (Mouratidis et al. (2024)) | Denmark | 14 | Type B |
| **P12** | Implementing the Integrated Social Sustainability Assessment to Norway: A Citizen-Centric and Expert-Weighted Approach. (Akbarinejad, Salaj, & Johansen (2023)) | Norway | 34 | Type A |
| **P13** | Developing Social Sustainability Criteria and Indicators in Urban Planning: A Holistic and Integrated Perspective. (Atalay & Gülersoy (2023)) | Turkey | 40 | Type A |

| | | | | |
|---|---|---|---|---|
| **P14** | A proposed model for evaluating social sustainability in gated communities in Egypt using the network analysis process: Madinaty case study. (Abd El-Hafez, Elminiawy, & Eraqi (2025)) | Egypt | 13 | Type A |
| **P15** | The Evolution of the Sustainability Assessment Tool SBToolPT: From Buildings to the Built Environment. (Castanheira & Bragança (2014)) | Portugal | 15 | Type A |
| **P16** | Systematic development of SUCCEED: urban sustainability assessment tool for developing countries (Nigeria focus). (Momoh et al. (2021)) | Nigeria | 27 | Type A |
| **P17** | Social criteria to develop an in-use holistic urban sustainable assessment tool: UHU2SAT. (Sánchez Cordero et al. (2021)) | Spain | 21 | Type A |
| **P18** | Ranking of Sustainability Indicators for Assessment of the New Housing Development Projects: Case of the Baltic States. (Tupenaite et al. (2017)) | Lithuania | 15 | Type A |
| **P19** | Social Sustainability and New Communities: Moving from concept to practice in the UK. (Woodcraft (2012)) | United Kingdom | 13 | Type A |

(A) 19 peer-reviewed academic indicator sources

| Code | Name | Country | No. of Indicators (SS) | Type |
|---|---|---|---|---|
| **P20** | LEED v4 for Neighbourhood Development (LEED-ND) | USA | 15 | Type C |
| **P21** | LEED cities and communities | USA | 10 | Type C |
| **P22** | MOSTADAM for Communities (Design + Construction) | KSA | 13 | Type C |
| **P23** | Building Research Establishment Environmental Assessment Method Communities | UK | 17 | Type C |

(B) Neighbourhood/community rating tools

***Table 11****: Instrument typology of analyzed academic indicator sources (I1–I19) and neighborhood/community rating tools.*

| Type | Meaning / Intent | No. of Instruments | % |
|---|---|---|---|
| **Type A** | Conceptual frameworks / indicator taxonomies (define dimensions/criteria + how to measure) | 14 | 60.87% |
| **Type B** | Empirical studies using indicator sets (apply indicators to a case; not a reusable framework) | 5 | 21.74% |
| **Type C** | Formal rating systems (auditable, certification-ready standards) | 4 | 17.39% |

The reviewed sustainability instruments span a wide range of geographic contexts and exhibit considerable variability in scope. They include context-specific academic frameworks developed for cities and neighbourhoods in Jordan, Egypt, Turkey, Malaysia, Nigeria, and beyond, as well as formal assessment tools originating from the USA, UK and other countries. Most of the academic frameworks were tailored to local priorities in urban planning, architecture, or community development, which underscores their context-dependency. For example, some scholarly studies focus narrowly on the social dimension of sustainability (in a few cases employing as few as two broad categories of social indicators), whereas others attempt a comprehensive coverage with dozens of criteria. Notably, a few recent academic tools SUCCEED-ND in Nigeria, RIA, and the Portuguese SBToolPT stand out for their very

high number of indicators or categories, in some cases exceeding one hundred individual measures, reflecting an ambitious all-encompassing approach.

By contrast, the formal neighbourhood assessment tools (such as LEED-ND and BREEAM Communities) are more standardized and designed for broad application, though they differ in their treatment of social sustainability. Some of these established rating systems delineate explicit social or socio-economic categories (for instance, BREEAM Communities includes criteria for community wellbeing), while others (e.g. LEED-ND) emphasize environmental and physical planning aspects and address social factors more indirectly. The indicator counts in the formal tools vary a few national or specialized frameworks as well (for example, Saudi Arabia's Mostadam for communities) enumerate several dozen credits, whereas more streamlined systems might define only a handful of key categories. Overall, the set of instruments examined ranges from extremely succinct frameworks with only a couple of indicators up to expansive tools with well over a hundred, highlighting the diverse and context-driven nature of neighbourhood sustainability assessment methods.

## 4.2 Evaluating the Existing Assessment Tools Based on Shared Features

### 4.2.1 Coverage analysis: assessing validity and reliability

***Description of analysed social sustainability assessment instruments.***

The four formal rating systems (Type C) include BREEAM Communities (UK), LEED v4 for Neighborhood Development (USA), LEED for Cities & Communities (USA), and MOSTADAM Communities (Saudi Arabia). These instruments represent institutional attempts to translate social sustainability into auditable, certification-oriented standards, typically positioned to support policy goals and national development agendas. MOSTADAM Communities reflects alignment with Saudi governance and planning priorities (often

discussed in relation to Saudi Vision 2030), while LEED and BREEAM emphasize standardized criteria intended for use across multiple contexts.

By contrast, the academic sample (I1–I19) is dominated by research-driven indicator development, and it spans two distinct purposes captured in Table 3's typology. Type A instruments (n=14; 60.87%) function as conceptual frameworks or indicator taxonomies, defining dimensions/criteria and suggesting methods of measurement (e.g., Dempsey et al., 2011; Shirazi & Keivani, 2019; Woodcraft, 2015). Type B instruments (n=5; 21.74%) are empirical applications, where indicator sets are assembled and applied to specific cases rather than proposed as transferable assessment frameworks (e.g., Abed et al., 2022; Ali et al., 2019; Khamis et al., 2023; Alipour & Galal Ahmed, 2021; Mouratidis et al., 2024). This distinction is important because treating empirical applications as transferable frameworks can overstate instrument authority and distort interpretation of the consolidated content domain.

Across the academic instruments, development is largely context-specific, shaped by local priorities, stakeholder input, and data constraints rather than a single shared theoretical model. This helps explain the wide variation in indicator counts (from 8 in I8 to 77 in I5): many studies tailor indicators to what measurable and salient in-place is, which can improve local relevance but often reduces external validity and limits transferability. This pattern indicates that many studies tailor indicators to local salience and data availability, which can improve contextual relevance but may reduce external validity and limit transferability across settings.

Geographically, the sample shows broad coverage with particularly strong representation from the MENA region (Jordan: I1, I3, I10; Egypt: I4, I14; Palestine: I7; UAE: I9) and Europe, especially the United Kingdom (I2, I5, I6, I19, plus BREEAM Communities), alongside Portugal (I15), Spain (I17), Norway (I12), Lithuania/Baltic states (I18), and

Denmark (I11). Additional contributions include Malaysia (I8), Nigeria (I16), and Turkey (I13).

The results of the coverage analysis are presented in the heatmap in Table 12, which shows the distribution of indicators across CSSAF categories and subcategories for each instrument. Each cell reports the number of indicators mapped to a given CSSAF element within an instrument. The final two columns of Table 12 summarize diagnostic coverage properties at the CSSAF element level: breadth, defined as the number of instruments that include at least one indicator mapped to that element, and depth, defined as the total number of mapped indicator instances across all instruments. Figure 14 provides a 3-stage overview of the CSSAF crosswalk, showing how indicator content flows from CSSAF categories through instruments to subcategories.

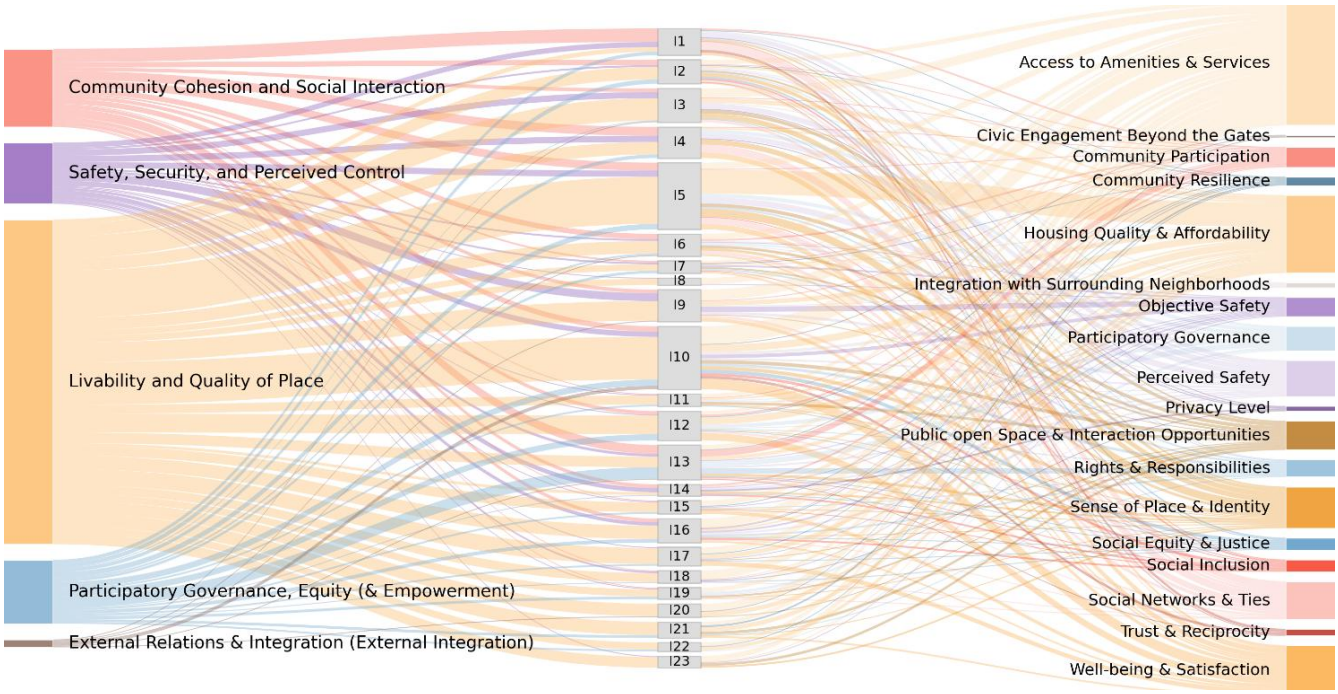


***Figure 14:*** *Sankey diagram showing the mapping from CSSAF categories to instruments and subcategories*

***Table 12:*** *Results of coverage analysis of the 19 peer-reviewed academic indicator sources and 4 Neighborhood rating tools (23 Instrument)*

| CSSAF | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 | P14 | P15 | P16 | P17 | P18 | P19 | P20 | P21 | P22 | P23 | Breadth | Depth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 Social Networks & Ties | 9 | 2 | 3 | 9 | 7 | 4 | 0 | 0 | 3 | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 12 | 43 |
| 1.2 Community Participation | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 1 | 0 | 1 | 2 | 7 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 24 |
| 1.3 Social Inclusion | 1 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 1 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 14 |
| 1.4 Trust & Reciprocity | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 8 |
| 2.1 Objective Safety | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 6 | 3 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 9 | 17 |
| 2.2 Community Perceived Safety | 5 | 2 | 6 | 6 | 7 | 2 | 0 | 1 | 3 | 3 | 1 | 1 | 2 | 2 | 0 | 3 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 16 | 46 |
| 2.3 Privacy Level | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 6 |
| 3.1 Access to Amenities & Services | 0 | 5 | 10 | 0 | 7 | 6 | 2 | 7 | 12 | 20 | 4 | 4 | 5 | 0 | 6 | 10 | 7 | 9 | 5 | 8 | 4 | 6 | 4 | 20 | 141 |
| 3.2 Public open Space & Interaction Opportunities | 0 | 2 | 4 | 0 | 4 | 3 | 2 | 0 | 1 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 3 | 3 | 13 | 33 |
| 3.3 Housing Quality & Affordability | 0 | 2 | 5 | 2 | 27 | 0 | 1 | 0 | 5 | 7 | 2 | 8 | 4 | 1 | 0 | 2 | 5 | 2 | 0 | 5 | 4 | 1 | 5 | 18 | 88 |
| 3.4 Well-being & Satisfaction | 3 | 1 | 0 | 7 | 7 | 2 | 2 | 0 | 4 | 12 | 0 | 8 | 0 | 0 | 4 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 59 |
| 3.5 Sense of Place & Identity | 2 | 4 | 6 | 6 | 9 | 3 | 0 | 0 | 0 | 4 | 1 | 1 | 3 | 2 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 2 | 1 | 16 | 47 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **4.1 Participatory Governance** | 1 | 1 | 0 | 4 | 4 | 2 | 0 | 0 | 0 | 0 | 1 | 4 | 6 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 10 | 27 |
| **4.2 Social Equity & Justice** | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 10 | 14 |
| **4.3 Rights & Responsibilities** | 1 | 1 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 3 | 0 | 1 | 6 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 20 |
| **4.4 Community Resilience** | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 8 | 9 |
| **5.1 Integration with Surrounding Neighborhoods** | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 6 |
| **5.2 External Civic Engagement** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 3 |
| **Grand Total** | 29 | 27 | 38 | 36 | 76 | 25 | 14 | 8 | 36 | 70 | 14 | 34 | 39 | 13 | 15 | 27 | 21 | 15 | 13 | 15 | 10 | 13 | 17 | 193 | 605 |

Selected results of the coverage analysis were further illustrated in Figures 15 and 16, where breadth of coverage was expressed as a percentage relative to the CSSAF. Figure 15 presented breadth of coverage at the category level, referred to as *comprehensiveness of coverage*. The y-axis in Figure 15 represented the percentage of CSSAF categories addressed by each instrument relative to the total number of categories in the CSSAF. A value of 100% indicated comprehensive coverage of all CSSAF categories, while the height of each bar represented the proportion of categories included in instrument.

Figure 16 illustrated breadth of coverage at the subcategory level, referred to as *representativeness of coverage*, also expressed as a percentage relative to the CSSAF. In Figure 7, the y-axis represented the percentage of CSSAF subcategories addressed by each instrument relative to the total number of subcategories in CSSAF. A value of 100% indicated complete representativeness, meaning that all CSSAF subcategories were covered, while the height of each bar represented the proportion of subcategories included in a specific instrument.

Table 15 presented the results of the depth-of-coverage analysis at both the category and sub-category levels. Specifically, it reported the percentage of CSSAF categories and subcategories that were covered by zero, one, two, or three and more indicators in each instrument thereby providing a detailed view of measurement intensity and indicator concentration across instruments.

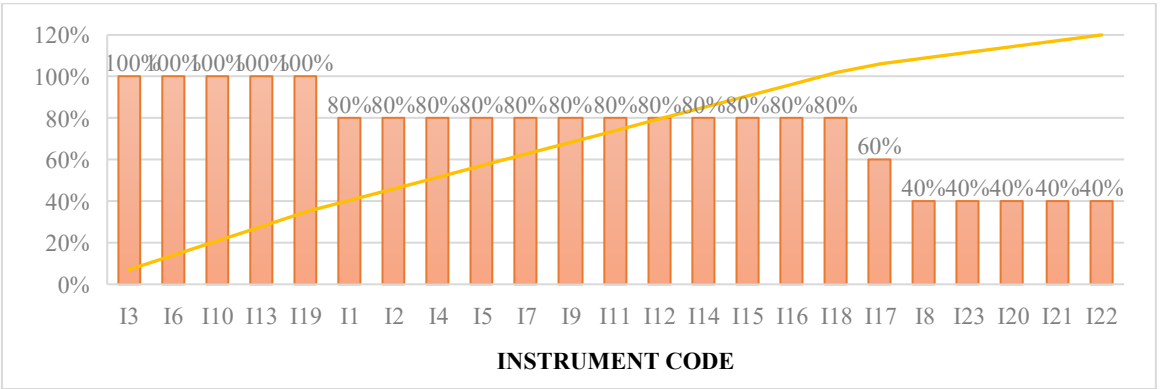


***Figure 15:*** *Breadth of Coverage at Category Level*

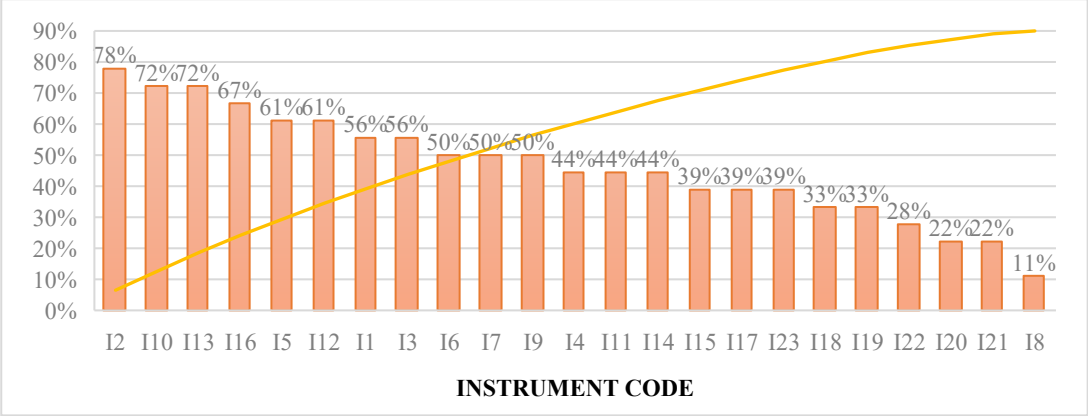


***Figure 16:*** *Breadth of Coverage at Sub-Category Level*

As described in Methodology Section, similarity was computed using Jaccard similarity on a binary presence/absence matrix of CSSAF indicators. A Tool similarity analysis was conducted to examine overlap in social sustainability indicator coverage across 23 instruments using the consolidated set of 213 unique indicators. A binary presence/absence matrix (1 = indicator present in an instrument; 0 = absent) was constructed and pairwise similarity was computed using Jaccard similarity.

Across all instruments, pairwise similarity values were generally low (mean J = 0.096, median J = 0.091, range 0.000–0.403), indicating limited shared indicator coverage. Notably, 20 of 253 instrument pairs (7.9%) exhibited zero overlap (J = 0.000), and 23.7% of pairs fell below J < 0.05, further demonstrating fragmentation in operational coverage. The strongest overlap was observed between I4 and I5 (J = 0.403), followed by I18 and I8 (J = 0.273) and I11 and I12 (J = 0.259) (Table 13).

***Table 13:*** *Highest pairwise overlaps among instruments (Top 10), Jaccard similarity*

| Rank | Instrument A | Instrument B | Jaccard similarity |
|---|---|---|---|
| 1 | P4 | P5 | 0.403 |
| 2 | P18 | P8 | 0.273 |
| 3 | P11 | P12 | 0.259 |

| | | | |
|---|---|---|---|
| 4 | P19 | P6 | 0.24 |
| 5 | P14 | P2 | 0.222 |
| 6 | P6 | P9 | 0.22 |
| 7 | I21 | P17 | 0.217 |
| 8 | P17 | P18 | 0.217 |
| 9 | P11 | P14 | 0.211 |
| 10 | P17 | P9 | 0.211 |

Focusing on the four formal neighbourhood rating tools (LEED-ND, LEED-CI-COM, MOSTADAM-C, and BREEAM-COM), similarity remained low (pairwise J = 0.080–0.160; Table 14). The highest overlap was between LEED-ND and BREEAM-COM (J = 0.160), whereas LEED-ND and MOSTADAM-C showed the lowest similarity (J = 0.080).

Hierarchical clustering (average linkage on Jaccard distance) indicated small "families" of instruments with comparatively higher overlap. Using a conservative similarity threshold (J ≥ 0.15), the most evident groupings included {I2, I11, I12, I14, I16, I17, I20, I21, I6, I9, I19}, {I10, I23}, {I8, I18}, and {I4, I5}, while I22 did not form a stable grouping under this threshold.

***Table 14.*** *Jaccard similarity among neighbourhood rating tools based on presence/absence of the 213 unique CSSAF indicators.*

| | **P20** | **P21** | **P22** | **P23** |
|---|---|---|---|---|
| **P20** | 1 | 0.143 | 0.08 | 0.16 |
| **P21** | 0.143 | 1 | 0.095 | 0.087 |
| **P22** | 0.08 | 0.095 | 1 | 0.12 |
| **P23** | 0.16 | 0.087 | 0.12 | 1 |

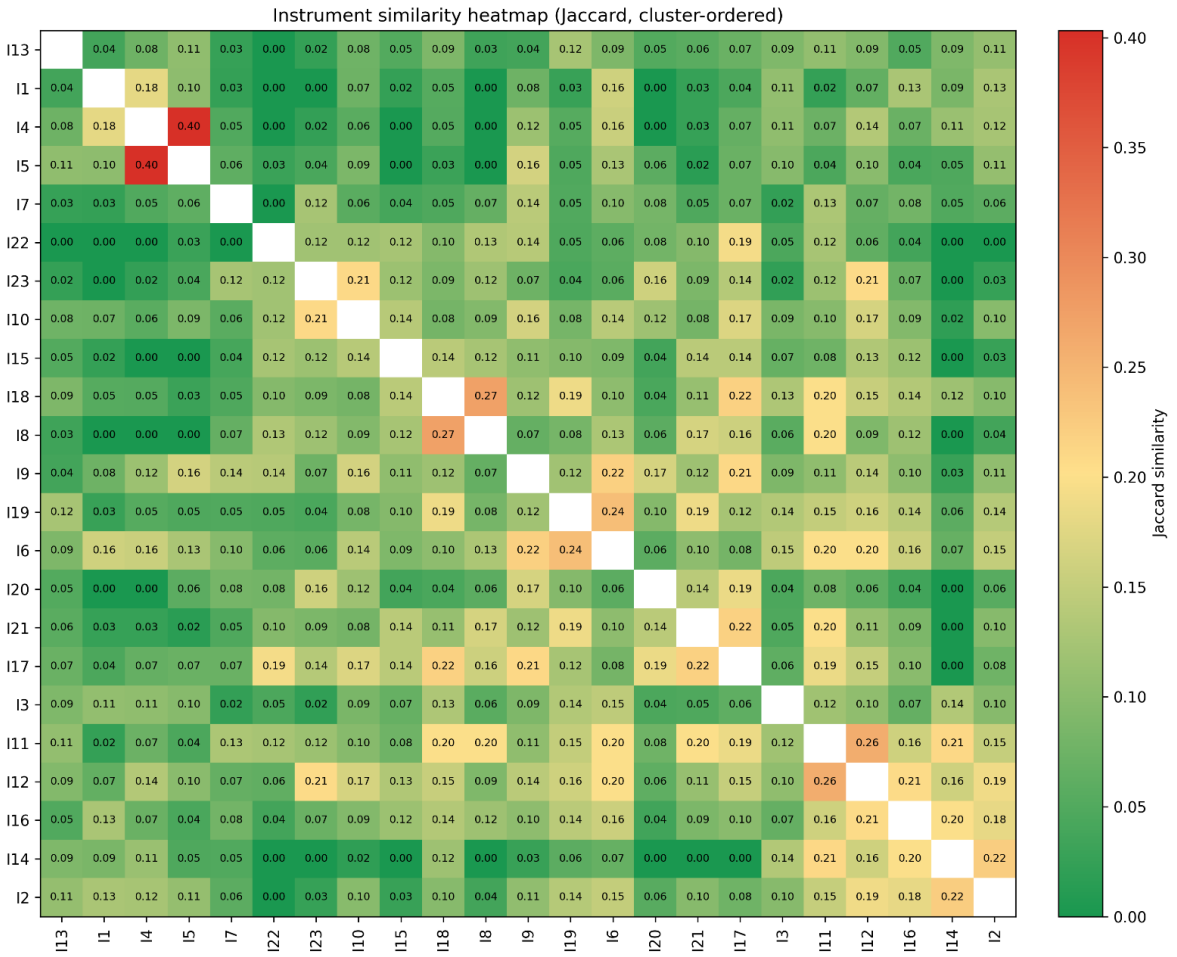


***Figure 17:*** *Instrument similarity heatmap (cluster-ordered).*

Cluster-ordered heatmap of pairwise Jaccard similarity (0–1) across 23 instruments based on binary presence/absence of 213 unique indicators as shown in figure 17 and figure 18. Higher values indicate greater overlap in indicator coverage. Hierarchical clustering of instruments using average linkage on Jaccard distance (1 − similarity). Shorter branch distances indicate higher overlap in indicator coverage.

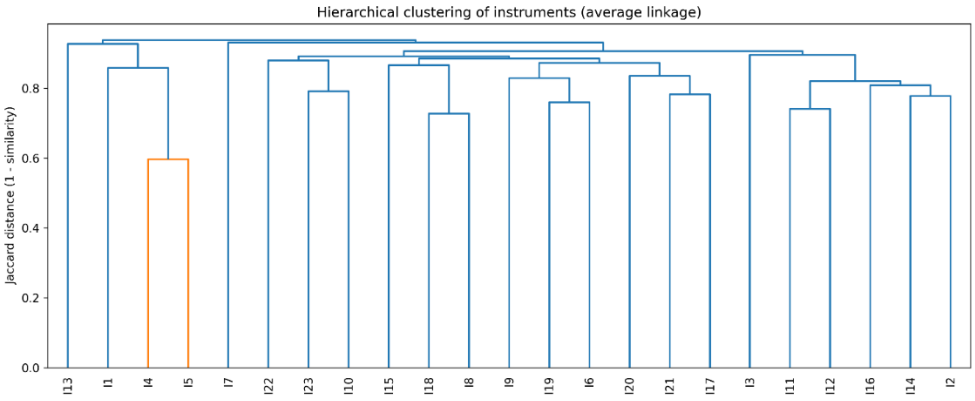


***Figure 18.*** *Hierarchical clustering dendrogram of instruments.*

## Optimal number of indicators

The sample exhibited wide dispersion in the number of social indicators employed by each assessment instrument. Among the 19 academic frameworks, indicator counts ranged from 8 (P8/NSA) to 77 (P5/TSS), with a median of 27. The four neighbourhood development assessment instruments showed narrower but still notable variation, with indicator counts of 10 (LEED-CI-COM), 13 (MOSTADAM-C), 15 (LEED-ND), and 17 (BREEAM-COM), and a median of 14. Across all 23 instruments combined, the range extended from 8 to 77 indicators (median = 21), indicating that the most extensive framework employed approximately ten times as many indicators as the most concise one.

In aggregate, the review identified 605 indicator instances that consolidated into 213 unique CSSAF indicators, highlighting limited convergence around a common indicator set. Individual tools utilized only a small subset of this overall indicator universe. For example, expansive research-oriented frameworks such as P5 (77 indicators) and P10 (70 indicators) contrasted with more streamlined designs such as P8 (8 indicators), reflecting differences in objectives, contextual focus, and data requirements. Certification-oriented systems, including BREEAM-COM, LEED-ND, and MOSTADAM-C, tended to maintain smaller, more

auditable indicator sets, whereas academic frameworks expanded their scope to capture more nuanced social processes.

This heterogeneity indicated that the examined instruments were not merely abbreviated or extended versions of a shared core framework but rather emphasized different social sustainability facets. The limited overlap in specific indicators, combined with uneven balances of breadth and depth, posed challenges for validity, reliability, and cross-tool comparability. Based on the observed distribution, the study suggested that a practical operating range of approximately 15–30 well-defined Level 3 indicators would support general application, with higher indicator counts being justified only when analytical capacity and data quality were sufficient to support them, thereby balancing comprehensiveness with feasibility and reproducibility.

**Convergence on a common set of used indicators**

The analysis revealed a critical lack of consensus around a core set of indicators for social sustainability assessment. This finding was clearly illustrated by the distribution of the 605 individual indicator instances across the 213 unique indicators of the Comprehensive Conceptual Social Sustainability Assessment Framework (CSSAF). Among the 23 analysed frameworks and tools, most unique indicators 71% (151 indicators) were used in only a single tool, while an additional 12% (26 indicators) appeared in just two tools. Consequently, 83% (177 indicators) of the entire CSSAF indicator set was considered essential by two or fewer tools, reflecting highly idiosyncratic and non-standardized measurement approaches.

In contrast, only 17% (36 indicators) were used in three or more tools. This limited subset indicated a weak and emergent consensus regarding indicators that might represent core components of the social sustainability construct. Repeated inclusion of an indicator across

multiple tools strengthened its claim to validity and reliability; therefore, the small number of indicators achieving such recurrence underscored the extent of fragmentation within the field.

This pronounced fragmentation suggested that existing assessment tools were largely measuring different social sustainability constructs rather than a shared conceptual foundation. The low level of indicator overlap challenged the convergent validity and inter-instrument reliability of current frameworks. In practical terms, this explained why the same urban development could be evaluated differently across tools, as each instrument prioritized distinct social attributes. The absence of a standardized indicator core significantly undermined the comparability, consistency, and practical applicability of social sustainability assessment outcomes.

**Breadth of coverage**

The breadth of coverage for each assessment tool was assessed at both the category and subcategory levels.

***Breadth of coverage at Category level***.

In this study, breadth of coverage at the category level (first-level indicators) was defined as the percentage of categories included in each tool relative to the five categories of the Comprehensive Social Sustainability Assessment Framework (CSSAF). This measure was used to evaluate whether an assessment instrument functioned as a comprehensive tool capable of capturing the key multidimensional components of social sustainability, and it therefore served as an indicator of comprehensiveness of coverage at this level. The highest level of comprehensive coverage was achieved when a tool encompassed all categories defined in the CSSAF, whereas non-comprehensive coverage occurred when one or more of the five core categories were entirely omitted. The results of the category-level coverage analysis were presented in Figure 15.

The analysis of breadth of coverage across all CSSAF categories revealed substantial variation in the extent to which the examined instruments and frameworks captured the social sustainability construct. As illustrated in Figure 15, the performance of the 23 analysed tools ranged from fully comprehensive to severely limited coverage.

Only four of the 23 tools (P3, P10, P13, and P16) demonstrated full comprehensive coverage, including all five core social sustainability categories (100%). An additional six tools (P1, P5, P9, P12, P14, and P19) exhibited adequate coverage, incorporating 80% of the categories (four out of five).

Most of the examined tools exhibited low or very low levels of comprehensive coverage. Ten frameworks covered only 60% (three out of five) or 40% (two out of five) of the CSSAF categories. All neighbourhood development assessment instruments BREEAM-COM, LEED-ND, LEED-CI-COM, and MOSTADAM-C fell within this group, each covering only 40% of the defined categories.

Most notably, three frameworks (P2, P6, and P18) demonstrated a severe lack of comprehensiveness, including indicators from only a single category (20%). As a result, frameworks such as P2 and P6 entirely omitted four of the five core social sustainability dimensions, including key aspects such as liveability, governance, and external integration, which were identified as essential within the consolidated CSSAF conceptual model.

This pronounced lack of comprehensive coverage across many tools raised significant concerns regarding their validity as multidimensional assessment instruments. The finding that an assessment tool could purport to measure social sustainability while addressing only one or two of its five core dimensions fundamentally challenged the robustness of such instruments and their capacity to support holistic urban development evaluation

***Breadth of coverage at Sub-Category level***.

The breadth of coverage at the subcategory level was used as a metric to evaluate whether an assessment instrument addressed all second-level components considered essential to the social sustainability construct. This measure served as an indicator of the representativeness of coverage of each assessment tool. In this study, representativeness of coverage at the subcategory level was quantified as the percentage of subcategories included in a given tool relative to the 18 subcategories defined within the Comprehensive Social Sustainability Assessment Framework (CSSAF). This metric assessed the extent to which each instrument captured the full range of detailed attributes within the hierarchical measurement model. The results of the subcategory-level coverage analysis across the 23 examined instruments were presented in Figure 16.

The findings revealed a severe deficiency in representativeness at the subcategory level across the examined field. As illustrated in Figure 13, none of the analysed tools covered more than 61% of the defined subcategories, and the majority covered less than 40%. Only one framework, P10, demonstrated moderate representativeness, including 11 of the 18 subcategories (61.1%). A small group of tools, including P5 (50.0%), P13 (44.4%), P3 (38.9%), and P16 (38.9%), exhibited basic levels of representativeness.

Most frameworks, as well as all neighbourhood development assessment instruments, displayed very low representativeness at the subcategory level. A substantial number of tools covered only between 22.2% and 33.3% of subcategories. The performance of the formal neighbourhood development assessment instruments was particularly limited; LEED-ND covered 22.2% (4 of 18 subcategories), while BREEAM-COM, LEED-CI-COM, and MOSTADAM-C each covered only 16.7% (3 of 18). Most notably, frameworks P6 and P8 demonstrated a critical lack of coverage, representing only 11.1% (2 of 18) of the defined subcategories.

This widespread inadequacy in subcategory-level coverage indicated that, although some tools appeared comprehensive at higher levels of aggregation, they consistently lacked the granularity required for robust and detailed assessment. The near absence of indicators addressing subcategories such as Trust and Reciprocity, Community Resilience, and External Integration across most tools highlighted significant blind spots in current approaches to social sustainability measurement.

**Comprehensiveness vs Representativeness of coverage**

The comparison between comprehensiveness of coverage (category-level) and representativeness of coverage (subcategory-level) revealed a clear pattern of superficial measurement within existing social sustainability assessment tools. At the category level, performance varied considerably across instruments: four of the 23 analyzed tools achieved high comprehensiveness by covering all five categories (100%), while six tools demonstrated adequate coverage, including 80% of the categories. In contrast, many tools (13 of 23) exhibited low to very low levels of comprehensive coverage, addressing only 20–60% of the core social sustainability categories.

By comparison, representativeness of coverage at the subcategory level was consistently deficient across all examined instruments. No tool covered more than 61% of the defined subcategories, and the majority included fewer than 40% of the detailed components. The highest-performing framework (P10) covered only 11 of the 18 subcategories (61%), while the lowest-performing tools (P6 and P8) addressed just 11% of the subcategories. Notably, even instruments that demonstrated high comprehensiveness at the category level exhibited weak representativeness at the subcategory level. For example, P3, which covered 100% of categories, included only 56% of subcategories, while P1, which covered 80% of categories, addressed only 50% of subcategories.

This consistent discrepancy demonstrated that, although many frameworks appeared structurally comprehensive at a high conceptual level, they generally lacked the granularity necessary for robust and detailed assessment of the social sustainability construct. The finding that even the strongest-performing tools covered little more than half of the essential subcategories indicated fundamental limitations in existing assessment methodologies and their capacity to capture the full complexity of social sustainability within urban development contexts.

## Depth of coverage

Depth of coverage was defined as the level of detail, elaboration, and comprehensiveness of measurement within each category or subcategory representing the major components of the social sustainability construct. Depth of coverage was quantified as the number of indicators used to assess a specific category or subcategory to ensure accurate measurement (Dempsey et al., 2011; Colantonio, 2011). Table 15 presented the depth of coverage for all social sustainability categories and subcategories across the examined assessment tools, operationalized as the percentage of CSSAF categories and subcategories covered by zero, one, two, or three or more indicators within each tool.

***Table 15:*** *Depth of coverage: categories and subcategories covered by 0, 1, 2, and 3+ indicators in each tool*

| **Tool** | **Depth of coverage at categories level** | | | | | **Depth of coverage at Sub-categories level** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 Indicators | 1 Indicators | 2 Indicators | 3+ Indicators | Average depth | 0 Indicators | 1 Indicators | 2 Indicators | 3+ Indicators | Average Depth |
| **P1** | 1 (20%) | 0 (0%) | 1 (20%) | 3 (60%) | **2** | 8 (44.4%) | 4 (22.2%) | 1 (5.5%) | 5 (27.7%) | **1.17** |
| **P2** | 1 (20%) | 0 (0%) | 1 (20%) | 3 (60%) | **2** | 4 (22.2%) | 6 (33.3%) | 6 (33.3%) | 4 (22.2%) | **1.56** |
| **P3** | 0 (0%) | 2 (40%) | 0 (0%) | 3 (60%) | **2.2** | 8 (44.4%) | 4 (22.2%) | 0 (0%) | 6 (33.3%) | **1.22** |
| **P4** | 1 (20%) | 0 (0%) | 0 (0%) | 4 (80%) | **2.4** | 10 (55.5%) | 2 (11.1%) | 1 (5.5%) | 5 (27.7%) | **1.06** |
| **P5** | 1 (20%) | 0 (0%) | 0 (0%) | 4 (80%) | **2.4** | 7 (38.8%) | 2 (11.1%) | 1 (5.5%) | 8 (44.4%) | **1.5** |
| **P6** | 0 (0%) | 1 (20%) | 2 (40%) | 2 (40%) | **1.8** | 9 (50%) | 1 (5.5%) | 4 (22.2%) | 4 (22.2%) | **1.17** |
| **P7** | 1 (20%) | 0 (0%) | 2 (40%) | 2 (40%) | **1.8** | 9 (50%) | 4 (22.2%) | 5 (27.7%) | 0 (0%) | **1.06** |
| **P8** | 3 (60%) | 1 (20%) | 0 (0%) | 1 (20%) | **0.8** | 16 (88.8%) | 1 (5.5%) | 0 (0%) | 1 (5.5%) | **0.22** |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **P9** | 1 (20%) | 1 (20%) | 0 (0%) | 3 (60%) | **2** | 9 (50%) | 3 (16.6%) | 0 (0%) | 6 (33.3%) | **1.17** |
| **P10** | 0 (0%) | 0 (0%) | 0 (0%) | 5 (100%) | **3** | 5 (27.7%) | 1 (5.5%) | 0 (0%) | 12 (66.6%) | **2.06** |
| **P11** | 1 (20%) | 2 (40%) | 1 (20%) | 1 (20%) | **1.6** | 10 (55.5%) | 5 (27.7%) | 1 (5.5%) | 2 (11.1%) | **0.83** |
| **P12** | 1 (20%) | 1 (20%) | 0 (0%) | 3 (60%) | **2** | 7 (38.8%) | 4 (22.2%) | 3 (16.6%) | 4 (22.2%) | **1** |
| **P13** | 0 (0%) | 1 (20%) | 0 (0%) | 4 (80%) | **2.2** | 5 (27.7%) | 6 (33.3%) | 1 (5.5%) | 6 (33.3%) | **1.39** |
| **P14** | 1 (20%) | 1 (20%) | 0 (0%) | 3 (60%) | **2** | 10 (55.5%) | 3 (16.6%) | 5 (27.7%) | 0 (0%) | **1.11** |
| **P15** | 1 (20%) | 2 (40%) | 1 (20%) | 1 (20%) | **1.6** | 11 (61.1%) | 5 (27.7%) | 0 (0%) | 2 (11.1%) | **0.83** |
| **P16** | 1 (20%) | 0 (0%) | 0 (0%) | 4 (80%) | **2.4** | 6 (33.3%) | 6 (33.3%) | 4 (22.2%) | 2 (11.1%) | **1.11** |
| **P17** | 2 (40%) | 1 (20%) | 1 (20%) | 1 (20%) | **1.4** | 11 (61.1%) | 4 (22.2%) | 0 (0%) | 3 (16.6%) | **0.94** |
| **P18** | 1 (20%) | 2 (40%) | 1 (20%) | 1 (20%) | **1.6** | 12 (66.6%) | 4 (22.2%) | 1 (5.5%) | 1 (5.5%) | **0.83** |
| **P19** | 1 (20%) | 2 (40%) | 0 (0%) | 2 (40%) | **1.8** | 12 (66.6%) | 3 (16.6%) | 1 (5.5%) | 2 (11.1%) | **0.94** |
| **BREEAM COM** | 3 (60%) | 0 (0%) | 1 (20%) | 1 (20%) | **1.2** | 11 (61.1%) | 3 (16.6%) | 1 (5.5%) | 3 (16.6%) | **1** |
| **LEED-ND** | 3 (60%) | 1 (20%) | 0 (0%) | 1 (20%) | **1.2** | 14 (77.7%) | 2 (11.1%) | 0 (0%) | 2 (11.1%) | **0.67** |
| **LEED-CI-COM** | 3 (60%) | 0 (0%) | 1 (20%) | 1 (20%) | **1.2** | 14 (77.7%) | 2 (11.1%) | 0 (0%) | 2 (11.1%) | **0.67** |
| **MOSTADAM-C** | 3 (60%) | 1 (20%) | 0 (0%) | 1 (20%) | **1.2** | 13 (72.2%) | 2 (11.1%) | 1 (5.5%) | 2 (11.1%) | **0.72** |

***Depth of coverage at subcategory level***.

The results of the depth of coverage analysis, as presented in Table 15, revealed that while some social sustainability subcategories were assessed using multiple indicators, indicating deeper levels of coverage, other essential subcategories were not assessed at all. The data demonstrated substantial variation in the extent to which different assessment tools measured the various components of social sustainability.

As shown in Table 15, the proportion of social sustainability subcategories assessed using a single indicator ranged from 5.5% (in P8 and P13) to 33.3% (in P2 and P9). The proportion of subcategories assessed using two indicators varied from 0% (in P3, P8, P9, P15, P17, LEED-ND, and LEED-CI-COM) to 27.7% (in P7 and P14). The proportion of subcategories assessed using three or more indicators ranged from 0% (in P7 and P14) to 66.6% (in P10). In contrast, between 44.4% and 88.8% of subcategories across the examined tools were not covered by any indicator, indicating major deficiencies in measurement, as critical elements of the social sustainability construct remained unmeasured.

The neighbourhood development assessment instruments exhibited particularly weak performance. LEED-ND and LEED-CI-COM failed to cover 77.7% of subcategories, while BREEAM-COM and MOSTADAM-C omitted 61.1% and 72.2% of subcategories, respectively.

This pattern of sparse and uneven depth of coverage indicated that existing assessment tools provided only partial and potentially misleading representations of social sustainability. The finding that most instruments left most social sustainability dimensions unmeasured fundamentally challenged their validity and usefulness for comprehensive urban development assessment.

***Depth of coverage at category level***.

As indicated in Table 15, the proportion of social sustainability categories assessed using a single indicator ranged from 0% (in P1, P4, P5, and P10) to 40% (in P3, P11, P13, P18, and P19). The proportion of categories assessed using two indicators varied from 0% (in P3, P4, P5, P8, P10, P12, P14, and P16) to 40% (in P6 and P7). The proportion of categories assessed using three or more indicators ranged from 20% (in P8, P11, P15, P17, P18, BREEAM-COM, LEED-ND, LEED-CI-COM, and MOSTADAM-C) to 80% (in P4 and P5) and reached 100% in P10. In contrast, between 20% and 60% of categories across the examined tools were not covered by any indicator, indicating critical measurement gaps in which fundamental dimensions of social sustainability remained entirely unassessed.

Depth of coverage was identified as a critical criterion for ensuring the robustness of indicator-based assessment tools. Deeper coverage achieved using multiple indicators to measure a single attribute, increased confidence in measurement accuracy and reduced the risk of error when assessing multidimensional constructs. In general, a greater number of indicators per attribute supported more reliable measurement. However, practical considerations

necessitated a balanced approach, whereby a well-designed assessment tool sought to balance comprehensiveness with feasibility.

The results revealed distinct patterns across existing tools. Some frameworks, such as P8, exhibited extremely sparse coverage, with 60% of categories remaining entirely unmeasured. In contrast, tools such as P5 demonstrated the opposite pattern; although achieving 80% category coverage with three or more indicators, this concentrated depth appeared to come at the expense of broader construct coverage. Both excessive depth within certain attributes and complete absence of coverage in others were problematic, as they led to the underrepresentation of key dimensions of the social sustainability construct. Increased measurement accuracy in selected areas did not compensate for the omission of other essential attributes.

Insufficient coverage was most observed in tools employing very small indicator sets (such as P8, which used only eight indicators) or in tools that concentrated indicators heavily on specific attributes while neglecting others. By contrast, tools such as P10 demonstrated a more balanced approach, achieving both full category coverage (100%) and substantial depth, with all categories assessed using three or more indicators. This pattern suggested a more comprehensive and robust measurement strategy for social sustainability assessment.

Neighbourhood-scale social sustainability instruments routinely claim to address inclusion, safety, participation, and well-being, but they often operationalize these concepts through different indicators and evidence pathways. Using a structured coverage analysis, this study extracted social sustainability content from 19 peer-reviewed academic indicator sources and four neighbourhood/community rating systems (LEED-ND, BREEAM Communities, MOSTADAM Communities, and LEED for Cities & Communities) and consolidated 605

indicator instances into 213 unique indicators organized in CSSAF (five categories; 18 subcategories).

Across the analysed instruments, the study extracted 605 indicator instances and consolidated them into 213 unique indicators, creating a transparent benchmark for mapping and comparison. The findings show weak consensus on a common operational core: 83% of the unique indicators appeared in only one or two instruments, indicating high fragmentation and limited cross-instrument comparability. Benchmarking against CSSAF also showed that no instrument covered more than 78% of the CSSAF subcategories, meaning that even the most "comprehensive" instruments still omit multiple dimensions of the consolidated content domain.

The benchmarking results show weak consensus and uneven construct representation. Most operational indicators are instrument-specific (83% appear in only one or two instruments), and even the broadest instruments omit multiple CSSAF subcategories (maximum subcategory coverage = 78%). Measurement effort concentrates on livability and quality-of-place categories, whereas external relations and integration remain systematically thin. This imbalance matters because neighborhood social sustainability depends not only on internal services and perceptions, but also on governance interfaces, permeability, and civic connections beyond the site boundary.

For practice, the findings suggest that rating outcomes should be interpreted as performance on a defined subset of social sustainability mechanisms rather than as comprehensive measures. CSSAF enables transparent crosswalk-based instrument selection and targeted supplementation, particularly for underrepresented outward-facing and governance-related categories.

Overall, the study contributes (1) a traceable consolidated content domain (CSSAF), (2) a crosswalk and coverage diagnostics that make scope differences explicit, and (3) a measurement-theory interpretation that clarifies how fragmentation and shallow coverage can threaten content validity and comparability.

***Implications of similarity*** Analysis

The similarity analysis indicates that social sustainability indicator coverage remains highly non-convergent across neighbourhood-scale assessment instruments. The low median overlap ($J \approx 0.09$) and the presence of zero-overlap pairs suggest that instruments frequently operationalize social sustainability through distinct indicator sets, limiting direct comparability between tools. This pattern aligns with the study's broader finding of uneven coverage across categories and subcategories and reinforces the interpretation of social sustainability assessment as a fragmented measurement space rather than a standardized construct.

Among the four formal neighbourhood rating tools, pairwise similarity remained low ($J = 0.08–0.16$), implying that the choice of rating tool can materially alter which social dimensions are prioritized or visible in assessment outcomes. This divergence may reflect differences in tool scope, governance context, and intended users (e.g., policy-facing versus certification-facing applications), as well as the underlying assumption that social sustainability indicators are context-sensitive rather than universally transferable. The clustering results further suggest that convergence, where it exists, occurs in small "families" of instruments rather than across the field.

From a framework development standpoint, the observed low overlap strengthens the rationale for adopting a core-plus-context strategy at the neighbourhood scale: a small set of cross-context "core" indicators could support comparability, while context-specific modules address culturally, regulatory, and spatially contingent social priorities. Practically, this implies

that assessors and decision-makers should interpret tool results as partial views of neighbourhood social sustainability rather than comprehensive representations and should select or supplement tools based on the intended social outcomes.

This similarity analysis is based on presence/absence of indicators and therefore does not capture differences in weighting, scoring, thresholds, or indicator definitions across instruments. Nevertheless, overlap patterns provide a useful structural diagnostic of convergence versus fragmentation in indicator selection and can inform both tool selection in practice and methodological refinement for future framework validation.

Relative to academic sources, the four formal rating tools show narrower representativeness. LEED-ND (I20) and LEED Cities & Communities (I21) each cover 4/18 subcategories (22%), MOSTADAM Communities (I22) covers 5/18 (28%), and BREEAM Communities (I23) covers 8/18 (44%). Category-level coverage is similarly constrained, with I20, I21, and I22 spanning only two of the five CSSAF categories, and I23 spanning three.

This pattern is consistent with the operational logic of certification-oriented tools. Rating systems tend to emphasize auditable, documentable credits and standardized evidence requirements, which supports repeatability but can construct coverage, particularly for experiential and relational dimensions. In practice, therefore, certification outcomes should be interpreted as evidence of compliance with a defined subset of social sustainability mechanisms, not as comprehensive assessment of neighborhood social sustainability performance.

For policy and practice, the implication is not that rating tools are “wrong,” but that their social content should be complemented when broader assessment is required. For example, if the decision-use is social risk screening, community wellbeing monitoring, or equity diagnosis, additional modules may be needed to capture underrepresented categories

such as external integration, rights/responsibilities, and participatory governance at meaningful depth.

### 4.2.2 Other Limitations and Concerns

This section presented the results of analysing 23 social sustainability assessment tools and frameworks based on their 20 shared attributes using a semiotic framework.

**Semiotics-Based Analysis Framework**

Building on the extracted content, each social sustainability assessment tool was analysed using a semiotics-based framework that conceptualizes assessment systems across interrelated levels (Figure 19): syntactic, semantics, pragmatics, and social consequences, supplemented by an empiric level capturing indicator operationalization and evidence practices. This framing treats assessment tools not only as technical measurement structures, but as meaning-making systems that encode concepts, guide interpretation, and shape decisions through their representational choices and institutional positioning (Morris, 1946; Stamper, 1973; Stamper, 1996; Liu, 2000).

Semiotics has been defined as the study of signs and sign systems, concerned with how meaning is produced, communicated, and stabilized through conventions of representation and interpretation (Saussure, 1916; Peirce, 1931–1958; Eco, 1976). Language has been the most recognizable sign system, yet semiotic theory has also emphasized that non-linguistic systems, including objects, artifacts, images, and spatial configurations, operate as sign systems shaped by cultural and institutional codes (Eco, 1976). On this basis, information systems and decision-support systems have been examined as sign systems that structure meaning and coordinate action across stakeholders, rather than as neutral containers of data (Stamper, 1973; Stamper, 1996; Liu, 2000).

Assessment systems were treated as a form of information system that captured, organized, and produced knowledge through measurable indicators, structured categories, and output formats. Inputs and outputs were represented through signs, including numbers, text, symbols, and visual elements, which acquired meaning through professional, institutional, and cultural conventions (Stamper, 1973; Liu, 2000). In this view, indicators did not simply record social reality; rather, they represented selected aspects of that reality through coding decisions and interpretive frames.

In semiotic terms, a sign has been classically described as relating a representational form to a concept. Saussure's dyadic model distinguished between the signifier (the form of the sign, such as a word or image) and the signified (the concept to which it referred) (Saussure, 1916). Peirce's triadic account further emphasized that meaning emerged through an interpretive relation between a sign, its object, and an interpretant (i.e., the understanding produced in use), highlighting that signification depended on interpretation and context (Peirce, 1931–1958). Consistent with these foundations, signs used within assessment systems were understood as structured representations that required interpretation by human agents and, increasingly, by automated or rule-based procedures embedded in the tool architecture.

Classical semiotic theory distinguished three principal domains of sign analysis: syntactic (formal relations among signs), semantics (relations between signs and what they refer to), and pragmatics (relations between signs and their users in context) (Morris, 1946). Organizational semiotics extended this structure by adding the social level, emphasizing that sign systems cannot be adequately understood without attending to their institutional conditions and social consequences (Stamper, 1996; Stamper et al., 2000). This fourth level was particularly relevant for assessing rating and assessment systems, where tool outputs can

shape policy decisions, resource allocation, and social outcomes beyond the intentions of tool designers.

**Empiric Level.** The empiric level concerns how indicators are operationalized and calculated before aggregation. It addresses measurement definitions, data sources, standardization procedures, and transformation rules. The empiric level addressed the relationship between assessment tools and the data through which social sustainability claims were substantiated, including data sources, data collection methods, indicator operationalization, and the degree to which measured variables corresponded to observable social conditions (Lazarsfeld, 1958; Bollen, 1989).

**Syntactic Level.** The syntactic level concerns how empirically defined indicators are structured into formal tools. It addresses grouping and hierarchy. At this level, analysis focused on the internal structure of the assessment system as a rule-governed representational schema, including the organization of indicators into categories and subcategories, the presence and logic of weighting, scoring and normalization procedures, and the aggregation rules through which outputs were generated (Stamper, 1996; Liu, 2000).

**Semantics Level.** The semantic level examined the relationship between signs and the concepts, objects, or phenomena to which they referred (Morris, 1946). At this level, analysis addressed how meaning was defined and stabilized within a tool: what "social cohesion," "safety," "participation," or "equity" meant in the system's conceptual language; how such concepts were delimited; and how relationships among concepts were constructed.

**Pragmatic Level.** The pragmatic level concerns how assessment tools are intended to be used. It addresses purpose, scale, and user context. At this level, analysis examined how assessment outputs were intended to be interpreted and acted upon who the intended users were (e.g., planners, policymakers, developers, residents), what decisions the tool supported, and

what operational contexts shaped implementation. Because tool use has depended on institutional settings, governance arrangements, and decision routines, pragmatics required attention to context as a constitutive condition of meaning in practice (Stamper, 1996; Liu, 2000).

**Social Level.** The social level concerns institutional origin, validation practices, and legitimacy. The social level examined the broader social consequences of sign systems, including the values, norms, beliefs, and conventions that shaped interpretation and the downstream effects of tool use (Stamper, 1996; Stamper et al., 2000). At this level, analysis addressed not only intended outcomes but also how assessment systems may produce unintended consequences through their categories, thresholds, and legitimized definitions of social sustainability. A key distinction at this level concerned intended versus actual effects.

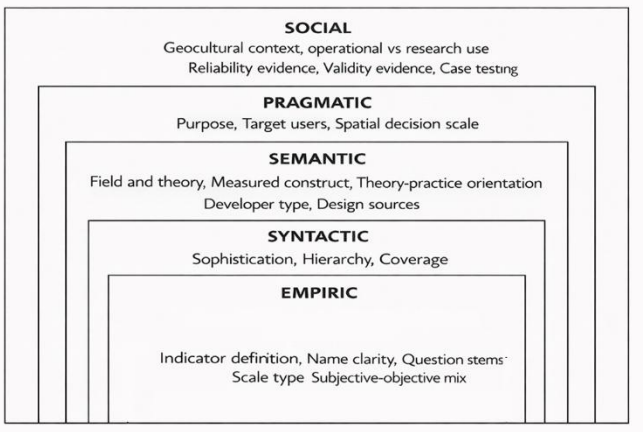


***Figure 19:*** *Five-level Semiotic Framework for Examining Social Sustainability Assessment Tools*

**Twenty Semiotic attributes of social sustainability assessment tools**

Applying the methodological approach described earlier, the analysis of 23 assessment tools identified Twenty key attributes that characterize social sustainability assessment tools. These attributes were used as analytical lenses for comparing systems across five levels: syntactic, semantic, empiric, pragmatic, and social. The Twenty attributes capture observable features of tool design, including how indicators are operationalized, how aggregation is

structured, how constructs are defined, how tools are positioned within decision processes, and how legitimacy is established. Together, these attributes represent the core dimensions through which social sustainability assessment tools differ.

For analytical clarity, the Twenty attributes are mapped onto the five semiotic levels described above. Attributes related to measurement specification and data configuration are assigned to the empiric level. Attributes concerning structural organization and aggregation architecture are assigned to the syntactic level. Attributes that define constructs and theoretical orientation are mapped to the semantic level. Attributes addressing intended purpose, spatial scale, and user groups are located at the pragmatic level. Finally, attributes concerning institutional origin, testing practices, and validation are assigned to the social level. Table 16 presents the Twenty attributes organized across the five semiotic levels.

***Table 16:*** *Semiotic Analysis Framework: Attributes of assessment tools Mapped to Semiotic Levels*

| Semiotics Level | No | Attribute | What is the attribute present? |
|---|---|---|---|
| Empiric | 1 | Operational definition of indicators | Degree to which indicators are formally defined in measurable terms |
| | 2 | Indicator name clarity | Precision and unambiguity of indicator descriptions |
| | 3 | Question Stems reported | Whether question stems of data-collection surveys are properly worded, standardized and reported for subjective indicators. |
| | 4 | Measurement scale type | Whether indicators are nominal, ordinal, ratio, or mixed |
| | 5 | Composition of indicators (subjective vs objective) | Whether data collected is subjective, objective, or both |
| Syntactic | 6 | Level of Sophistication | Whether the system is a complete assessment tool (i.e. tool) or partial complete assessment tool (i.e. framework). |
| | 7 | Hierarchical structure and level of coverage | Structural depth and number of aggregation tiers in the system |

| | | | |
|---|---|---|---|
| Semantic | 8 | Field of study and theoretical orientation | Disciplinary lens shaping how health and place are framed |
| | 9 | Construct measured | Core concept or outcome the tool claims to assess |
| | 10 | Theory-based or pragmatic orientation | Extent of explicit linkage between indicators and theoretical foundations |
| | 11 | Developer Type | Whether the tool is developed by researchers or institutionally developed |
| | 12 | Sources for Indicator Design | Institutional or empiric origin of the data used |
| Pragmatics | 13 | Purpose and Objective | Intended use (diagnosis, monitoring, benchmarking, certification, etc.) |
| | 14 | Tool Intended Users | Target decision-makers or actors expected to apply the tool |
| | 15 | Spatial scale as a decision context | Geographic level at which results are meant to guide action |
| Social | 16 | Geographic and cultural context | Cultural and institutional setting of development |
| | 17 | Real-life operational tools versus research-based tools | Whether the tool is embedded in practice or primarily academic |
| | 18 | Reliability testing evidence | Whether reliability testing or replication guidance is reported |
| | 19 | Validity testing evidence | Whether validity argumentation/testing is reported |
| | 20 | Tool tested on sample (case) | Whether the tool tested on a sample / case study. |

This mapping sets up the analytical foundation for the results that follow. The aim is not to judge which tools are better or worse, but to explore how these attributes are distributed across levels and how their arrangement leads to recurring differences. By placing empirically identified attributes within a layered semiotic framework, the analysis highlights both internal consistency and cross-level misalignment within Neighbourhood-level social sustainability assessment tools.

## Semiotic Framework Results

### Empiric-level attributes

At the empiric level, the main attributes of social sustainability assessment tools are related to how the indicators are defined, measured, and calculated prior to structural aggregation. This includes operational definitions question stems, indicator name clarity, subjective or objective indicator types, and measurement scale types. Variation at this level affects reproducibility and measurement stability before hierarchical organization or weighting is applied. Table 17 presents the main identified empiric-level attributes.

***Table 17.*** *Empiric Level Attributes*

| Tool Attribute | No. of Tool | (%) |
|---|---|---|
| **1. Operational Definition** | | |
| Provided | 10 | 43.48% |
| Not Provided | 13 | 56.52% |
| **2. Question Stems reported** | | |
| reported | 10 | 43.48% |
| Not reported | 13 | 56.52% |
| **3. Indicator name clarity** | | |
| All clearly defined | 12 | 52.17% |
| Some clear | 7 | 30.43% |
| Vague/ ambiguous | 4 | 17.4% |
| **4. Measurement Scale Type** | | |
| Nominal | 5 | 21.74% |
| Ordinal | 8 | 34.78% |
| Interval | 0 | 0.00% |
| Ratio | 2 | 8.70% |
| Mixed Type | 8 | 34.78% |
| **5. Composition of indicators (subjective vs objective)** | | |

| | | |
|---|---|---|
| Subjective | 5 | 21.73% |
| Objective | 5 | 21.73% |
| Mixed | 13 | 56.54% |

**Operational definition of Indicators.** Across the reviewed tools, operational definitions are more often missing than provided. Only 43.48% (10 out of 23) explicitly specify an operational definition, while 56.52% (13 out of 23) do not. This means that in over half the sample, indicators are presented without a clear statement of what exactly is being measured and how the value is derived, which weakens consistency and makes replication or comparison across tools harder.

**Question stem reported.** Patterns in question-stem design mirror the operational-definition issue: reported question stems are less common than not reported. Only 43.48% (10 out of 23) report question stems clearly in the published paper or available documentation, whereas 56.52% (13 out of 23) do not. When stems are not reported, item intent can drift during implementation (different respondents or evaluators may "fill in the blanks"), reducing reliability even if indicator titles look standardized.

**Indicator name clarity.** Indicator name clarity shows moderate performance overall, but with a meaningful minority still unclear. Indicators names are fully and clearly defined in 52.17% (12 out of 23) of tools. Another 30.43% (7 out of 23) provide some clear names but leave parts of scope, interpretation, or boundaries implicit. A further 17.40% (4 out of 23) rely on vague or ambiguous descriptions. Even when tools appear to assess similar themes, this variability in specificity increases interpretive discretion and the risk of inconsistent application.

**Measurement scale type.** Most of the examined tools (65.22%, n=15) used a single measurement type: nominal, ordinal, interval or ratio type, while the remaining 34.78% used mixed measurement typers. Nominal scales alone account for 21.74% (5 out of 23), while ratio scales appear in 8.70% (2 out of 23). Ordinal scales are used in 34.78% (8 out of 23) and mixed scale types also appear in 34.78% (8 out of 23), indicating many tools combine formats (for example, ordinal ratings alongside nominal classifications or ratio-like quantities). Notably, interval scales are absent (0%, 0 out of 23). This distribution suggests limited use of measurement formats that support more robust arithmetic interpretation, and a heavy reliance on ranking, categorization, or hybrid approaches that may complicate aggregation and comparability

**Composition of indicators (subjective vs objective).** Most tools combine subjective and objective content rather than relying on a single data mode. Mixed data types dominate at 56.54% (13 out of 23), while subjective-only and objective-only tools are evenly split at 21.73% each (5 out of 23 for each category). Mixed approaches can strengthen coverage of complex constructs, but they also introduce extra demands for calibration (e.g., aligning perception-based responses with observed/recorded measures) and may require stronger validation strategies to maintain internal coherence.

**Syntactic-level Attributes**

Table 18 presents a syntactic attribute of the examined tools, meaning the structural way these tools are built and operated. The identified syntactic attributes include it includes level of sophistication (Tool or Framework), Hierarchical structure and level of coverage.

***Table 18.*** *Syntactic-level Attributes*

| Tool Attribute | No. of Tool | (%) |
|---|---|---|

| | | |
|---|---|---|
| **1. Level of Sophistication** | | |
| Tool | 10 | 43.5% |
| Framework | 13 | 56.5% |
| **2. Hierarchical structure** | | |
| Three Hierarchical Levels (L1-L3) | 13 | 56.5% |
| Two Hierarchical Levels (L1-L2) | 5 | 21.7% |
| One Hierarchical Levels (L1) | 5 | 21.7% |

**Level of Sophistication (Tool or Framework)**. A distinction is evident between tools designed as fully operational tools and those positioned as adaptable frameworks. Framework-based tools dominate (56.5%, 13 out of 23), typically defining domains and indicator logics while allowing flexibility in implementation and contextual tailoring. Operational tools comprise 43.5% (10 out of 23) and tend to provide clearer workflows, predefined structures, and more explicit scoring or aggregation procedures. This difference affects reproducibility and procedural closure: tools generally promote more standardized outputs, while frameworks enable greater local adaptation but may reduce cross-case comparability.

**Hierarchical structure and level of coverage.** Coverage across hierarchical levels varies, indicating different depths of structural specification. Most tools (56.5%, 13 out of 23) span all levels (L1, L2, L3), supporting multi-layer aggregation from indicators upward through categories & subcategories. In contrast, 21.7% (5 out of 23) cover only two levels (L1–L2), enabling domain structuring without full higher-level consolidation, while the rest of the tools 21.7% (5 out of 23) provides only one level (L1), focusing on indicators without formal grouping or nested aggregation. While reduced depth of coverage provides less accurate

measurement, more levels of coverage increase accuracy and sincerity of the tool while increasing the structural complexity of the tool.

**Semantic-level attributes**

At the semantic level, the attributes are related to how social sustainability assessment tools construct and communicate meaning. Semantic differences reflect underlying assumptions about what constitutes social sustainability, how it should be understood. Table 19 presents the semantic attributes.

***Table 19.*** *Semantic Level Attributes*

| Tool Attribute | No. of Tool | (%) |
|---|---|---|
| **1. Field of study** | | |
| Social Sciences and Humanities | 2 | 8.70% |
| Urban Studies | 13 | 56.52% |
| Architecture | 8 | 34.78% |
| **2. Construct Measured** | | |
| Neighborhood and Urban Social Sustainability | 11 | 47.83% |
| Gated Community and Social Sustainability | 3 | 13.04% |
| Integrated Sustainability for Communities/Cities | 9 | 39.13% |
| **3.Theory-based or pragmatic orientation** | | |
| Theory Based | 3 | 13.0% |
| Pragmatic | 6 | 26.1% |
| Hybrid | 14 | 60.9% |
| **4. Developer Type** | | |

| | | |
|---|---|---|
| Individuals (academic authors) | 17 | 73.91% |
| Institutions | 6 | 26.09% |
| **5. Sources for Indicator Design** | | |
| From Literature Review | 10 | 43.48% |
| From Theoretical Models/frameworks and tools | 11 | 47.82% |
| Policy and institutional guidelines | 2 | 8.70% |

**Field of study.** The selected assessment tools originate from three main fields of study, and this disciplinary distribution shapes how social sustainability is conceptualized and evaluated. As shown in Table 19, Urban Studies represents the largest share, accounting for 56.52% of the tools (13 out of 23). Tools developed within this field tend to frame social sustainability in relation to broader urban systems and processes, such as governance, accessibility, equity, social inclusion, and the provision of public services. Architecture constitutes the second largest group, comprising 34.78% of the tools (8 out of 23). These tools more often emphasize the spatial and design-related dimensions of social sustainability, focusing on the built environment, livability, user experience, and ways physical form can support social interaction and well-being. The smallest category is Social Sciences and Humanities, which represents 8.70% of the tools (2 out of 23). Tools from this field typically place greater emphasis on human-centered and qualitative aspects, such as community values, cultural identity, social cohesion, and residents lived experiences. In sum, the field of study acts as an interpretive lens, influencing whether social sustainability is approached primarily as an urban policy issue, a spatial design concern, or a socio-cultural and human experience.

**Construct measured.** A second source of variation lies in the primary construct that each tool is designed to assess. As shown in Table 5, the largest category is Neighbourhood and Urban Social Sustainability, accounting for 47.83% of the tools (11 out of 23). These tools primarily focus on social sustainability as it is experienced and evaluated across urban and neighbourhood settings, with emphasis on issues such as social cohesion, inclusion, safety, accessibility, participation, and the quality of everyday community life. The second category, Integrated Sustainability for Communities/Cities, represents 39.13% of the tools (9 out of 23). In these cases, social sustainability is not treated as an independent construct, but rather as one component within a broader sustainability framework that also incorporates environmental, economic, and sometimes governance-related dimensions. This broader framing tends to shift the emphasis from purely social outcomes toward a more balanced evaluation of overall community or city performance. Finally, Gated Community and Social Sustainability accounts for 13.04% of the tools (3 out of 23). These tools address social sustainability within the specific context of gated communities, often highlighting themes such as security, internal social interaction, exclusivity, privatized governance, and the relationship between gated developments and their surrounding urban environment. Overall, the distribution shows that while most tools directly measure social sustainability at neighbourhood and urban levels, a substantial proportion embed it within integrated sustainability models, whereas only a limited number are specifically tailored to gated community contexts.

**Theory-based versus pragmatic orientation.** The tools also vary in how explicitly their meaning is anchored in theory versus operational practice. Hybrid tools dominate the sample, representing 60.9% (14 out of 23). These approaches typically begin with theory or literature-derived constructs and then translate them into measurable structures (criteria, indicators, weighting, scoring, and case application). Pragmatic tools account for 26.1% (6 out of 23) and are primarily organized around usability, standardization, and implementation, often

emphasizing scoring rules, compliance logic, or certification pathways over explicit conceptual argument. Theory-based tools form the smallest share at 13.0% (3 out of 23), generally contributing definitional clarity and conceptual structuring but providing less direct guidance for implementation-ready measurement. This matters because theoretical grounding stabilizes interpretation (clearer construct–indicator logic), while pragmatic orientation often stabilizes use (repeatable scoring and comparability), and hybrid tools attempt to do both, with uneven success.

**Developer Type.** Who defines the indicators strongly influences both legitimacy and portability. Most tools rely on Individuals (academic authors), accounting for 73.91% (17 out of 23). These typically draw from literature synthesis and empiric studies, which supports conceptual specificity but can lead to fragmentation across studies (many "new" indicators set with slightly different meanings). Institutions developed tools (institutional standards, established systems) make up 26.09% (6 out of 23), and these tend to prioritize standardization and transferability across contexts, often at the cost of local specificity. This pattern aligns with your broader evidence: institutional systems frequently appear as the more operationally "fixed" tools, while author-derived systems are where most conceptual innovation and contextual adaptation occur.

**Sources for Indicators Design.** The development of indicators relies predominantly on academic and methodological sources rather than policy-driven frameworks. Theoretical models, frameworks, and tools constitute the largest source category, accounting for 47.82% (11 of 23), followed by the literature review at 43.48% (10 of 23). Policy and institutional guidelines make up the smallest share at only 8.70% (2 of 23). This pattern indicates that indicator design is chiefly informed by conceptual and scholarly foundations, with comparatively limited input from institutional or policy-based references. Although such an

approach may enhance theoretical robustness, it may also constrain the practical alignment of the tool with formal governance requirements and standardized policy benchmarks.

### Pragmatic-level attributes

At the pragmatic level, the attributes are related to how social sustainability assessment tools are intended to be used in practice, the scope and the aim of the tool and the actors and contexts within which their outputs are expected to operate. Pragmatic differences do not concern what indicators mean, but how assessment results are interpreted, acted upon, and embedded in real-world decision processes. Table 20 presents the Pragmatic level attributes.

***Table 20.*** *Pragmatic-level attributes*

| Tool Attribute | No. of Tool | (%) |
|---|---|---|
| **1. Purpose and Objective** | | |
| Measurement and benchmarking | 14 | 60.87% |
| Policy and standards | 4 | 17.39% |
| Monitoring and evaluation | 5 | 21.74% |
| **2. Tool Intended Users** | | |
| General (non-experts) | 1 | 4.35% |
| Mixed Stakeholders (General + Experts) | 2 | 8.70% |
| Experts / Certified professionals | 15 | 65.22% |
| Academic / research users | 5 | 21.74% |
| **3. Spatial scale as a decision context** | | |
| Neighborhood / Urban Areas | 17 | 73.91% |
| City | 5 | 21.74% |

| | | |
|---|---|---|
| Multiple cities | 1 | 4.35% |

**Purpose and objective.** Across the 23 social sustainability assessment tools, the dominant purpose is measurement and benchmarking, which accounts for 60.87% of the sample (14 out of 23). This indicates that most tools are primarily designed to quantify performance, compare results across cases, and identify strengths and weaknesses in relation to social sustainability objectives. Such tools are generally used to support structured assessment and benchmarking exercises rather than broader strategic or regulatory functions. A smaller group of tools is oriented toward monitoring and evaluation, representing 21.74% of the sample (5 out of 23). These tools are typically intended to track progress over time, assess outcomes, and support follow-up reviews of policies, plans, or development performance. Finally, policy and standards tools account for 17.39% of the total (4 out of 23). These tools are usually aligned with formal frameworks, guidelines, or standards, and are often used to inform policy direction, establish criteria, or support compliance with predefined requirements. Overall, these differences in purpose reflect distinct practical functions: some tools are developed for comparative measurement, others for ongoing evaluation, and others for guiding policy and standard setting.

**Tool Intended Users.** The intended users of the selected assessment tools vary considerably, and this affects both how the tools are structured and the level of expertise required for their application. As shown in Table 5, the largest category is experts or certified professionals, accounting for 65.22% of the tools (15 out of 23). These tools are typically designed for practitioners with technical knowledge, professional training, or certification, and often involve specialized indicators, structured procedures, or expert-based interpretation. Academic and research users represent the second largest group, comprising 21.74% of the

tools (5 out of 23). Such tools are generally intended to support scholarly analysis, framework development, and evidence-based investigation of social sustainability issues. A smaller proportion of tools are designed for mixed stakeholders (general users and experts), accounting for 8.70% of the sample (2 out of 23). These tools tend to balance technical rigor with broader accessibility, allowing both professionals and non-specialists to engage with the assessment process. Finally, only 4.35% of the tools (1 out of 23) are intended for general, non-expert users, indicating that fully accessible assessments remain relatively limited. Overall, this distribution suggests that most social sustainability assessment tools are oriented toward specialized or research-based audiences, while comparatively few are designed for direct use by the public.

**Spatial scale as a decision context.** The spatial scale distribution is heavily concentrated at the neighbourhood level, which dominates the tool set at 73.91% (17 out of 23). This indicates that social sustainability is most often operationalized where social life is most directly experienced and managed: local services, daily mobility, public space, community interaction, and place-based equity concerns. City-scale tools represent 21.74% (5 out of 23), aligning with broader municipal planning agendas and strategic social sustainability reporting. Multi-city assessments appear only once in the dataset (4.35%, 1 out of 23), suggesting that cross-jurisdictional benchmarking is comparatively rare in this tool pool. In pragmatic terms, scale here works like a boundary on action: neighborhood tools support localized intervention, while city-level tools tend to support planning coordination and policy framing.

**Social level attributes**

At the social level, the analysis examines the assessment tools in terms of the geographical context or location, and whether the tool is real life tool or research based, validity

and reliability of the tools. Social-level Attributes concern the origins, validation practices, and real-world standing of tools as socio-technical systems rather than their technical design or intended use. Table 21 describes the social attributes.

***Table 21.*** *Social level attributes*

| Tool Attribute | No. of Tool | (%) |
|---|---|---|
| **1. Geographic and cultural context** | | |
| Middle East (Levant & Gulf) | 7 | 30.43% |
| Europe and UK | 10 | 43.48% |
| North Africa | 2 | 8.70% |
| North America | 2 | 8.70% |
| Other | 2 | 8.70% |
| **2. Real-life vs research-based tool** | | |
| Real-life tool (embedded in practice) | 6 | 26.09% |
| Research-based tool (primarily academic) | 17 | 73.91% |
| **3. Reliability testing evidence** | | |
| Fully Reported | 1 | 4.35% |
| Partially reported | 1 | 4.35% |
| Not reported | 19 | 82.61% |
| Unclear | 2 | 8.70% |
| **4. Validity testing evidence** | | |
| Fully Reported | 3 | 13.04% |
| Partially reported | 3 | 13.04% |
| Not reported | 14 | 60.88% |
| Unclear | 3 | 13.04% |

| 5. Tools Tested on a Sample (Case) | | |
|---|---|---|
| Tested | 14 | 60.87% |
| Not Tested | 9 | 39.13% |

**Geographic and cultural context.** Each tool is developed for specific culture and geographic region. 30.43% (7 out of 23) of the tools are developed for the Middle East (Levant & Gulf). Europe and the United Kingdom account for 43.48% (10 out of 23), representing a sizeable portion of the sample, which suggests that European policy and research environments remain influential in shaping assessment approaches. North Africa, North America, and other countries are each represented by 8.70% (2 out of 23). This distribution matters socially because geographic context often shapes what is considered "credible" evidence, which stakeholders are prioritized, and how legitimacy is constructed (for example, through policy alignment in some regions versus academic validation in others).

**Real-life operational tools vs research-based tools.** Tools differ in whether they are designed for direct implementation or primarily for academic and methodological development. Research-based tools dominate the sample, comprising 73.91% (17 out of 23), while real-life operational tools represent 26.09% (6 out of 23). Research-based tools are commonly produced to refine conceptual models, test indicators, and extend theoretical understanding within academic settings. In contrast, real-life tools are embedded in institutional practice and tend to gain authority through adoption, routine use, and alignment with regulatory or organizational needs. This distinction is important at the social level because it affects legitimacy pathways: research tools often depend on scholarly credibility and publication norms, whereas operational tools are frequently validated through institutional endorsement, stakeholder acceptance, and policy relevance.

**Reliability Testing Evidence.** Reliability evidence is, predictably, a mess across the sample. Only 4.35% (1 out of 23) explicitly report reliability evidence, while another 4.35% (1 out of 23) provide partial reporting (typically limited to internal consistency checks like decision-model consistency rather than full measurement reliability). By contrast, the overwhelming majority, 82.61% (19 out of 23), do not report reliability evidence at all, and 8.70% (2 out of 23) are unclear or not classifiable due to insufficient accessible reporting. This illustrates lack of formal statistical testing/verification to legitimize knowledge claims regarding these tools. In practical terms, this pattern suggests that most tools in this domain establish credibility through mechanisms other than formal psychometric reliability, such as expert consensus, methodological precedent (indicator-based assessment traditions), institutional legitimacy (especially for rating systems), or normative acceptance within planning and built-environment practice. This does not automatically mean the tools are "weak." It reflects a common reality in applied sustainability and policy assessment work: tools are often designed to be usable, communicable, and decision-relevant, even when reliability testing is not emphasized or transparently documented.

**Validity Testing Evidence.** Validity evidence is somewhat more visible than reliability evidence in this sample, but it is still far from complete. Only 13.04% (3 out of 23) fully report validity evidence, while another 13.04% (3 out of 23) provide partial validity reporting (often through expert review, Delphi agreement, or consistency checks rather than formal construct validation). The majority, 60.88% (14 out of 23), do not report validity evidence, and 13.04% (3 out of 23) remain unclear due to inaccessible or insufficient reporting. This distribution suggests that validity is often treated as an assumed quality established through expert authority, methodological convention, or institutional credibility, rather than something demonstrated through explicit validation procedures. Socially, validity claims frequently function as a legitimacy signal, helping tools appear defensible to reviewers, practitioners, and

stakeholders, particularly when they are intended to support planning, governance, benchmarking, or evaluation decisions.

**Tools Tested on a Sample (Case).** Evidence of real-world or sample-based testing is moderately common across the papers. 60.87% (14 out of 23) apply the proposed tool/framework to a case study, empiric setting, or sample (e.g., neighbourhoods, gated communities, expert panels, or resident surveys), while 39.13% (9 out of 23) do not report any case-based testing in the reference itself. This pattern suggests literature often prioritizes demonstrating applicability through pilot use or case illustration, but a substantial minority still operates at the conceptual, taxonomic, or standards-document level where testing is either outside the scope of the publication or assumed to occur through later adoption rather than reported evaluation.

**Divergence across Social Sustainability Assessment Tools.**

The preceding analysis shows that divergence among Neighbourhood-level social sustainability assessment tools is not explained by indicator choice alone. Most variation emerges from cross-level semiotic misalignment, especially at the semantic, pragmatic, and social levels, where meaning, intended use, and legitimacy are constructed. Tools may appear internally coherent within a single level (for example, a neat indicator list or a tidy hierarchy) yet fail to maintain coherence across levels. This disrupts the relationship between measurement, meaning, use, and legitimacy, creating problems that make comparability and cross-tool benchmarking unreliable, while also casting doubt on the robustness and interpretability of individual tool outputs. Table 22 provides examples of divergences observed across tools.

***Table 22.*** *Examples of Divergence across Social Sustainability Assessment tools*

| Semiotics Level | Attribute | Example Manifestations in Analysed Tools | Comparability Challenges |
|---|---|---|---|
| Empiric | Operational definition of indicators | Provided vs Not provided | Same indicator labels may reflect different measurements; weak reproducibility |
| | Indicator name clarity | All clearly defined, Some clear, Vague/ambiguous | Different scope and interpretation of similarly named indicators |
| | Question Stems reported | Reported vs Not reported | Subjective items cannot be assumed equivalent across tools |
| | Measurement scale type | Nominal, Ordinal, Ratio, Mixed type | Different scale logics limit aggregation and direct comparison |
| | Composition of indicators (subjective vs objective) | Subjective, Objective, Mixed | Results may differ due to data type, not actual social conditions |
| Syntactic | Level of Sophistication | Tool vs Framework | Operational tools are more standardized; frameworks are more adaptable but less comparable |
| | Hierarchical structure and level of coverage | L1 only, L1-L2, L1-L3 | Different aggregation depth produces non-equivalent outputs |
| Semantic | Field of study and theoretical orientation | Social Sciences and Humanities, Urban Studies, Architecture | Different disciplinary lenses define social sustainability differently |
| | Construct measured | Neighborhood and Urban Social Sustainability, Gated Community and Social Sustainability, Integrated Sustainability for Communities/Cities | Tools do not always assess the same construct |
| | Theory-based or pragmatic orientation | Theory-based, Pragmatic, Hybrid | Variation in conceptual grounding versus implementation logic |
| | Developer Type | Individuals (academic authors) vs Institutions | Academic tools vary more; institutional tools are more standardized |

| | | | |
|---|---|---|---|
| | Sources for Indicator Design | Literature review, Theoretical models/frameworks and tools, Policy and institutional guidelines | Different evidence bases produce different indicator logics |
| Pragmatics | Purpose and Objective | Measurement and benchmarking, Monitoring and evaluation, Policy and standards | Different purposes generate different output forms and use |
| | Tool Intended Users | General, Mixed stakeholders, Experts/certified professionals, Academic/research users | Tool design and interpretation vary by user group |
| | Spatial scale as a decision context | Neighborhood/Urban areas, City, Multiple cities | Scale differences change what is measured and how results are used |
| Social | Geographic and cultural context | Middle East (Levant and Gulf), Europe and UK, North Africa, North America, Other | Context-specific norms and priorities limit transferability |
| | Real-life operational tools versus research-based tools | Real-life tool vs Research-based tool | Institutional uptake differs from academic conceptual development |
| | Reliability testing evidence | Fully reported, partially reported, not reported, Unclear | Limited reliability evidence weakens confidence in cross-tool comparison |
| | Validity testing evidence | Fully reported, partially reported, not reported, Unclear | Weak validation reduces interpretability of claimed constructs |
| | Tool tested on sample (case) | Tested vs Not tested | Applied and unapplied tools are not equally robust or comparable |

Together, these patterns suggest that comparability problems arise not only from the diversity of indicators used, but also from cross-level misalignment between what is measured, what it is claimed to signify, how it is intended to be used, and how its legitimacy is established. This highlights the need for a framework that minimizes divergence and enhances compatibility and comparability among assessment tools in the field. The next section proposes a semiotic compliance framework that defines the minimum explicit specifications required to reduce irrational divergence across tools while preserving the contextual flexibility necessary across disciplines and neighbourhood settings.

**Proposed Semiotic Compliance Framework**

In response to the diagnosed misalignments and divergences across various levels, this study proposes a semiotic compliance framework as a structured approach for ensuring coherence and comparability among social sustainability assessment tools. The framework establishes minimum viable requirements at each semiotic level to promote transparency, internal coherence, interpretability, and cross-tool alignment.

"Minimum viable requirements" refer to the essential specifications that an assessment tool must declare to function as a coherent socio-technical sign system. The Twenty attributes mapped across the five semiotic levels provide a practical compliance checklist: they define baseline expectations for how indicators are operationalized (empiric), structured (syntactic), justified and delimited (semantic), positioned for use (pragmatic), and legitimized (social). Importantly, the framework does not advocate indicator standardization; it instead requires that tools make their representational commitments explicit so that divergence can be interpreted as legitimate variation rather than hidden inconsistency.

***Table 23.*** *Minimum Explicit Specifications Required for well-designed Social Sustainability Assessment Tools.*

| Semiotic Level | Minimal Specifications Required |
|---|---|
| **Empiric** | The tool should report: **(1)** operational definition of indicators; **(2)** clear indicator names and scope; **(3)** question stems where subjective indicators are used; **(4)** measurement scale type; and **(5)** whether indicators are subjective, objective, or mixed. These are needed for transparent and reproducible measurement. |
| **Syntactic** | The tool should specify: **(6)** whether it is a tool or framework; and **(7)** its hierarchical structure and level coverage (L1, L2, L3). These are needed to show how the system is structured and how outputs are produced. |
| **Semantic** | The tool should define: **(8)** field of study and theoretical orientation; **(9)** construct measured; **(10)** whether it is theory-based, pragmatic, or hybrid; **(11)** developer type; and **(12)** sources for indicator design. These are needed to make conceptual meaning explicit. |
| **Pragmatic** | The tool should state: **(13)** purpose and objective; **(14)** intended users; and **(15)** spatial scale as a decision context. These are needed to clarify how the tool is meant to be used in practice. |

| Semiotic Level | Minimal Specifications Required |
|---|---|
| **Social** | The tool should report: **(16)** geographic and cultural context; **(17)** whether it is research-based or operational; **(18)** reliability testing evidence; **(19)** validity testing evidence; and **(20)** whether it was tested on a sample or case. These are needed to clarify legitimacy and robustness. |

This study investigated divergence among neighbourhood-level social sustainability assessment tools and examined why they often produce incompatible and weakly comparable results. To address this, it developed and applied a semiotics-based analytical framework to evaluate 23 identified social sustainability assessment tools. The framework conceptualized these tools as socio-technical sign systems. The analysis identified twenty key attributes, which were mapped across the empiric, syntactic, semantic, pragmatic, and social levels. The findings show that divergence is patterned and is frequently rooted in cross-level misalignment rather than in indicator choice alone.

Divergence across neighbourhood-level social sustainability assessment tools is unevenly distributed across the five semiotic levels. The least divergence appears at the empiric level, where tools still differ in indicator specification, but the variation is narrower and more visible than at the higher levels. The most frequent empiric pattern is the absence of operational definitions and unreported question stems at 56.52% each, while mixed subjective-objective indicators are the most common data configuration at 56.54%. Although many tools also show relatively clear indicator naming (52.17%), differences in wording, measurement scale, and data composition still create interpretive discretion before aggregation. Thus, empiric misalignment remains important, but it is the least severe form of divergence in the overall framework.

At the syntactic level, divergence becomes moderate, as tools differ in how they are structurally organized and how results are generated. The most common pattern is the use of frameworks rather than fully operational tools (56.5%), alongside three-level hierarchical

structures (L1-L3) also at 56.5%. This indicates that while many tools share a tendency toward layered organization, they do not all provide the same degree of procedural closure. As a result, similar indicator sets may still be translated into different forms of output depending on how aggregation, grouping, and structural depth are arranged.

At the semantic level, divergence is high, because tools differ substantially in what they treat as social sustainability and how they conceptually frame it. The largest share of tools comes from Urban Studies (56.52%), most commonly measures Neighbourhood and Urban Social Sustainability (47.83%), and is most often hybrid in orientation (60.9%). In addition, most tools are developed by individual academic authors (73.91%), and indicator design most often draws on theoretical models, frameworks, and existing tools (47.82%). These patterns show that semantic misalignment is not simply a matter of terminology, but of differing disciplinary lenses, construct boundaries, and conceptual justifications, which make apparently similar tools non-equivalent in meaning.

At the pragmatic level, divergence is also moderate to high, as tools are designed for different purposes, users, and decision scales. The dominant pattern is measurement and benchmarking (60.87%), with most tools aimed at experts or certified professionals (65.22%) and primarily positioned at the neighbourhood or urban area scale (73.91%). This means that many tools are not intended for the same type of decision-making process or user environment. Pragmatic misalignment arises when tools built for expert benchmarking, for example, are compared with tools intended for monitoring, policy support, or other forms of practical use.

The highest divergence appears at the social level, where legitimacy, transferability, and robustness vary most strongly. Most tools are research-based rather than operationally embedded (73.91%), and the strongest single pattern in the whole study is that reliability testing evidence is not reported in 82.61% of tools. In addition, validity evidence is most often not

reported (60.87%), while 60.87% of tools are at least tested on a sample or case. These findings show that social-level misalignment is the most serious, because tools differ not only in technical design, but in how their authority is established, how far they are trusted in practice, and whether their claims are supported by sufficient testing across contexts.

The study also proposed a semiotic compliance framework that defines the minimum requirements for well-designed assessment tools at each semiotic level. It serves as a checklist for both developers and users by clarifying what must be explicitly documented and declared to enhance tool coherence, transparency, and comparability across assessment tools. In doing so, it supports more defensible tool design, clearer interpretation of outputs, and more accountable local adaptation, without requiring the standardization of indicators or assuming that their scores are universally comparable

The study is limited by its reliance on publicly available documentation, as some tools may be more fully specified or tested than the accessible record suggests. Future research should apply the compliance framework prospectively in the development of new neighbourhood-level assessment tools, including those tailored to specialized residential typologies; evaluate their effects on usability and decision integration, including data infrastructure requirements; and strengthen its validation through stakeholder engagement and cross-context replication.

### 4.3 The Developed Assessment Frameworks

This section outlined the process of developing and proposing an assessment framework for evaluating social sustainability within gated communities in Saudi Arabia.

### 4.3.1 Normalization of Depth and Breadth at Category Level

The process of selecting key indicators involved normalizing the raw depth and breadth scores to a common scale, thereby allowing direct comparison across the five categories. Analysis of the normalized values revealed a clear leading category. *Liveability and Quality of Place* demonstrated a substantially higher normalized depth (Dc = 0.608) than all other categories, indicating a strong concentration of research attention and detailed metrics within this domain.

In terms of normalized breadth (Bc = 0.271), which reflected the diversity of topics covered, *Liveability and Quality of Place* also ranked highest, followed by *Safety, Security, and Perceived Control* (Bc = 0.235). This finding indicated that *Liveability and Quality of Place* was not only the most deeply researched category but also the most thematically diverse.

By contrast, *External Relations and Integration* recorded the lowest values for both normalized depth (Dc = 0.015) and breadth (Bc = 0.071), identifying it as a significantly underrepresented area within the existing literature. Table 24 illustrated the development of the selection score at category level based on metrics.

***Table 24**: Integrated Matrix of Normalized Dimensionality and Composite Selection Metrics (Category)*

| Categories and Sub-categories of the comprehensive list of social sustainability indicators | Depth (Raw) | Depth (Average) | Breath (Raw) | Normalized Breadth (Bc) | Normalized Depth (Dc) | Selection Score (SS) | Normalized SS | # of Unique Indicators in Each Category |
|---|---|---|---|---|---|---|---|---|
| 1. Community Cohesion and Social Interaction | 89 | 3.87 | 17 | 0.200 | 0.147 | 0.172 | 0.184 | 15 |
| 2. Safety, Security, and Perceived Control | 69 | 3 | 20 | 0.235 | 0.114 | 0.164 | 0.175 | 14 |
| 3. Liveability and Quality of Place | 368 | 16 | 23 | 0.271 | 0.60 | 0.406 | 0.434 | 35 |
| 4.Participatory Governance, Equity (& Empowerment) | 70 | 3.04 | 19 | 0.224 | 0.116 | 0.161 | 0.172 | 14 |
| 5. External Relations & Integration (External Integration) | 9 | 0.39 | 6 | 0.071 | 0.015 | 0.032 | 0.035 | 3 |
| ***Grand Total*** | **605** | **26.30** | **85** | **1.000** | **1.000** | **0.934** | **1.000** | **80** |

### 4.3.2 Selection Score (SS) at Category Level

The Selection Score (SS), which synthesized both depth and breadth by taking the square root of the product of Bc and Dc, as previously illustrated in Figure 10, was subsequently normalized to sum to 1.00. The resulting Normalized Selection Score confirmed the prominence of the *Liveability and Quality of Place* category (Normalized SS = 0.434), establishing it as the most critical category within the framework.

Based on these normalized scores, a proposed number of unique indicators was allocated to each category. *Liveability and Quality of Place* was assigned the highest number of indicators (35), reflecting its comprehensive importance within the assessment framework. The categories *Community Cohesion and Social Interaction*, *Safety, Security, and Perceived Control*, and *Participatory Governance, Equity, and Empowerment* each received a moderate allocation of 14–15 indicators. In contrast, *External Relations and Integration* was allocated the fewest indicators (three), consistent with its low selection score. Figure 20 illustrated the distribution of unique indicators across categories in the proposed framework based on selection score and average of depth

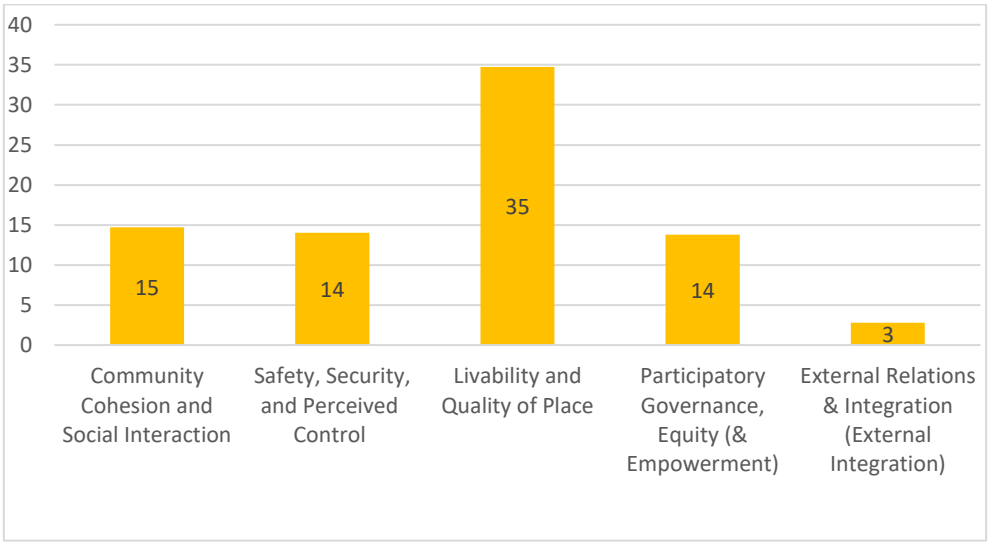


***Figure 20:*** *Suggested Number of Indicators (Construct 1) based on Geometric mean and Average Depth*

### 4.3.3 Normalization of Depth and Breadth at Sub-Category Level

The analysis was extended to the subcategory level, where normalized depth (Ds) and breadth (Bs) scores were calculated to determine the relative intensity and thematic diversity of each area. The normalization process, which functioned as a quota-based mechanism for indicator selection, ensured proportional representation of each subcategory according to its prominence within the scholarly literature.

The subcategory *3.1 Access to Amenities* emerged as the most dominant thematic area, exhibiting the highest normalized depth (Ds = 0.233) and the highest normalized breadth (Bs = 0.104). This indicated that access to amenities was not only the most deeply researched subtopic within the *Liveability* category but also the most thematically comprehensive. Other subcategories demonstrated notable breadth, including *2.2 Perceived Safety* (Bs = 0.083) and *3.5 Sense of Place and Identity* (Bs = 0.083). In contrast, subcategories such as *5.2 Civic Engagement Beyond the Gates* were minimally emphasized, as reflected by very low normalized depth values (Ds = 0.005). Table 25 illustrated the development of the selection score as sub-category level based on metrics.

***Table 25:*** *Integrated Matrix of Normalized Dimensionality and Composite Selection Metrics (Sub-category)*

| Categories and Sub-categories of the comprehensive list of social sustainability indicators | | Depth (Raw) | Depth (Average) | Breath (Raw) | Normalized Breadth (Bc) | Normalized Depth (Dc) | Selection Score (SS) | Normalized SS | # of Unique Indicators in Each Category |
|---|---|---|---|---|---|---|---|---|---|
| **1. Community Cohesion and Social Interaction** | | | | | | | | | |
| 1.1 | Social Networks & Ties | 43 | 1.87 | 12 | 0.062 | 0.071 | 0.10678258 | 0.056 | 4 |
| 1.2 | Community Participation | 24 | 1.04 | 13 | 0.067 | 0.040 | 0.094162208 | 0.049 | 4 |
| 1.3 | *Social Inclusion* | 14 | 0.61 | 9 | 0.047 | 0.023 | 0.075063813 | 0.039 | 3 |
| 1.4 | *Trust & Reciprocity* | 8 | 0.35 | 4 | 0.021 | 0.013 | 0.053287517 | 0.028 | 2 |
| **2. Safety, Security, and Perceived Control** | | | | | | | | | |
| 2.1 | Objective Safety | 17 | 0.74 | 9 | 0.047 | 0.028 | 0.077005347 | 0.040 | 3 |
| 2.2 | Community Perceived Safety | 46 | 2.00 | 16 | 0.083 | 0.076 | 0.114042697 | 0.060 | 5 |
| 2.3 | *Privacy Level* | 6 | 0.26 | 5 | 0.026 | 0.010 | 0.051242267 | 0.027 | 2 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **3. Liveability and Quality of Place** | | | | | | | | | |
| 3.1 | Access to Amenities & Services | 141 | 6.13 | 20 | 0.104 | 0.233 | 0.251092907 | 0.132 | 11 |
| 3.2 | Public open Space & Interaction Opportunities | 33 | 1.43 | 13 | 0.067 | 0.055 | 0.156814599 | 0.082 | 7 |
| 3.3 | *Housing Quality & Affordability* | 88 | 3.83 | 18 | 0.093 | 0.145 | 0.217375684 | 0.114 | 9 |
| 3.4 | *Well-being & Satisfaction* | 59 | 2.57 | 13 | 0.067 | 0.098 | 0.181330562 | 0.095 | 8 |
| 3.5 | *Sense of Place & Identity* | 47 | 2.04 | 16 | 0.083 | 0.078 | 0.180437428 | 0.095 | 8 |
| **4. Participatory Governance, Equity (& Empowerment)** | | | | | | | | | |
| 4.1 | Participatory Governance | 27 | 1.17 | 10 | 0.052 | 0.045 | 0.087939118 | 0.046 | 4 |
| 4.2 | Social Equity & Justice | 14 | 0.61 | 10 | 0.052 | 0.023 | 0.074623081 | 0.039 | 3 |
| 4.3 | *Rights & Responsibilities* | 20 | 0.87 | 10 | 0.052 | 0.033 | 0.081582811 | 0.043 | 3 |
| 4.4 | *Community Resilience* | 9 | 0.39 | 8 | 0.041 | 0.015 | 0.063193773 | 0.033 | 3 |
| **5. External Relations & Integration (External Integration)** | | | | | | | | | |
| 5.1 | Integration with Surrounding Neighbourhoods | 6 | 0.26 | 4 | 0.021 | 0.010 | 0.021554081 | 0.011 | 1 |
| 5.2 | Integration with Surrounding Neighbourhoods | 3 | 0.13 | 3 | 0.016 | 0.005 | 0.01686698 | 0.009 | 1 |
| | ***Grand Total*** | **605** | **26.30** | **193** | **1.00** | **1.00** | **1.904397453** | **1.000** | **80** |

### 4.3.4 Selection Score (SS) at Sub-Category Level

The Selection Score (SS) for each subcategory was calculated using the formula $SS = \sqrt{((Bc^2) \times (Dc \times Ds))}$, where Bc and Dc represented the normalized scores at the main category level and Ds represented the normalized depth score of the subcategory. This formulation ensured that each subcategory score was weighted by the relative importance of its parent category, thereby establishing a proportional and hierarchical quota system for indicator allocation.

The resulting Selection Scores were normalized to sum to 1.00 to determine the final distribution of indicators across subcategories. Based on these normalized scores, subcategory *3.1 Access to Amenities* achieved the highest normalized SS (0.132) and was allocated the largest quota of indicators (11). Indicator allocations decreased proportionally with lower Selection Scores, with substantial quotas assigned to *3.3 Housing Quality and Affordability*

(nine indicators) and *3.5 Sense of Place and Identity* (eight indicators). In contrast, subcategories within *External Relations and Integration* received minimal allocations, with one indicator assigned to each. Figure 21 illustrated the distribution of unique indicators across subcategories in the proposed framework based on selection score and average of depth.

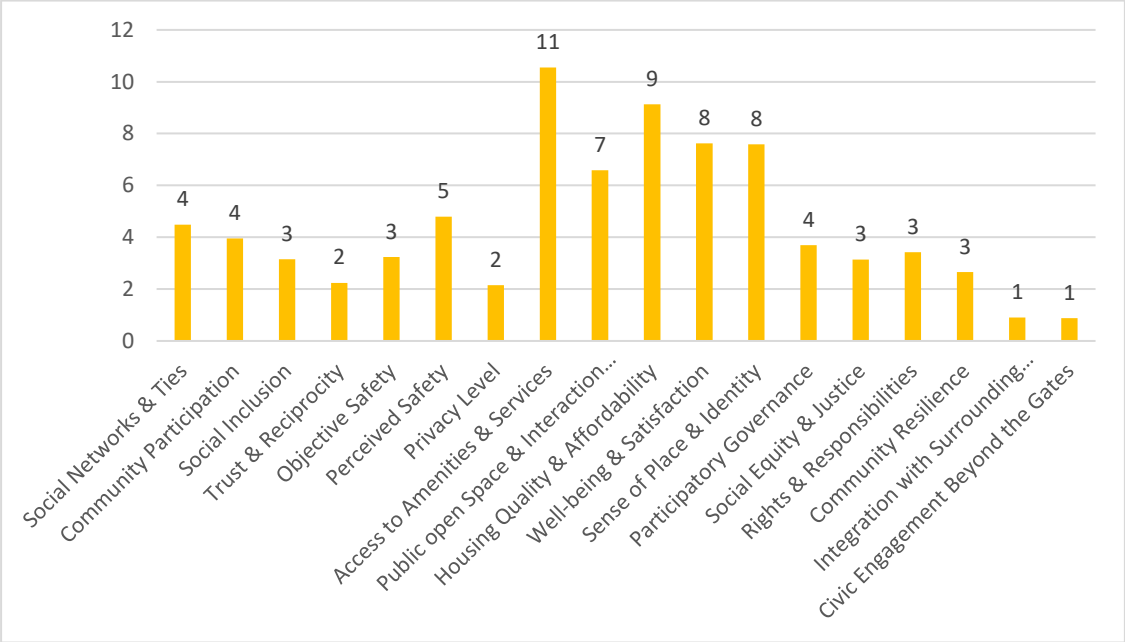


***Figure 21:*** *Suggested Number of Indicators (Construct 2) based on Geometric mean and Average Depth*

### 4.3.5 Selecting Unique Indicators

The development of the social sustainability assessment framework proceeded through a systematic, multi-stage indicator selection process designed to ensure scholarly rigor and contextual relevance, in line with the methodology presented in Chapter 3. This phase translated the quantitative prioritization of categories and subcategories into a concrete and measurable set of indicators, followed by structured qualitative evaluation. Indicator selection was guided by three well-defined criteria: (1) Selection Score (SS), which determined the number of indicators allocated to each category and subcategory; (2) relevance to the social sustainability construct; and (3) relevance to the Saudi Arabian context.

### 4.3.6 Selection of indicators Based on Selection Score.

The initial stage of indicator selection was driven by a quantitative analysis of indicator prominence within the reviewed literature. From a comprehensive master list of 213 unique indicators identified through the systematic literature review and content analysis process, a preliminary pool of 80 indicators was derived.

At the category and subcategory levels, the Selection Score (SS) was used to determine proportional indicator allocation. The Selection Score was calculated as the geometric mean of normalized depth and normalized breadth, capturing both the intensity of scholarly attention (frequency of indicators) and the diversity of framework coverage. In parallel, the average depth of indicators within each category and subcategory was considered to ensure that areas characterized by more detailed measurement were not underrepresented.

Together, the Selection Score and the average depth determined the number of indicators assigned to each category and subcategory, as illustrated in Figures 22 and 23. Subsequently, unique indicators with higher frequency (depth) and greater breadth of coverage were selected within each allocation. This approach ensured proportional and fair representation of thematic areas based on both their prominence and measurement intensity in existing literature.

### 4.3.7 Selection of indicators Based on Relevance to Construct and Context.

This Section included the second and third selection criteria which is based on level of relevancy. The indicators were given a score on a 1 to 10 score against the following criteria:

1. **Relevance to the Construct:** The indicator was evaluated for its direct conceptual alignment with the principles of *social sustainability* (e.g., equity, social interaction,

quality of life) and its specific applicability to the unique social and physical fabric of *gated communities*.

2. **Contextual Relevance to the KSA:** This criterion assessed the indicator's sensitivity and appropriateness within the socio-cultural, economic, and regulatory context of Saudi Arabia. Indicators that might be relevant in Western contexts but are incongruent with local social norms, family structures, or urban planning paradigms were critically examined.

This multi-stage methodology combining quantitative frequency analysis with systematic qualitative filtration ensured the development of a robust, relevant, and practical tool. Indicators that scored poorly on either criterion were revised where possible or excluded where alignment could not be achieved. Through this screening process, seven indicators were removed, resulting in a final provisional framework comprising 74 indicators.

The final indicator set spanned all five main categories and 18 subcategories of the Comprehensive Conceptual Social Sustainability Assessment Framework (CSSAF) and was organized into a three-level structure. To reflect relative importance, the indicators were further classified into key, supplementary, and supporting indicators based on their frequency and prominence in literature.

Overall, this multi-stage selection process ensured that the final indicator set was quantitatively justified, conceptually robust, and contextually appropriate, forming a solid foundation for subsequent expert validation and empirical application.

### 4.3.8 Conceptual and measurement model of the framework (FASSGC-74)

Following the rigorous selection processes and the conceptual framework (CSSAF), an initial contextualized measurement assessment framework for assessing social sustainability within gated communities (FASSGC-74) was developed. This framework was structured as a

three-tier hierarchical model designed to systematically deconstruct the complex concept of social sustainability into measurable and actionable components. The structure ensured that each abstract principle was grounded in a concrete metric, thereby providing a holistic yet detailed tool for empirical research. This section presented the full list of indicators proposed for the developed framework.

**The Hierarchical Structure: From Categories to Direct Measurements**

The framework is organized across three distinct levels, each serving a specific function in the assessment process:

- **L1 Variable (Category):** This highest level comprises the five fundamental pillars of social sustainability identified and prioritized in this study: 1) Community Cohesion and Social Interaction, 2) Safety, Security, and Perceived Control, 3) Livability and Quality of Place, 4) Participatory Governance, Equity (& Empowerment), and 5) External Relations & Integration. These categories provide macro-level thematic organization for the entire framework.
- **L2 Variable (Sub-Category):** Nestled within each L1 category, the sub-categories offer a more granular thematic breakdown. For instance, the broad category "Livability and Quality of Place" is divided into specific sub-categories such as "3.1 Access to Amenities & Services," "3.2 Public Open Space & Interaction Opportunities," and "3.3 Housing Quality & Affordability." This level ensures that each major pillar is examined through its key constituent dimensions.
- **L3 Variable (Direct Measurement):** This is the operational level of the framework, containing the 74 unique indicators themselves. Each L3 indicator is defined by several critical components:

- **Name of Indicator:** A concise label for the indicator (e.g., "Calling the neighbour," "Children's safety," "Walkability").
- **Operational Definition:** A precise explanation of what the indicator measures, providing conceptual clarity (e.g., "The frequency and comfort level of residents in initiating and maintaining communication with neighbour").
- **Question Stem / Item:** The exact survey question or data collection prompt used to measure the indicator (e.g., "My kids are playing with neighbour' kids safely in the streets of the community").
- **Subjective or Objective:** A classification of the data type, distinguishing between resident perceptions (Subjective) collected via questionnaires and observable, verifiable facts (Objective) collected through spatial analysis, records, or site surveys.
- **Measurement Instrument:** The specific tool for data collection, such as a Questionnaire Survey, Spatial Analysis, Census Data, or Site Survey.
- **Frequency Score:** The original prevalence score from the literature review, justifying the indicator's initial inclusion.

**Description of the Initial Measurement Framework Categories and Sub-Categories**

The proposed initial contextualized measurement assessment framework (FASSGC-74) was organized into five distinct categories, each representing a fundamental pillar of social sustainability within the context of gated communities. The following subsections described the scope, composition, and key characteristics of each category.

**Category 1: Community Cohesion and Social Interaction**

This category formed the foundational social fabric of the community, focusing on the strength and nature of relationships among residents. It was composed of four subcategories

that measured the progression of neighbourly contact into meaningful social capital. Subcategory 1.1 Social Networks and Ties captured the frequency and depth of informal interactions through indicators such as *relationships with neighbours* and *mutual help*. Subcategory 1.2 Community Participation assessed residents' involvement in organized collective activities, including *participation in social activities*. Subcategory 1.3 Social Inclusion evaluated levels of acceptance, belonging, and respect for diversity within the community, while 1.4 Trust and Reciprocity measured residents' fundamental belief in the reliability and goodwill of fellow community members.

This category relied primarily on subjective survey-based data to capture perceptions of community life and social relationships. Table 26 illustrated the Community Cohesion and Social Interaction category, including its subcategories, question stems, and indicator items within the FASSGC-74 measurement framework.

**Category 2: Safety, Security, and Perceived Control**

This category addressed the critical need for residents to feel safe and in control within their living environment, which was considered a prerequisite for overall community well-being. It is distinguished between objective conditions of security and residents' subjective perceptions of safety. Subcategory 2.1 Objective Safety included verifiable indicators such as crime-free environment and the presence of security infrastructure, which were measured using records and spatial or environmental analysis. In contrast, 2.2 Perceived Safety examined residents' personal feelings of security across different situations, including walking at night and children's safety. The category was further complemented by 2.3 Privacy Level, which assessed residents' satisfaction with personal and spatial privacy, a dimension that was often heightened within gated community settings.

Table 26 illustrated the Safety, Security, and Perceived Control category, including its subcategories, question stems, and indicator items within the FASSGC-74 measurement framework.

**Category 3: Liveability and Quality of Place**

As the most comprehensive category within the framework, this pillar assessed both the tangible and intangible aspects of the physical environment that directly influenced residents' daily lives. It contained the highest number of indicators, reflecting its dominant role in the reviewed literature. The category was divided into five key subcategories.

Subcategory 3.1 Access to Amenities and Services evaluated the availability of, and ease of access to, essential facilities, with indicators such as walkability and accessibility to nearby services. Subcategory 3.2 Public Open Space and Interaction Opportunities examined the quality, distribution, and maintenance of spaces that supported social encounters and everyday interaction. Subcategory 3.3 Housing Quality and Affordability addressed both physical design aspects, such as barrier-free design, and issues related to economic accessibility. Subcategory 3.4 Well-being and Satisfaction measured residents' overall contentment with their community, while 3.5 Sense of Place and Identity captured the emotional attachment and cultural alignment residents experienced within their neighbourhood.

Table 26 illustrated the Livability and Quality of Place category, including its subcategories, question stems, and indicator items within the FASSGC-74 measurement framework.

**Category 4: Participatory Governance, Equity (& Empowerment)**

This category evaluated the structures and processes that enabled residents to have a voice and ensured fair treatment within the community. It extended beyond interpersonal social

dynamics to examine systems of management, inclusion, and collective empowerment. Subcategory 4.1 Participatory Governance focused on residents' influence in decision-making processes, captured through indicators such as *influence and sense of control*. Subcategory 4.2 Social Equity and Justice assessed the fairness of access to opportunities, services, and resources across different social groups. Subcategory 4.3 Rights and Responsibilities examined civic duties and socio-economic conditions, including indicators related to *educational status* and *community fee payment*. Finally, 4.4 Community Resilience measured the community's preparedness and capacity to adapt to external shocks, stresses, or disruptive events.

Table 26 illustrated the *Participatory Governance, Equity, and Empowerment* category, including its subcategories, question stems, and indicator items within the FASSGC-74 measurement framework.

**Category 5: External Relations & Integration (External Integration)**

This final category critically examined the relationship between the gated community and its wider urban context, addressing concerns related to social isolation and urban fragmentation. It represented the smallest category within the framework, reflecting its comparatively limited emphasis in the reviewed literature, yet it remained theoretically significant. Subcategory 5.1 Integration with Surrounding Neighbourhoods assessed the degree of permeability and social connectivity across the community's boundaries, using indicators such as social permeability. Subcategory 5.2 Civic Engagement Beyond the Gates measured the extent to which residents participated in the broader civic, social, and economic life of the surrounding urban environment. This category ensured that the framework considered gated communities not as isolated enclaves but as integrated components of the wider urban ecosystem.

***Table 26:*** *Initial Contextualized Measurement assessment framework (FASSGC-74)*

| L-1 Variable | L-2 Variable | L-3 Variable (Direct Measurement) | | |
|---|---|---|---|---|
| **Category** | **Sub-Category** | **Direct Measurement** | **Operational Definition** | **Question Stems (Subjective) / Items (Objective)** |
| **1. Community Cohesion and Social Interaction** | **1.1 Social Networks & Ties** | Calling the neighbour | The frequency and comfort level of residents initiating and maintaining communication with neighbour through conversation or phone calls. | Q1. I feel comfortable calling neighbour and usually interact with them |
| | | Children Relationship | The level of safety, comfort, and interaction between children of different households within the community. | Q2. My kids are playing with neighbour' kids safely in the streets of the community. |
| | | Friendship Development | The degree to which interactions among neighbour evolve into friendships, indicating strong social ties. | Q3. My relationship with neighbor has developed into friendship |
| | | Mutual Help | Describes the level of cooperation and social interaction among residents in gated communities. | Q4. If I need help or support, I will ask my neighbour and I will help my neighbour (there is mutual support) |
| | | Relationship with neighbor | The frequency of social visits and informal interactions among neighbour that strengthen community bonds. | Q5. I have good relationships with neighbour where we have occasional visits |
| | | Knowing neighbor | Measures of whether the neighbour are introverted or extraverted | Q6. I know the names of most of my neighbour. |
| | | Meeting neighbor | The degree to which interactions among neighbour evolve into friendships, indicating strong social ties. | Q7. I meet a lot of my neighbor |
| | **1.2 Community Participation** | Social activities participation | Enhancing social connections and fostering collaboration within communities | Q8. I Participate with neighbour in social, cultural, religious events and voluntary work, and I'm an active member of community associations |
| | | Volunteering Participating | The extent to which residents contribute time and effort to volunteer activities that enhance community well-being. | Q9. I Volunteer for activities that help in developing my community |
| | | Participation in public works | Participation of local people in design | Q10. I Participate in the project design process in the community |
| | **1.3 Social Inclusion** | Open-mindedness | Describes the level of trust, cooperation, and social interaction among residents in gated communities. | Q11. There is a level of acceptance and open-mindedness within neighbour. |
| | | Social Coexistence | The level of mutual respect, tolerance, and positive interaction among residents of different cultural, ethnic, or social backgrounds within the community | Q12. I respect my neighbour of different ethnicities and am satisfied with homogeneity. |
| | **1.4 Trust & Reciprocity** | Trust in residents | Describes the level of trust, cooperation, and social interaction among residents in gated communities. | Q13. I Trust people in my community |
| | | Trust in Vigilante groups | Describes the level of trust, cooperation, and social interaction among residents in gated communities. | Q14. I Trust the vigilante group in my community. |
| **2. Safety, Security, and Perceived Control** | **2.1 Objective Safety** | Crime-Free Environment | Reducing crime rates to create safer living environments. | Q1. Crime Reported Rate |
| | | Safe Communities | Ensure 24-h safety via measures (e.g., night security lighting, cameras). | Q2. There is security lighting/cameras; vigilance plans. |
| | | Safety in the streets | Pedestrian safety & crime prevention through urban design (street layout, lighting, speed reduction). | Q3. Index of safety on the streets |

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| | **2.2 Perceived Safety** | Crime Reduction | It measures people experience of safety and level free from crime | Q4. I have never experienced any type of crime in my community. |
| | | Walking Daytime | how secure and free from crime residents feel in their community, influenced by personal experiences, environmental conditions, and social interactions | Q5. I Feel comfortable, safe and secure walking during the daytime. |
| | | Walking Night-time | The perceived sense of safety residents have when walked alone in public spaces or streets after dark. | Q6. I feel comfortable, safe and secure while walking (in streets and public open spaces) alone after dark in the area surrounding my house. |
| | | Safety during travelling | The residents' perception of their home's security and safety while they are away or traveling. | Q7. I Feel that my house is safe and secure during whether I'm attending or not attending it. |
| | | Open spaces safety | The perceived level of safety and security within public open spaces such as parks and plazas. | Q8. I Feel that open spaces in my community are safe and secure. |
| | | Children's safety | It measures level of safety for children | Q9. My children play safely outside my home. |
| | **2.3 Privacy Level** | Level of Privacy | The perceived adequacy of personal and spatial privacy within the community. | Q10. I'm Satisfied with level of privacy that is available in the community. |
| **3. Livability and Quality of Place** | **3.1 Access to Amenities & Services** | Accessibility to nearby services and facilities | Ensure that community facilities and public spaces are accessible to all individuals, including those with disabilities. | Q1. I use different available facilities and services such as the community center, public library, and sports facilities. |
| | | Transportation Modes | To ensure accessible, connected and safe walking and cycling infrastructure to improve public health and reduce environmental impacts. | Q2. I'm satisfied with the transportation modes in the community and out the community |
| | | Walkability | Promote pedestrian-friendly environments to encourage walking and enhance social interaction. | Q3. My community streets and pavements are well organized and friendly for walking and biking |
| | | Provision of Parking | Provide appropriate parking and integrate it with a pedestrian-friendly public realm. | Q4. Parking Demand Analysis & Management Strategy; pedestrian-friendly interfaces; curb management; EVSE ≥ 2% of public spaces. |
| | | Density of Services | How many essential services exist in the community, how evenly they are spread, and how many residents can reach them on foot. | Q5. Number of services distributions within the community. |
| | | Access to open green public space | The share of residents who can reach public open/green spaces on foot via safe, barrier-free routes, and how much green area is available per person. | Q6. I Can easily access nearby open and green areas. |
| | | Bicycle Network | Provide convenient and safe bicycle infrastructure. | Q7. Community bicycle network meets layout/connection requirements; 90% of buildings within 180 m bicycling of network linked to 5 amenities within 5 km. |
| | | Access to quality transit | Ensure facilities for bicycles/other emission-free transport to enhance health. | Q8. From your home, can you reach a public transit stop using a safe, continuous bicycle route (protected lane or traffic-calmed street)? |
| | | Land Uses | Diversity of functional land uses (residential, commercial, industrial, institutional, transportation). | Q9. Number of Mixed-use buildings plots |
| | **3.2 Public open Space & Interaction Opportunities** | Public spaces availability | The presence and variety of open public spaces that support diverse community activities and social engagement opportunities. | Q10. The availability of a range of activities (Such as kid's activities, celebrations, etc.) in open public spaces will improve social interaction in the community. |
| | | Open/gathering spaces | Measuring Satisfaction towards green spaces in the community. | Q11. I'm Satisfied with the available green areas within my community. |
| | | Care and maintenance | The physical condition and cleanliness of building exteriors and public outdoor areas in the community, and residents' satisfaction with maintenance. | Q12. Houses, buildings and outdoor areas in my community area are well looked after and maintained. |

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| | | Play and recreation | Availability, proximity, variety, and basic quality of publicly accessible play/leisure spaces and programs for all ages in the community. | Q13. There is an opportunity for play and leisure activities in the community. |
| | | Outdoor spaces Distribution | The spatial distribution and availability of outdoor spaces (e.g., plazas, squares, green areas) across the community to meet residents' needs. | Q14. Outdoor areas (plaza, squares) are well distributed in the community to satisfy residents' needs. |
| | | Open Space size | Whether the plan: (a) gives most buildings a nearby public open space, (b) dedicates enough site area to open space, and (c) commits to maintaining it. | Q15. Outdoor open space within 350 m of ≥ 75% of res/com buildings; total open space area ≥ 25% of site; maintenance commitment. |
| | **3.3 Housing Quality & Affordability** | Housing Types | It defines the used house types within the gated community | Q16. Housing Types |
| | | Population Density | The concentration of residents living within a given area reflects the community's spatial organization and density level. | Q17. Population Density |
| | | Housing and community | Minimize urban heat-island effects via vegetation and reflective surfaces. | Q18. Community and houses meet the needs of those who live in. |
| | | Environmental awareness | Measures the awareness of people towards environmental aspects | Q19. People are aware to Clean their environment and the community. |
| | | Houses area | Measures the area used for each housing unit | Q20. Built Up area ratio |
| | | Affordability Index | To provide access to housing at reasonable costs to sections of society which need assistance. | Q21. What percentage of income is spent on housing? |
| | | Cycling Path | Spatial connectivity of the neighbourhood's street network | Q22. Length of Cycling Path |
| | | Barrier-Free Design | Extend to which the community is inclusive of differently abled residents. | Q23. Houses in the community are friendly for people with disabilities |
| | **3.4 Well-being & Satisfaction** | Satisfaction with the community | The overall satisfaction of residents with their living environment and their willingness to continue residing in the community long-term. | Q24. I am satisfied with living in this community and planning to stay here. |
| | | Satisfaction with noise pollution/neighbour | The degree of residents' contentment regarding noise levels and disturbances from neighbour. | Q25. I'm Satisfied with less noise and pollution from neighbour. |
| | | satisfaction with cleanness | The perceived cleanliness and maintenance level of the streets, public areas, and lighting conditions. | Q26. I'm Satisfied with cleanliness of the community and street lighting. |
| | | satisfaction with reputation and attractiveness | Residents' satisfaction with the aesthetic and design quality of the community environment and public spaces. | Q27. I'm Satisfied with attractiveness of the design features of the community (such as lighting fixtures, etc.) |
| | | satisfaction with quality of service | The perceived adequacy and quality of services and facilities provided within the community. | Q28. I'm Satisfied with quality of services and facilities within the community |
| | **3.5 Sense of Place & Identity** | Level of attachment | The emotional connection and sense of pride, loyalty, and identification that residents feel toward their community. | Q29. I feel attached, loyal and proud to be resident in this community |
| | | Affection & intimacy | Residents' emotional attachment to the neighbourhood | Q30. I Feeling that it is a good place to live in forever. |
| | | Historic conservation and heritage | Maintain key architectural styles/heritage and stimulate use of public spaces. | Q31. There are changes that have happened through the community. |
| | | Identity of the community | The extent to which the architectural and spatial design of the community strengthens residents' sense of belonging, identification, and pride in their locality. | Q32. The Local design of the community enhances my sense of identification. |
| | | Leaving the community | Desire to leave the community | Q33. I have a desire to leave the community |
| | | Length of residency | The Number of residency years measures the level of attachment and comfort towards the community | Q34. Number of Years and length of residency. |

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| | | Cultural Values and beliefs | The degree to which individuals' actions and attitudes align with the shared cultural norms, traditions, and moral values are upheld by their community. | Q35. My behavior is always aligned with cultural values and beliefs of the community. |
| | | Missing Home | The depth of emotional belonging and affection residents have for their community, reflected by feelings of longing or missing it when away. | Q36. I miss home while I'm of the community |
| **4. Participatory Governance, Equity (& Empowerment)** | **4.1 Participatory Governance** | Influence and sense of control | Inclusion of residents in decisions about community management | Q1. I contribute to making decisions and to associations in my community. |
| | | Community Organizations | Community based organizations participate. | Q2. I know my community-based organizations. |
| | | Governance Participation | The institutional and procedural backbone that enables residents to participate meaningfully and equitably. | Q3. Sometimes I Participate in local governance meetings |
| | | Membership | Membership in community organizations | Q4. I'm a member of community association and I help in organize events in my community |
| | **4.2 Social Equity & Justice** | Equality and justice | Fairness and equality across present and future generations | Q5. There is a access to from the community to workplaces and job opportunities. |
| | | Gender Equity | Extent to which women are represented in governance, employment, and community participation | Q6. Are there activities and programs that accommodate all ages and all social groups. |
| | **4.3 Rights & Responsibilities** | Community Support perception | The institutional and procedural backbone that enables residents to participate meaningfully and equitably. | Q7. I Pay fees for the benefit of my community. |
| | | Education status | The Level of education within the community | Q8. Level of Education and Literacy within the community. |
| | | Employment status | Opportunities for local employment | Q9. Level of employment of the population in the community. |
| | **4.4 Community Resilience** | Disaster Management | Measures in place for community resilience against disasters or external shocks | Q10. Does the community flexible to accommodate the changes? |
| | | Risk Management | Evaluate disaster-prevention plans and evacuation strategies. | Q11. Presence of risk assessment, routes, safe meeting points. |
| **5. External Relations & Integration (External Integration)** | **5.1 Integration with Surrounding Neighbourhoods** | Social homogeneity | The extent to which the community's social and cultural environment promotes inclusivity while allowing interaction with people outside the gated community. | Q1. The gated community does not hinder me identifying strangers and build strong connections and relationships with communities outside the gated community (easy to interact with outsider world and outside can easily interact). |
| | | Social permeability | Ease of access for visitors; frequency of external engagement | Q2. It is easy for community members to host visitors and let them access the housing without excessive restrictions. |
| | **5.2 Civic Engagement Beyond the Gates** | Access to Civic & Public Space | Access to government agencies | Q3. I can access the urban working areas in the community. |

### 4.3.9 Conceptual and measurement model of the framework (FASSGC-42)

The final phase in developing the assessment framework involved the strategic stratification of the 74 selected indicators into three hierarchical tiers: key, supplementary, and support indicators. This stratification was conducted to prioritize assessment resources and to establish a clear hierarchy of indicator importance for both empirical evaluation and future policymaking.

The tiering process was not arbitrary. The Selection Score determined the number of indicators allocated to each category and subcategory, while the frequency score (depth) and breadth of coverage guided the identification of which specific indicators should be selected within each allocation. Indicators with higher frequency of occurrence across literature and wider coverage across existing frameworks were prioritized, as these measures reflected stronger scholarly consensus and greater empirical recognition.

**Key Indicators (FASSGC-42)**

This group constitutes the most critical and non-negotiable components of the framework. Accordingly, the 42 key indicators corresponded to those exhibiting the highest depth and breadth values across the reviewed sources, representing the most prominent and widely acknowledged measures of social sustainability. The remaining indicators were classified as supplementary or support indicators based on comparatively lower frequency and coverage, while still contributing additional conceptual and contextual insight. In addition, the Selection Score derived from the category- and subcategory-level analyses ensured that the prioritization of individual indicators remained aligned with the broader thematic importance of their respective categories and subcategories within the framework. Figure 22 depicted the 42 selected unique Indicators (FASSGC-42)

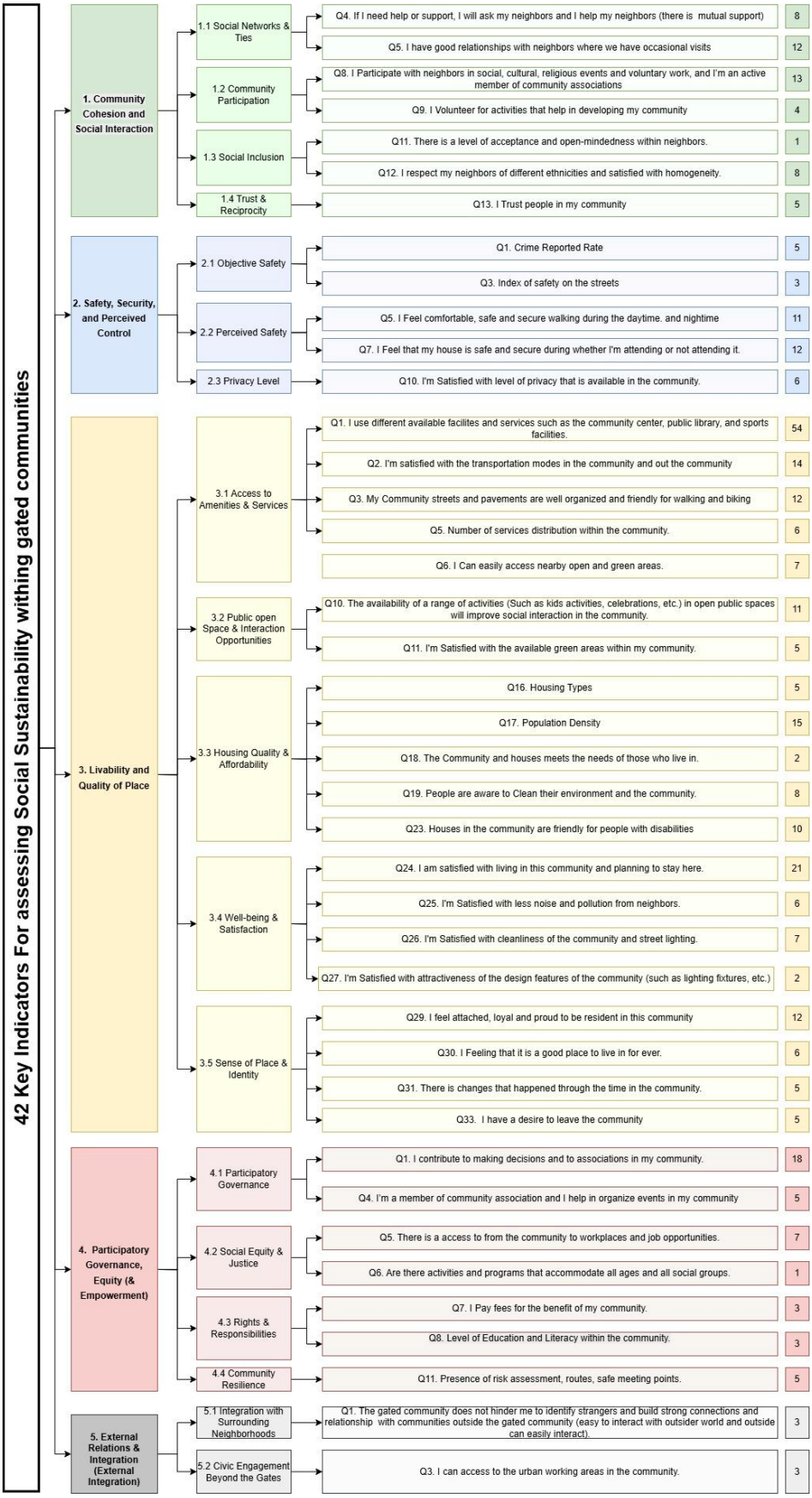


***Figure 22:*** *42 Key Indicators for assessing social sustainability within gated communities*

**Supplementary (20 Unique indicators)**

The second tier served as a vital supplementary set that added depth and nuance to the overall assessment. These indicators exhibited strong frequency scores, although slightly lower than those of the key indicator tier. The supplementary indicators provided essential contextual information and addressed important, though not universally dominant, dimensions within the social sustainability categories. This tier included indicators such as trust in residents, children's safety, housing and community, and level of attachment. When considered alongside the key indicators, the supplementary indicators contributed to a comprehensive and detailed representation of community social dynamics. Figure 23 summarized the 20 supplementary indicators extracted from the proposed framework.

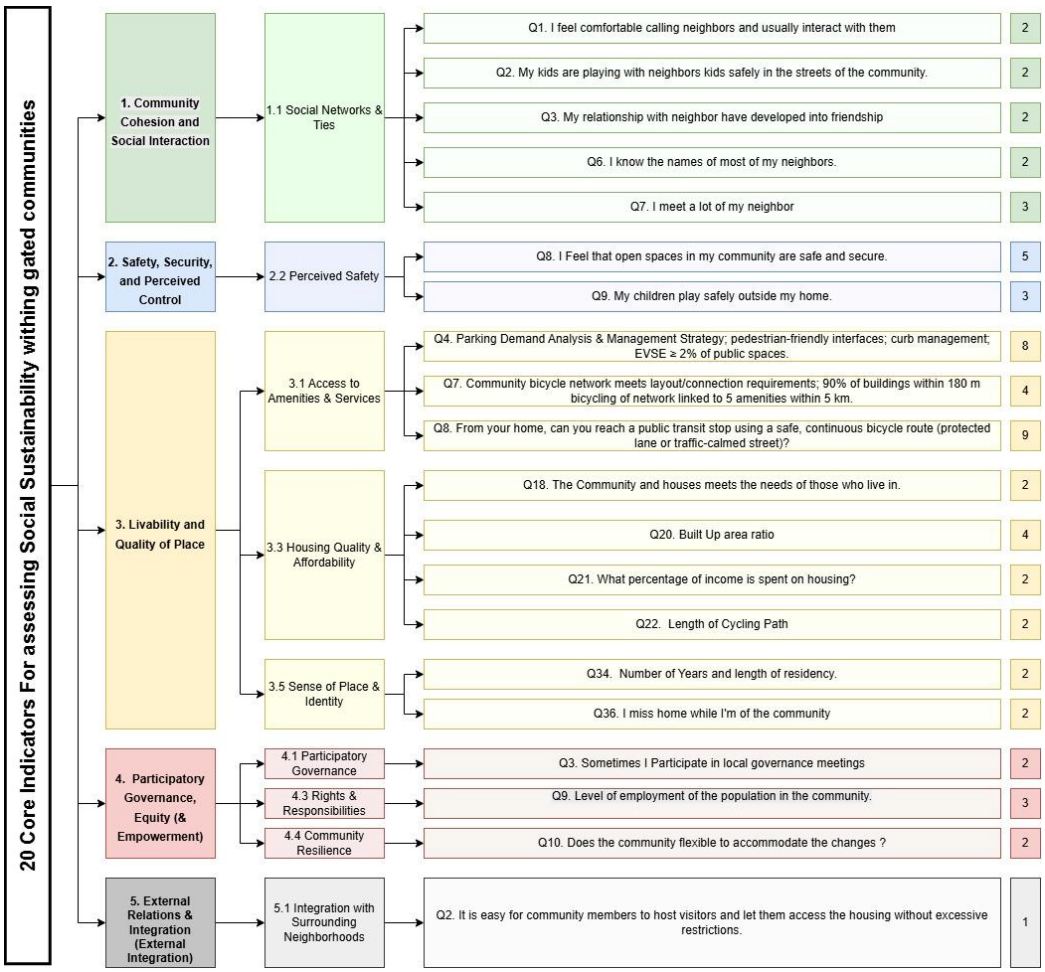


***Figure 23:*** *20 Supplementary Indicators for assessing social sustainability within gated communities*

**Support Indicators (12 Unique indicators)**

The final tier consisted of specialized and context-specific indicators that provided foundational or highly targeted insights. Although these indicators exhibited the lowest frequency scores, they were retained due to their unique ability to capture specific social nuances, such as trust in vigilante groups, open space size, gender equity, and social permeability. These indicators served to generate granular data that helped explain patterns observed in the higher indicator tiers or addressed highly specific contextual factors, particularly relevant for detailed diagnostic or exploratory studies. Figure 24 summarized the 12 support indicators extracted from the proposed framework.

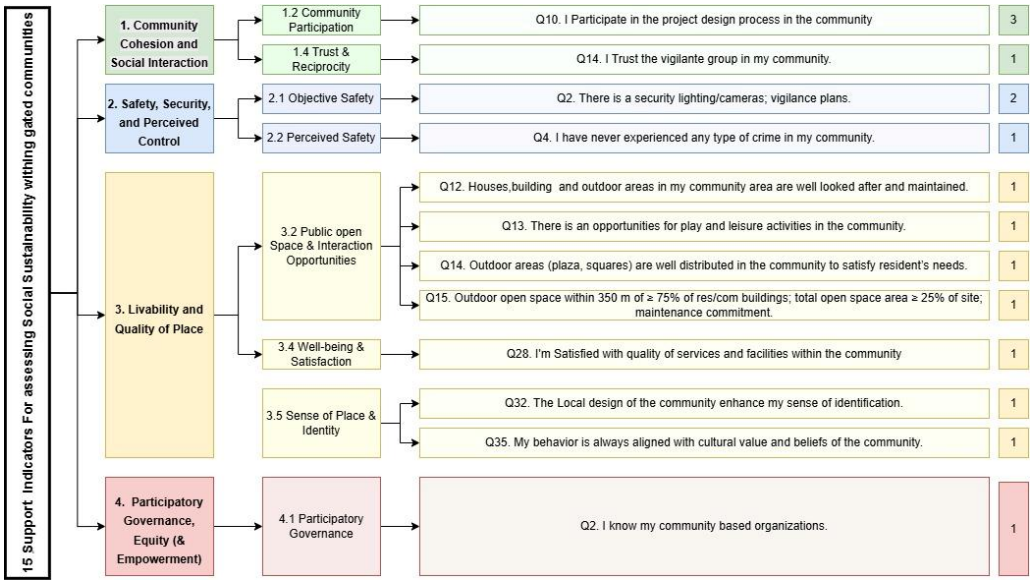


***Figure 24:*** *12 Support Indicators for assessing social sustainability within gated communities*

The synthesis of indicators achieved through the proposed framework directly addressed the fragmentation previously identified in social sustainability assessment tools. Earlier studies highlighted a critical lack of consensus on a core set of indicators, with more than 80% of social sustainability indicators appearing in only a single framework. By consolidating the selected indicators into a single, structured framework, this study established a more coherent and unified approach to assessing social sustainability in gated communities.

The five-category structure provided a shared conceptual language for evaluating social well-being, responding to repeated calls in the literature for more cohesive and standardized assessment approaches. As a result, planners and researchers were able to reference a common baseline set of indicators, reducing ambiguity and inconsistency associated with fragmented and case-specific tools.

The content of the framework aligned closely with established dimensions of social sustainability while also extending them. Core themes widely recognized in the literature such as safety, social cohesion, participation, and quality of life were reflected across the framework's categories and indicators. The prominence of the *Liveability and Quality of Place* category, which contained the largest number of indicators, reinforced extensive evidence linking the built environment to social outcomes. The inclusion of both tangible indicators (e.g., housing quality and access to services) and intangible indicators (e.g., sense of belonging and trust) demonstrated a balanced integration of physical and experiential aspects of community life. This approach reflected contemporary shifts in social sustainability research that increasingly emphasize lived experience alongside material conditions, confirming that social sustainability was shaped by both environmental provision and social relationships.

A notable contribution of the framework was the explicit inclusion of *External Relations and Integration* as a standalone category. Gated communities have frequently been criticized for reinforcing social isolation and urban fragmentation. By assessing permeability, civic engagement, and social ties beyond the gates, the framework acknowledged that social sustainability extended beyond internal community boundaries. Although this category included fewer indicators due to its limited emphasis in existing literature, it remained conceptually significant, responding directly to urban studies scholarship addressing enclavism and socio-spatial segregation. Its inclusion ensured that gated communities were examined as

components of a wider urban system rather than as isolated entities.The tiered structure of indicators constituted a central structural feature of the framework. By stratifying the 74 selected indicators into three hierarchical tiers Key (42 indicators), Supplementary (20 indicators), and Support (12 indicators) the framework responded to two recurring challenges in the literature: the proliferation of fragmented indicators and the limited capacity of practitioners to assess all dimensions with equal depth. This tiered structure translated a broad evidence base into a clear hierarchy of priorities, supporting both conceptual clarity and practical application.

The Key indicators formed the core of the framework. Concentrating across the five main categories, these indicators represented the most consistently emphasized measures in literature. They captured essential aspects of social sustainability, including social networks, participation, perceived safety, access to amenities, satisfaction with the living environment, governance, and external integration. Together, they provided a comprehensive baseline for understanding social sustainability in gated communities without reducing it to a single dominant dimension.

The Supplementary indicators added analytical depth to the framework. While these indicators were cited less frequently than those in the Key tier, they addressed important themes such as trust among residents, children's safety, housing community relationships, and place attachment. These indicators refined broader dimensions captured by the Key indicators and supported more nuanced interpretation of social dynamics across different community contexts.

The Support indicators played a complementary and context-sensitive role. Although these indicators appeared less frequently in the literature, they captured localized or emerging social issues such as trust in vigilante groups, gender equity, open space size, and social

permeability. Their inclusion acknowledged the context-dependent nature of social sustainability and allowed the framework to address specific governance, cultural, or spatial conditions that may be critical in certain gated communities.

Collectively, the three-tier structure functioned as both a conceptual map and a measurement strategy. Conceptually, it articulated social sustainability in gated communities as an interaction between internal cohesion, safety and control, quality of place, participatory governance and equity, and external integration. Methodologically, it operationalized these domains through indicators of varying priority and specificity. This design allowed flexible application depending on assessment objectives and available resources, ranging from baseline evaluations to detailed diagnostic or comparative studies.

### 4.3.10 The Reliability and Validity of the Developed Assessment Framework

This section presented and discussed the reliability and validity of the developed social sustainability assessment frameworks, namely the comprehensive framework (FASSGC-74) and its condensed version (FASSGC-42). The discussion focused on three key aspects that underpin the robustness of the frameworks: (1) their conceptual validity, derived from a strong theoretical foundation; (2) their content validity, demonstrated through comprehensive and balanced coverage of social sustainability dimensions; and (3) their measurement reliability, supported by a systematic and transparent indicator allocation process. Together, these aspects demonstrated that the developed frameworks were not ad hoc indicator compilations, but methodologically grounded tools suitable for assessing social sustainability in gated communities.

#### Conceptual Validity of the FASSGC-74 and FASSGC-42 Frameworks

The two assessment tools developed in this study the initial comprehensive contextualized measurement framework (FASSGC-74) and the condensed framework

(FASSGC-42) were grounded in a robust conceptual model derived from an extensive review of social sustainability literature. Both frameworks organized indicators into five overarching categories and multiple subcategories that reflected widely recognized dimensions of urban social sustainability: community cohesion and social interaction, safety and perceived control, liveability and quality of place, participatory governance and equity, and external relations and integration.

This categorical structure was not arbitrarily defined. It emerged from systematic content analysis of existing frameworks and theoretical models, ensuring that the developed tools captured the full conceptual breadth of social sustainability as articulated in prior research. By consolidating 74 unique indicators from diverse sources into a single structured framework, the study addressed the conceptual fragmentation observed in earlier tools and established a coherent and shared language for evaluating social well-being in gated communities.

The model was hierarchical and evidence-based, with broad categories (Level 1) decomposed into specific subcategories (Level 2), each operationalized through direct measurement indicators (Level 3). This structure enabled the integration of both objective conditions, such as access to amenities and infrastructure, and subjective perceptions, such as sense of belonging, trust, and perceived safety. Such integration aligned with contemporary research emphasizing that social sustainability assessment must capture both material conditions and lived experience.

Notably, the explicit inclusion of *External Relations and Integration* as a standalone category strengthened the conceptual completeness of the model. While many previous frameworks focused primarily on internal community dynamics, this framework acknowledged that the social sustainability of gated communities also depended on their permeability and

relationships with the surrounding urban context. Overall, the conceptual structure of FASSGC-74 and FASSGC-42 demonstrated strong alignment with established theory, supporting their conceptual validity.

**Content Validity Through Comprehensive Coverage**

Content validity of the developed frameworks was demonstrated through their comprehensive and balanced coverage of all identified social sustainability categories and subcategories. Both FASSGC-74 and FASSGC-42 were deliberately designed to ensure that every main category and every subcategory defined in the conceptual model was represented by at least one indicator, thereby eliminating gaps that were common in many existing assessment tools.

The comprehensive framework (FASSGC-74) comprised 74 indicators spanning five main categories and 18 subcategories, achieving full coverage of the conceptual dimensions the study set out to measure. This ensured that no aspect identified as important within the conceptual framework remained unmeasured, a critical requirement for strong content validity. In contrast, the benchmarking analysis of existing tools revealed frequent omissions, with some frameworks excluding entire categories due to limited indicator sets or narrow thematic focus.

The developed frameworks avoided these shortcomings by ensuring coverage at both the category and subcategory levels. Even categories that traditionally received less attention in literature, such as *External Relations and Integration*, were represented through targeted indicators addressing social permeability and civic engagement beyond the gates. At the same time, more complex and literature-dominant categories, particularly *Liveability and Quality of Place*, were allocated a greater number of indicators to reflect their thematic richness.

Importantly, indicator allocation was proportional rather than equal. Categories characterized by greater conceptual complexity and empirical emphasis included multiple

indicators to capture nuance, while less-emphasized domains retained foundational indicators to ensure representation. Quantitative assessment of coverage confirmed that both frameworks achieved 100% comprehensiveness at the category level and 100% representativeness at the subcategory level. This balanced coverage supported holistic assessment while avoiding overrepresentation or neglect of any single dimension, thereby strengthening content validity.

**Alignment with Average Depth and Geometric Mean Metrics**

Measurement reliability of the developed frameworks was supported by the systematic, rule-based approach used to allocate and prioritize indicators across categories and subcategories. Rather than relying on ad hoc judgment, indicator distribution was governed by explicit quantitative criteria, including normalized breadth, normalized depth, the geometric-mean Selection Score, and the average depth of indicators.

The Selection Score determined the number of indicators allocated to each category and subcategory, ensuring proportional representation based on the combined intensity and diversity of emphasis observed in the reviewed literature. This approach reduced subjectivity in framework construction and enhanced internal consistency, as categories of comparable importance were treated consistently across the framework. Categories and subcategories that were widely recognized and extensively measured in prior studies received greater indicator representation, while less-emphasized domains were still included at a foundational level.

Within each allocated set, the selection of specific indicators was guided by frequency (depth) and breadth of occurrence across existing frameworks. Indicators that appeared frequently and across multiple sources were prioritized, reflecting stronger scholarly consensus and increasing the likelihood that similar constructs would be measured consistently across different applications. This selection logic strengthened measurement stability by favoring indicators with established usage rather than idiosyncratic or one-off measures.

The subsequent stratification of indicators into three hierarchical tiers Key, Supplementary, and Support further reinforced reliability by introducing a structured measurement hierarchy. The Key indicators formed a stable core dataset suitable for consistent baseline assessment, while Supplementary and Support indicators allowed additional analytical depth without compromising comparability. This tiered structure enabled flexible application while maintaining a consistent measurement backbone across studies and planning contexts.

Overall, the proportional allocation rules, hierarchical organization, and transparent selection criteria supported reliable application of the FASSGC-74 and FASSGC-42 frameworks. By ensuring that similar domains were measured with comparable depth and that indicator selection followed consistent principles, the frameworks minimized internal imbalance and measurement ambiguity, thereby strengthening their reliability as social sustainability assessment tools.

### 4.4 Framework Refinement, Delphi Validation Results (Two-Rounds)

This section outlined the process of refining and validating the proposed initial measurement contextual measurement assessment framework (FASSGC-42) through analysis of the two round Delphi. A sample of 50 responses (Round 1) and 30 (Round 2) were collected via Google Forms, and these data are used to refine and contextualize the framework.

#### 4.4.1 Round 1: Initial Delphi Results and Analysis

This section presented the Round 1 Delphi findings (n = 50) used to appraise and refine the proposed contextualized social sustainability assessment framework for gated communities in Saudi Arabia. The analysis began Indicator-level descriptive statistics were then reported (mean and standard deviation), and the interquartile deviation (IQD) was calculated to capture the spread of responses and the degree of consensus for each item.

The Delphi approach as shown in figure 25 is a research method commonly used to reach consensus on complex problems by collecting informed judgments from a panel of experts across multiple rounds of questionnaires. Panel selection is critical: while Delphi does not require representative sampling, participants should have relevant expertise and deep familiarity with the topic. For this study, the panel was designed to include both academic and practice-based experts with experience in Saudi urban development, housing, and sustainability assessment.

In this two-round Delphi, participants were encouraged to review, refine, and validate the proposed initial contextualized social sustainability framework. The purpose of this phase was to leverage local expertise to ensure that the framework's categories and indicators were valid and contextually appropriate for gated communities in Saudi Arabia. Delphi was selected because it provides an iterative, structured process to build expert consensus through multiple rounds and controlled feedback. Expert evaluation is a crucial step for establishing content validity and tailoring the framework to real-world conditions. As Creswell (2014) and others note, gathering feedback from knowledgeable practitioners and academics helps align research outcomes with professional standards and local realitiesA one-way ANOVA was used to examine whether ratings differed across expert subgroups, and Pearson correlation analysis explored interrelationships among the five thematic categories to identify potential overlaps. The section concluded with a thematic analysis of open-ended feedback, which informed item refinements and generated additional indicators to be carried forward into Delphi Round 2.

Delphi Panel Composition and Rounds: A panel of Saudi experts (80 experts) in relevant fields was convened. These experts were purposefully selected based on the following criteria:

- Proven expertise in architecture, urban planning, or related disciplines, with a focus on community development or sustainability.
- Familiarity with social sustainability concepts, preferably as part of their professional experience or research interests.
- A strong academic or professional track record (e.g., advanced degrees, relevant publications) indicating depth of knowledge in sustainable design or social aspects of urban development.
- Practical experience with housing or community projects in Saudi Arabia (to provide insight into the local gated community context).
- Saudi nationality (or extensive work experience in KSA), to ensure that they understand the cultural and societal context this was important for context-specific relevance.
- Qualifications such as professional certifications in sustainability or planning (for example, being a LEED Accredited Professional (LEED-AP), or having certification in BREEAM Communities or Mostadam Community rating systems.

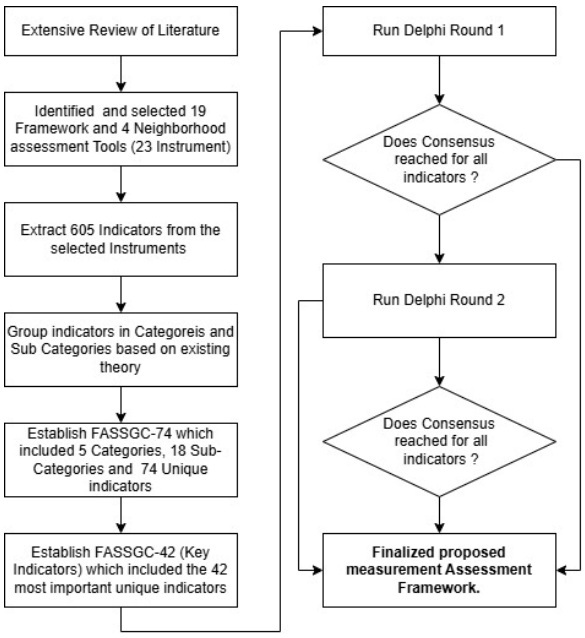


***Figure 25:*** *Delphi Procedure*

A group of local experts in Saudi Arabia rated the importance of 42 key indicators (FASSGC-42) using a two-round Delphi procedure. Eighty experts were invited to participate; 50 completed Round 1 and 30 completed Round 2. The quantitative ratings and qualitative feedback were analysed to determine whether consensus and agreement were reached on the importance of each indicator for assessing social sustainability within gated communities in Saudi Arabia.

Median (Mdn) and interquartile deviation (IQD) were used to determine consensus and retention, while the mean (M) was calculated only to rank indicators by perceived importance within categories and overall. The median is well suited for Likert-scale (ordinal) ratings because it is less sensitive to extreme values than the mean. IQD captures dispersion between the 25th and 75th percentiles and is commonly used as a consensus measure in Delphi studies, where smaller values indicate stronger agreement. On a 7-point Likert scale, an IQD of 1.0 or less is commonly interpreted as indicating good consensus.

In each Delphi round, indicators were sorted into clear decision outcomes based on importance and expert agreement. Using the 7-point Likert scale, consensus was evaluated with the median (Mdn) as the measure of central tendency and the interquartile deviation (IQD) as the measure of dispersion. Indicators were accepted with consensus when $Mdn \geq 5$ and $IQD \leq 1.0$, indicating importance above the neutral midpoint and acceptable convergence in expert judgment. Indicators with $Mdn \geq 5$ but $IQD > 1.0$ were classified as lacking sufficient agreement and were retained for re-rating and potential refinement in Round 2. Indicators that did not meet the minimum importance threshold ($Mdn < 5$) were considered for removal or substantial revision. Indicators that achieved Round 1 consensus were retained and not re-presented in the next round, while items lacking consensus were carried forward to Round 2 alongside additional indicators generated from experts' qualitative feedback.

**Characteristics of the Participants in Round 1**

Table 27 summarized the characteristics of the sample. A total of 50 respondents (experts) participated in round 1. In terms of education level, nearly half of the participants held a master's degree (46%), followed by those with a PhD or Doctorate (34%), while 20% held a bachelor's degree. Regarding current employment, the majority were academicians in higher education institutions (52%), with just over one-third working as professionals in private practice, such as architects, engineers, or planners (34%). Smaller proportions were employed in governmental or semi-governmental organizations (10%), while only 2% each worked as contractors or real estate developers.

In relation to years of professional experience, the largest group reported less than five years of experience (42%), followed by those with more than fifteen years (22%), those with five to nine years (20%), and those with ten to fifteen years of experience (16%). Overall, the sample was dominated by academically oriented professionals with varied, but generally early- to mid-career, experience.

***Table 27:*** *Characteristics of the Selected Sample (Round 1)*

| Variable Name | Options | Number | Percentage % |
|---|---|---|---|
| **Education Level** | Bachelor | 10.00 | 20% |
| | Master | 23.00 | 46% |
| | PhD, Doctorate | 17.00 | 34% |
| | **Total** | 50.00 | 100% |
| **Current Work** | Academician in higher education institution | 26.00 | 52% |
| | Contractor | 1.00 | 2% |
| | Employed in governmental or semi-governmental organization | 5.00 | 10% |
| | Professional in private practice (Architect, Engineer, Planner) | 17.00 | 34% |
| | Real estate developer | 1.00 | 2% |
| | **Total** | 50.00 | 100% |
| **Year of Experience** | More than 15 years | 11.00 | 22% |
| | 10 to 15 years | 8.00 | 16% |
| | 5 to 9 years | 10.00 | 20% |
| | Less than 5 years | 21.00 | 42% |
| | **Total** | 50.00 | 100% |

**Descriptive Statistics (Means, Median, SD, IQD) – Round 1**

The results of the analysis of the first-round Delphi procedure are presented in Table 28, with selected findings also illustrated in Figure 26, 27 and 28 to support interpretation that is related to IQD and M. Table 28 reports the mean (M), median, standard deviation (SD), and interquartile deviation (IQD) for each of the 42 indicators assessed in Round 1, together with their category-level and overall rankings. Although the median was used as the primary statistic for determining consensus (given the ordinal nature of Likert-scale data), Means were also reported to provide greater differentiation in the relative importance of indicators, as median values often cluster and offer less resolution between items.

The study found that all indicators received mean scores between 4.22 and 6.46 all above the neutral midpoint of 4 on the scale indicating that experts regarded every proposed indicator as at least moderately important. Across all 42 items, the average mean was about 5.45, with a pooled standard deviation of approximately 1.47. The interquartile deviation (IQD) values ranged from 0.5 to 1.875, reflecting varying levels of consensus among the experts. Lower IQDs (around 0.5) signified strong agreement on certain indicators' importance, whereas higher IQD values (up to 1.875 for one item) suggested more variability in expert opinions. Nonetheless, even the lowest-ranked items had meant ratings slightly above neutral, underscoring that the full set of indicators was generally viewed as relevant by the expert panel, albeit with clear differences in priority.

The highest-ranked indicators were concentrated in the category of Safety, Security, and Perceived Control. The top-rated item was the feeling that one's house and community are safe and secure whether the resident is present or not (Indicator 2.4, M = 6.46, IQD = 0.5, overall rank = 1). This was closely followed by feeling comfortable and secure walking in the community during both daytime and nighttime (Indicator 2.3, M = 6.38, IQD = 0.5, overall

rank = 2). Other indicators that scored very highly included respecting neighbour of different ethnicities and feeling satisfied with community homogeneity (Indicator 1.6, M = 6.14, IQD = 0.875, rank = 3), being satisfied with the level of privacy available in the community (Indicator 2.5, M = 6.08, IQD = 0.5, rank = 4), and the availability of a range of social and recreational activities in public spaces (Indicator 3.6, M = 5.94, IQD = 0.5, rank = 5). Together with strong results for trusting people in the community (Indicator 1.7, M = 5.86, IQD = 1.0, rank = 6) and the sense that the community and its housing meet residents' needs (Indicator 3.13, WM = 5.84, IQD = 1.0, rank = 7), these findings suggested that experts viewed social sustainability in gated communities primarily through the lens of security, mutual respect, privacy, and everyday livability supported by active communal spaces. The two highest means (6.46 and 6.38) were near the top of the 7-point scale, indicating a strong consensus that safety and security are paramount in this social sustainability framework (as evidenced by their very low IQDs of 0.5, signifying high agreement among experts)

***Table 28:*** *Round 1 indicator importance (median) and agreement (IQD*

| Category | Indicators | Mean (M) | Median | Std. Deviation (SD) | Interquartile Deviation (IQD) | Ranking By Category | Overall Ranking |
|---|---|---|---|---|---|---|---|
| **1. Community Cohesion and Social Interaction** | 1.1 I have good relationships with neighbour where we have occasional visits. | 5.68 | 6 | 1.096 | 0.5 | 4 | 13 |
| | 1.2 If I need help or support, I will ask my neighbour, and I will help my neighbour (there is mutual support). | 5.70 | 6 | 1.233 | 1.0 | 3 | 11 |
| | 1.3. I participate with neighbour in social, cultural, and religious events and voluntary work, and I'm an active member of community associations. | 5.48 | 6 | 1.581 | 1.0 | 6 | 19 |
| | 1.4 I volunteer for activities that help in developing my community. | 5.54 | 6 | 1.232 | 0.875 | 5 | 18 |
| | 1.5 There is a level of acceptance and open mindedness within neighbour. | 5.20 | 5 | 1.370 | 0.875 | 7 | 33 |
| | 1.6 I respect my neighbour of different ethnicities and am satisfied with homogeneity. | 6.14 | 7 | 1.088 | 0.875 | 1 | 3 |
| | 1.7 I trust people in my community. | 5.86 | 6 | 1.178 | 1.0 | 2 | 6 |
| **2. Safety, Security, and Perceived Control** | 2.1 Crime Reported Rate | 5.76 | 6 | 1.546 | 1.0 | 4 | 8 |
| | 2.2 Index of safety on the streets. | 5.36 | 6 | 1.735 | 1.5 | 5 | 25 |
| | 2.3 I Feel comfortable, safe and secure walking during the daytime and nighttime. | 6.38 | 7 | 0.780 | 0.5 | 2 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2.4 I Feel that my house and community is safe and secure during whether I'm attending or not attending it. | 6.46 | 7 | 0.706 | 0.5 | 1 | 1 |
| | 2.5 I'm Satisfied with level of privacy that is available in the community. | 6.08 | 6 | 1.104 | 0.5 | 3 | 4 |
| **3. Livability and Quality of Place** | 3.1 I use different available facilities such as the community center, public library, and sports facilities. | 5.74 | 6 | 1.352 | 1.0 | 3 | 9 |
| | 3.2 I'm satisfied with the transportation modes in the community and outside the community | 5.34 | 6 | 1.636 | 1.0 | 12 | 26 |
| | 3.3 My community streets and pavements are friendly for walking and biking. | 5.42 | 6 | 1.566 | 1.0 | 9 | 21 |
| | 3.4 Number of services distributions within the community. | 5.02 | 6 | 1.708 | 1.0 | 18 | 36 |
| | 3.5 I'm Satisfied with the available green areas within my community. | 5.48 | 6 | 1.657 | 1.0 | 8 | 20 |
| | 3.6 The availability of a range of activities (Such as kid's activities, celebrations, etc.) in open public spaces will improve social interaction in the community. | 5.94 | 6 | 1.316 | 0.5 | 1 | 5 |
| | 3.7 Outdoor areas (plaza, squares) are well distributed in the community to satisfy resident€™s needs. | 5.70 | 6 | 1.147 | 0.5 | 4 | 12 |
| | 3.8 There is an opportunity for play and leisure activities in the community. | 5.30 | 6 | 1.644 | 0.875 | 13 | 27 |
| | 3.9 Population Density. | 4.86 | 5 | 1.796 | 1.375 | 20 | 40 |
| | 3.10 Houses in the community are friendly for people with disabilities. | 5.42 | 6 | 1.642 | 0.5 | 10 | 22 |
| | 3.11 People are aware to Clean their environment and the community. | 5.24 | 6 | 1.673 | 1.5 | 15 | 31 |
| | 3.12 Housing Types. | 4.90 | 5 | 1.764 | 1.0 | 19 | 39 |
| | 3.13 The Community and houses meet the needs of those who live in. | 5.84 | 6 | 1.235 | 1.0 | 2 | 7 |
| | 3.14 I am satisfied with living in this community and planning to stay here. | 5.68 | 6 | 1.347 | 1.0 | 5 | 14 |
| | 3.15 I'm Satisfied with less noise and pollution from neighbour. | 5.40 | 6 | 1.485 | 0.875 | 11 | 23 |
| | 3.16 I'm Satisfied with cleanliness of the community and street lighting. | 5.62 | 6 | 1.483 | 1.0 | 6 | 15 |
| | 3.17 I'm Satisfied with attractiveness of the design features of the community (such as lighting fixtures, etc.) | 5.22 | 6 | 1.753 | 1.375 | 16 | 32 |
| | 3.18 I feel attached, loyal and proud to be resident in this community | 5.62 | 6 | 1.563 | 1.0 | 7 | 16 |
| | 3.19 I Feeling that it is a good place to live in forever. | 5.12 | 6 | 1.814 | 1.5 | 17 | 34 |
| | 3.20 There are changes that happened through time in the community. | 5.30 | 5 | 1.529 | 1.375 | 14 | 28 |
| | 3.21 I have a desire to leave the community | 4.60 | 5 | 1.773 | 1.5 | 21 | 41 |
| **4. Participatory Governance, Equity & Empowerment** | 4.1 I contribute to making decisions and to associations in my community. | 5.30 | 6 | 1.418 | 0.5 | 2 | 29 |
| | 4.2 I'm a member of the community association, and I help organize events in my community. | 5.06 | 5 | 1.695 | 0.875 | 4 | 35 |
| | 4.3 There is access to the community and job opportunities. | 5.30 | 6 | 1.418 | 0.5 | 3 | 30 |
| | 4.4 Are their activities and programs that accommodate all ages and all social groups. | 5.72 | 6 | 1.457 | 1.0 | 1 | 10 |
| | 4.5 I Pay fees for the benefit of my community. | 4.94 | 5 | 1.683 | 1.0 | 5 | 37 |
| | 4.6 Level of Education and Literacy within the community. | 4.94 | 5 | 1.683 | 1.375 | 6 | 38 |
| | 4.7 Presence of risk assessment, routes, safe meeting points. | 4.22 | 5 | 2.003 | 1.875 | 7 | 42 |
| **5. External Relations & Integration** | 5.1 The gated community does not hinder me from identifying strangers and building strong connections and relationships with communities outside the gated community. | 5.40 | 6 | 1.773 | 1.0 | 2 | 24 |
| | 5.2 I can access the urban working areas in the community. | 5.58 | 6 | 1.230 | 0.5 | 1 | 17 |

By contrast, the lowest-ranked indicators were mainly related to Participatory Governance, Risk Management, and long-term Attachment to the community. The presence of risk assessments, evacuation routes, and safe meeting points for emergencies (Indicator 4.7) received the lowest importance rating (M = 4.22, IQD = 1.875, overall rank = 42). Notably, this item's high IQD of 1.875 was the largest of any indicator, suggesting that experts had diverse or divided opinions about the importance of formal risk preparedness measures in the community. The indicator reflecting a desire to leave the community (Indicator 3.21) was the second-lowest rated item (M = 4.60, IQD = 1.5, rank = 41), implying that *considering* residents' inclination to move away was not seen as a strong indicator of social sustainability. Other relatively low-ranked items included the community's population density (Indicator 3.9, M = 4.86, IQD = 1.375, rank = 40), the variety of housing types in the community (Indicator 3.12, M = 4.90, IQD = 1.0, rank = 39), the practice of paying community fees for communal services/upkeep (Indicator 4.5, M = 4.94, IQD = 1.0, rank = 37), the overall level of education and literacy within the community (Indicator 4.6, M = 4.94, IQD = 1.375, rank = 38), and formal membership in community associations (Indicator 4.2, M = 5.06, IQD = 0.875, rank = 35). Although all these lower-ranked indicators still had mean scores above the neutral midpoint of 4, they were deemed less critical by the experts compared to the safety, privacy, trust, and quality-of-place attributes that dominated the top of the rankings. The means for the bottom two items (4.22 and 4.60) were only slightly above neutral, which suggests that experts were more cautious or ambivalent about treating emergency planning and an expressed desire to leave the community as core elements of social sustainability.

The results established a clear, evidence-based ranking of social sustainability indicators for gated communities. Experts agreed that the most critical factors were related to security, privacy, mutual respect, and overall quality of place. While most other indicators were still considered important, they clustered around moderate priority levels, indicating agreement

on relevance but differences in emphasis. Indicators linked to participatory governance and emergency preparedness were ranked lowest, suggesting that they might require clearer definition, contextual support, or policy reinforcement.

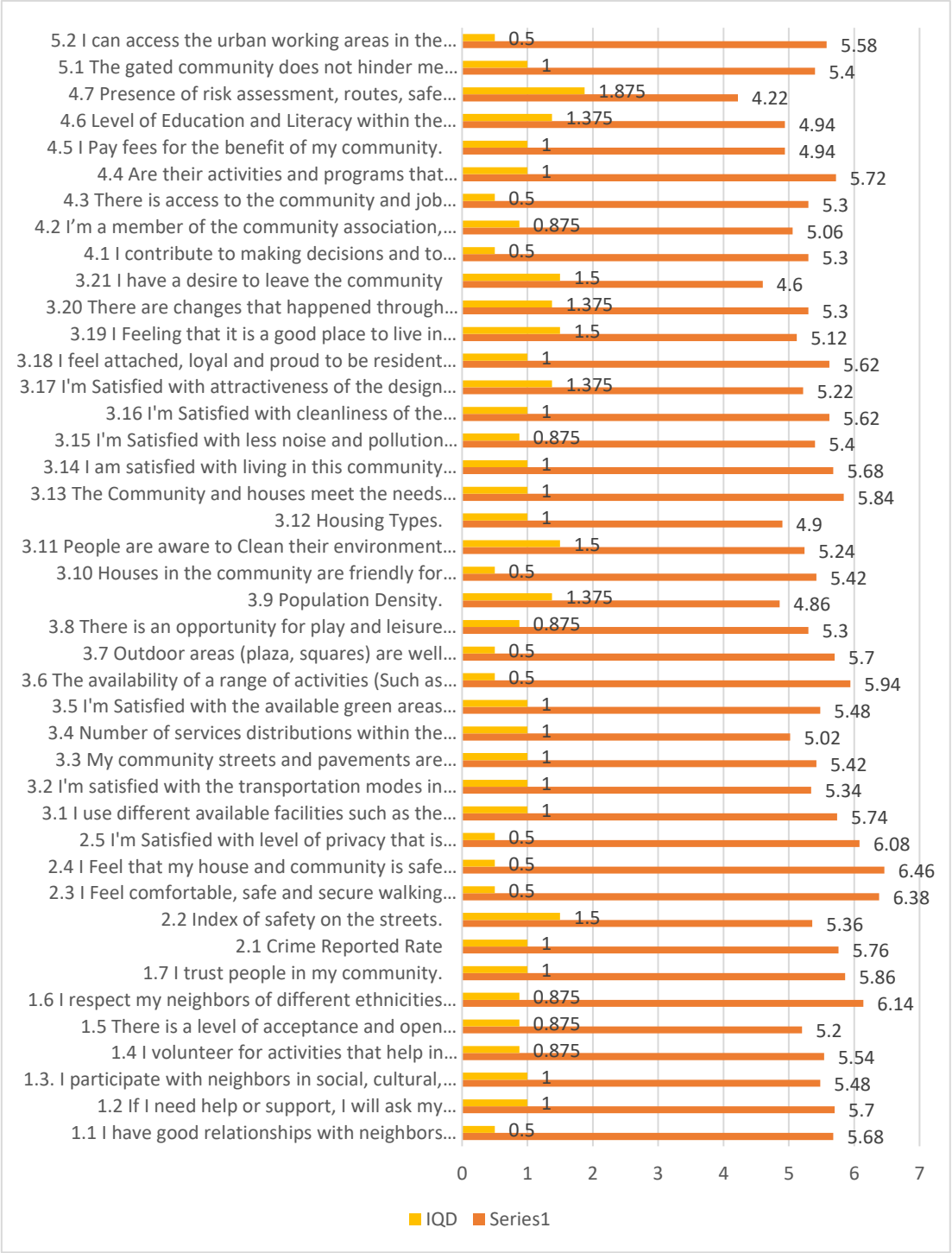


***Figure 26:*** *Round 1 indicator importance (median) and agreement (IQD) with retention threshold (Mdn ≥ 5; IQD ≤ 1.0)*

Figure 26 presented the overall rating for each indicator individually, ranging from Extremely Important (7) to Extremely Unimportant (1), as assessed by the panel of expert participants. The stacked bar chart visually summarized the distribution of responses across all 42 indicators, enabling a direct comparison of perceived importance within and across thematic categories.

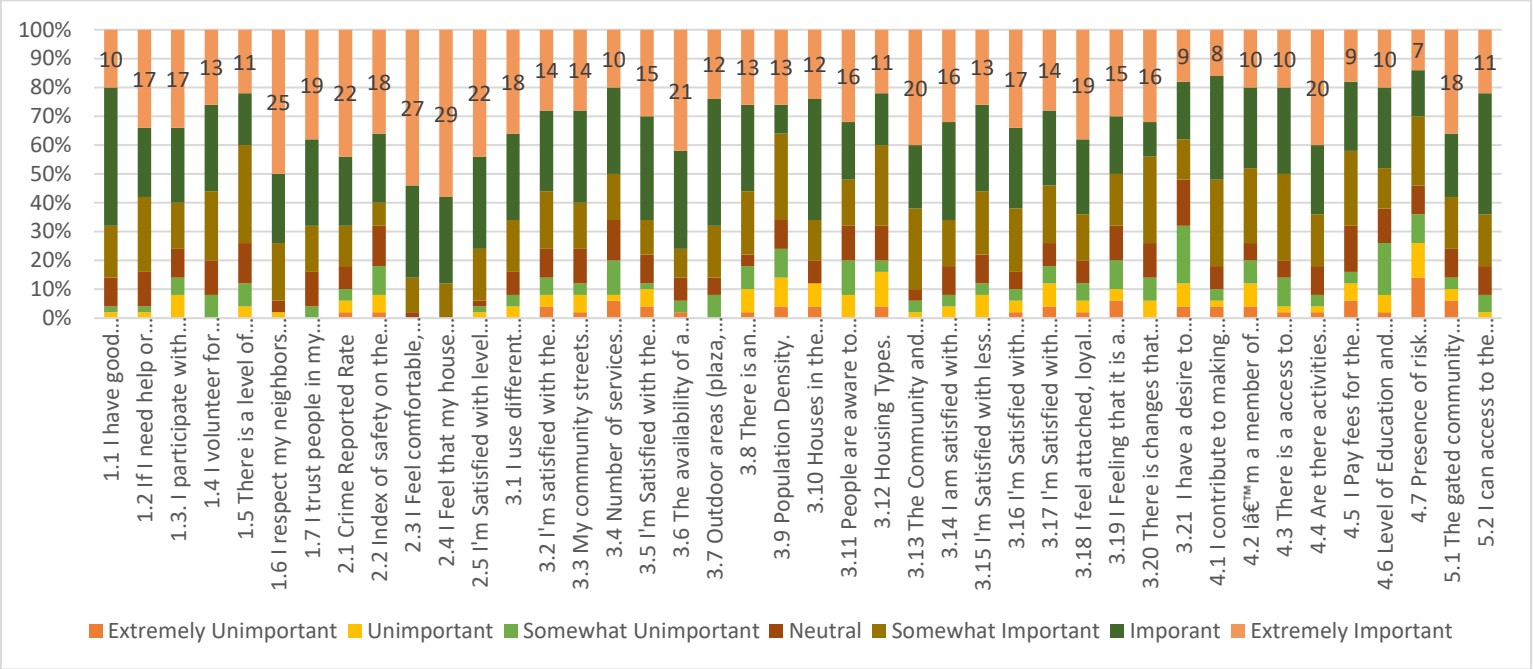


***Figure 27:*** *Rating of Each Indicator*

Most indicators received ratings skewed toward the upper end of the scale, with a noticeable concentration in the *Important* and *Extremely Important* categories. Notably, indicators such as 2.4 (“I felt that my house and community was safe and secure”), 2.3 (“I felt comfortable and safe walking in the community”), and 3.16 (“I was satisfied with the cleanliness of the community”) exhibited particularly strong consensus, with most experts rating them as highly important.

In contrast, some indicators displayed more varied opinions, with larger proportions of *Neutral* or *Unimportant* ratings. For instance, Indicator 3.9 (Population Density), Indicator 3.12 (Housing Types), and Indicator 4.7 (Presence of risk assessment and safe meeting points) were

among the items that received a broader spread of ratings, indicating lower perceived relevance or potential ambiguity in interpretation.

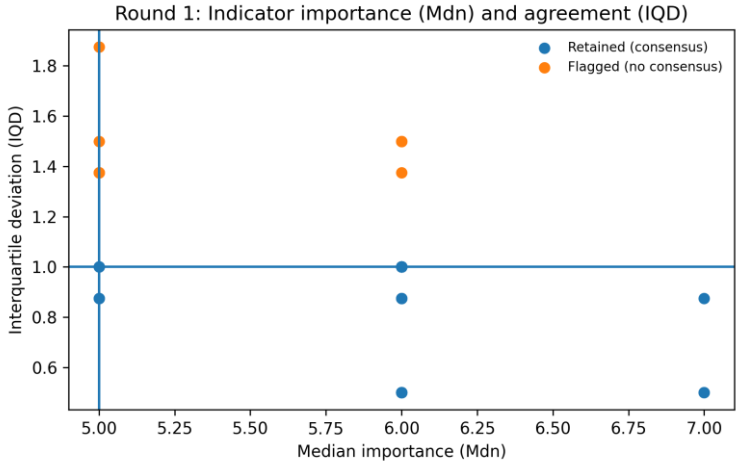


***Figure 28**: Median Importance*

In Round 1, indicators were assessed against predefined consensus criteria. Indicators with Mdn ≥ 5 and IQD ≤ 1.0 were interpreted as achieving acceptable consensus and were accepted for inclusion in the framework; therefore, they were not re-presented in the subsequent round. In contrast, indicators with Mdn ≥ 5 but IQD > 1.0 were classified as lacking sufficient agreement and were retained for re-rating and potential refinement in Round 2 as shown in figure 5. Applying these criteria, experts reached consensus on 33 out of the 42 indicators by the end of Round 1, while 9 indicators did not meet the agreement threshold and were flagged for follow-up in the next round.

In addition to the quantitative ratings, round 1 included open-ended feedback that was thematically analysed to identify issues of redundancy, unclear wording, and missing context-specific dimensions. This qualitative phase resulted in the proposal of additional indicators addressing gaps such as informal neighbour interaction, culturally relevant gathering spaces, inclusivity and non-discrimination, visible security infrastructure, and external social openness.

These proposed indicators were consolidated and carried forward into Round 2 alongside the re-rated original items.

**Qualitative Analysis of Open-Ended Survey Comments**

In the survey of social sustainability indicators for gated communities, participants provided open-ended comments focusing on suggested deletions, modifications, or additions to questionnaire items. Through open coding of the *Comments and Suggestions* responses, several codes were identified and grouped into broader themes. Table 29 summarized the codes, their definitions, the thematic category to which each code belonged, and representative quotes used for illustration.

***Table 29:*** *Summary of themes, codes, and illustrative quotes from participants' comments*

| Code | Definition | Theme | Representative Quote |
|---|---|---|---|
| **Unnecessary indicators** | Certain survey items were viewed as not important or not adding value, leading participants to recommend their removal. | Streamlining & Clarity of Items | "3.14 I think you can eliminate this indicator (not needed)." |
| **Redundant indicators** | Some indicators were seen as duplicating or overlapping with others, suggesting they could be consolidated or omitted. | Streamlining & Clarity of Items | "3.16 You already mentioned cleanliness in this section... Either eliminate this indicator or specify that you're talking about the quality of street lighting." |
| **Unclear wording** | Participants found the wording of some questions confusing or ambiguous, indicating a need for clarification or rephrasing. | Streamlining & Clarity of Items | "3.21 It's not clear; it's better to eliminate it." |
| **Informal neighbor interactions** | Emphasizing everyday social contact by measuring how frequently residents engage in casual conversations with neighbour. | Community Cohesion & Inclusivity | "How often do you have casual conversations with neighbour? - adding this indicator will help assess the level of social interaction." |
| **Community social activities** | Proposing the inclusion of organized community events or activities as an indicator of social interaction and cohesion. | Community Cohesion & Inclusivity | "Suggestions to add: Community building activities." |
| **Children's relationships** | Highlighting the need to assess how children in the community form relationships, reflecting family-oriented social cohesion. | Community Cohesion & Inclusivity | "Indicator that assesses children's relationships." |
| **Sense of belonging** | Stressing residents' feelings of attachment, pride, and shared values within the community as a key aspect of cohesion. | Community Cohesion & Inclusivity | "…the sense of belonging to the community and neighbourhood, as well as having shared norms and values among the community." |
| **Cultural norms and values** | Accounting for local cultural context (e.g. Saudi social and religious norms) in the indicators to ensure relevance. | Community Cohesion & Inclusivity | "We must consider cultural [sic] norms in Saudi societies [sic]." |
| **Religious gathering places** | Recognizing the role of communal religious institutions (such as mosques) in fostering neighbourhood cohesion. | Community Cohesion & Inclusivity | "The mosque is one of the most important elements for the cohesion of the neighbourhood." |
| **Acceptance and non-discrimination** | Ensuring the community climate is welcoming and free of prejudice, so that all residents feel accepted and respected. | Community Cohesion & Inclusivity | "Ensuring acceptance and a judgment-free environment (to be sure there is no discrimination or any racist mindset or behaviors)." |
| **Security systems and surveillance** | Suggesting the inclusion of physical security measures (e.g. CCTV cameras, gated access, alarms) as indicators of safety. | Safety & Security Enhancements | "You may include indicators related to CCTV and security watch." |
| **Lighting and visibility** | Emphasizing environmental design for safety, such as having well-lit areas and passive surveillance to eliminate "dark spots." | Safety & Security Enhancements | "There are no dark spots within the neighbourhood (everywhere is well lit at night), and streets are designed for passive surveillance." |
| **Safety for women and children** | Addressing the protection of vulnerable groups (children, women, elders) and freedom from harassment as part of community safety. | Safety & Security Enhancements | "Ensuring safety for all family members, especially elders and children... as a woman, to be safe from any kind of harassment in the community." |
| **Guest access policies** | Considering how restrictions on visitor entry (guest access) are managed, reflecting the balance between security and openness. | Safety & Security Enhancements | "Resident restrictions on guest access." |
| **Pedestrian-friendly design** | Incorporating walkability and pedestrian comfort (e.g. continuous, shaded sidewalks) as a factor in community livability. | Physical Environment & Livability | "Pedestrian routes are continuous, shaded, and safe." |

| | | | |
|---|---|---|---|
| **Adequate parking** | Noting the availability and adequacy of parking facilities as an important aspect of the community's physical infrastructure. | Physical Environment & Livability | "Parking lots." |
| **Responsive maintenance** | Emphasizing timely maintenance and services (quick response to repair requests) as part of a high-quality living environment. | Physical Environment & Livability | "Maintenance services respond quickly to requests." |
| **Community endorsement** | Gauging residents' overall satisfaction and pride by whether they would recommend living in the community to others. | Physical Environment & Livability | ""I will recommend the community to others." |
| **Openness to outsiders** | Encouraging social integration by welcoming non-residents (outsiders) to community events, markets, or gatherings. | External Integration & Openness | "Non-residents are welcome to visit community events, markets, or gatherings." |
| **Avoiding isolation** | Ensuring that living in the gated community does not lead to feelings of isolation from the broader society. | External Integration & Openness | "Living here does not make me feel isolated from the broader society." |
| **Access to outside services** | Evaluating how well the community is connected to external infrastructure, such as public transportation and essential services. | External Integration & Openness | "Accessibility to public transportation and essential services." |
| **Balancing security & integration** | Acknowledging the need to maintain security while also fostering connections and interaction with the outside community. | External Integration & Openness | "The relation with the outside should be carefully considered to not allow intruders and at the same time not create isolation." |
| **Transparent governance** | Highlighting open governance practices, where community rules, budgets, and decisions are communicated transparently to residents. | Governance & Participation | "Community rules, budgets, and decisions are shared transparently with residents." |
| **Inclusive decision-making** | Ensuring all resident groups (e.g. different genders, ethnicities) are equally represented and have a voice in community decisions. | Governance & Participation | "Equal representation of all demographic groups, such as by ethnicity or gender." |
| **Fair community fees** | Assessing whether service charges and fees paid by residents are appropriate and equitable. | Governance & Participation | "Service charges and fees are appropriate." |
| **Accountability mechanisms** | The presence of mechanisms for accountability and conflict resolution within the community's management or association. | Governance & Participation | "Accountability and conflicts" |

The thematic analysis identified six major themes reflecting participants' feedback on the questionnaire items: (1) *Streamlining and Clarity of Questionnaire Items*, (2) *Community Cohesion and Inclusivity*, (3) *Safety and Security Enhancements*, (4) *Physical Environment and Livability*, (5) *External Integration and Openness*, and (6) *Governance and Participation*. Each theme was supported by illustrative quotes from respondents' open-ended comments.

The first theme reflected participant concerns about the relevance and wording of certain survey questions. Several respondents identified specific indicators they considered unnecessary or duplicative, suggesting that these be omitted to streamline the questionnaire. For example, one comment plainly stated, "3.14 I think you can eliminate this indicator (not needed)." Similarly, another noted that an item on cleanliness overlapped with other questions, advising "either eliminate this indicator or specify that you're talking about the quality of street lighting." Such feedback indicated perceptions of redundancy in the survey. In addition, participants pointed out ambiguity in some items; one described a question as having a "mixed signal," and another wrote that "the last indicator 4.7 is not clear." These responses showed a

desire for clearer, more direct questions and for the removal of items seen as irrelevant or confusing.

A prominent theme was the need to better capture the social and cultural aspects of community life. Participants emphasized indicators that would reflect stronger community cohesion, such as regular informal interactions and inclusive social activities. For instance, one respondent suggested adding a question on casual neighbourly interaction: “How often do you have casual conversations with neighbour?” to gauge everyday social connectedness. Others proposed incorporating community activities (e.g., organized events or “community building activities”) and measures of relationships among specific groups such as children. One comment explicitly recommended an “indicator that assess children’s relationships,” underlining that the social bonds of younger residents were also important for cohesion.

A sense of belonging emerged as another critical element, with participants highlighting the importance of residents feeling attachment and loyalty to their community. This was illustrated by a response stressing “the sense of belonging to the community and neighbourhood, as well as having shared norms and values among the community.” In terms of inclusivity, respondents advocated for acknowledging cultural and religious factors that influenced social cohesion in Saudi gated communities. One participant wrote that “we must consider cultural norms in Saudi societies. Integration of local cultural and religious values” was essential, pointing to the local context in shaping community relations. Religious gathering places were noted as key social hubs; as another respondent observed, “The mosque is one of the most important elements for the cohesion of the neighbourhood.” Participants also emphasized the importance of an inclusive, welcoming atmosphere free from discrimination. For example, one comment called for “ensuring acceptance and a judgment-free environment” in the community so that no resident faced prejudice. Overall, this theme underscored that the

questionnaire should encompass the various social dynamics from everyday interactions to cultural values and inclusivity that contributed to a cohesive community.

The third theme encompassed suggestions to broaden the survey's coverage of safety and security within the gated community. Respondents felt that more concrete measures of security infrastructure and personal safety should be included. For instance, participants recommended adding indicators related to physical security systems, such as the effectiveness of security gates, CCTV cameras, and surveillance. One suggestion stated, "You may include indicators related to CCTV and security watch." Another respondent provided a detailed example indicator, suggesting the need to ensure that there were "no dark spots within the neighbourhood (everywhere is well lit at night), and streets are designed for passive surveillance." This highlighted the perceived importance of lighting and environmental design for safety.

Additionally, participants stressed safeguarding vulnerable groups as part of community security. They noted that the questionnaire should consider the safety of women, children, and the elderly specifically. A representative comment outlined the need to ensure "safety for all family members, especially elders and children," and "as a woman, to be safe from any kind of harassment in the community." Such feedback suggested that beyond general crime rates or security perceptions, the survey should gauge how secure different demographic groups felt. Participants also pointed to guest access policies as relevant to security and integration; one mentioned "resident restrictions on guest access" as an indicator to consider, reflecting how strictly outsiders were regulated. In summary, this theme indicated that experts wanted the questionnaire to address a wider range of safety aspects from infrastructure (lighting and cameras) and environmental design to personal safety and community access policies to fully capture perceived security in gated communities.

The fourth theme related to the built environment and services within the community that affected residents' quality of life. Respondents suggested including indicators that measured how well the physical layout and amenities supported a livable community. Walkability and mobility were highlighted, with one participant proposing an item such as "Pedestrian routes are continuous, shaded, and safe." This underscored the value of pedestrian-friendly designs such as sidewalks and pathways that encourage walking and cycling as part of livability. Another practical aspect raised was the availability of parking; a respondent simply noted "Parking lots," implying that parking facilities should be assessed in terms of adequacy or convenience.

Maintenance and upkeep of the community were also featured in the feedback. Participants indicated that responsive maintenance services contributed to residents' satisfaction. For example, one respondent suggested including whether "maintenance services respond quickly to requests." Efficient maintenance was viewed as integral to the quality of place, ensuring that infrastructure and amenities were well maintained. Finally, some comments addressed overall satisfaction and attachment to the community, recommending an indicator of residents' willingness to endorse their community. One participant suggested adding the statement "I will recommend the community to others." Such an item would capture residents' overall approval of their living environment, indirectly reflecting multiple livability factors. In essence, this theme suggested broadening the questionnaire to evaluate key physical and service-related elements from walkability and parking to maintenance responsiveness along with an outcome measure of residents' contentment with their community.

The fifth theme centered on the relationship between the gated community and the wider society. Participants felt that the survey should account for how well the community was integrated with external networks and how open it was to outsiders. One aspect of this theme

was community openness, wherein respondents proposed indicators related to welcoming non-residents into the community for events or visits. A clear example was the suggestion, “Non-residents are welcomed to visit for community events, markets, or gatherings.” This reflected an attitude of openness that could foster social integration beyond the compound’s boundaries.

Relatedly, participants wanted to ensure that living in a gated community did not lead to social isolation. They suggested gauging whether residents still felt connected to broader society; as one comment stated, “Living here does not make me feel isolated from the broader society.” Including such an item would directly measure perceived isolation versus integration. Practical connectivity to the city was another recurrent idea. Respondents mentioned access to public transportation and essential services outside the community as important indicators. One wrote about “accessibility to public transportation and essential services,” highlighting that a socially sustainable community should not be physically or functionally disconnected from the urban fabric. Finally, participants emphasized the need to balance security with integration, recognizing that while security was crucial in gated communities, it should not completely hinder external engagement. This balance was described by a participant who cautioned that “the relation with the outside should be carefully considered to not allow intruders and at the same time not create isolation.” Collectively, this theme suggested that the questionnaire should include measures of outward-looking connectivity and openness, assessing how gated communities interacted with and depended on the surrounding city and society.

The final theme involved the governance of the community and residents’ participation in decision-making. Respondents pointed out that social sustainability was also influenced by how communities were managed and how inclusive governance structures were. They advised adding indicators to capture transparency and accountability in governance. For instance, one suggestion was to assess whether “community rules, budgets, and decisions are shared

transparently with residents." Such transparency was viewed as fostering trust and empowerment among residents.

Another aspect of this theme was inclusive decision-making, with participants emphasizing the importance of ensuring that all demographic groups had a voice in community affairs. One comment highlighted the need for "equal representation of all demographic groups, such as by ethnicity or gender." Participants also considered the fairness of financial obligations within the community, suggesting the evaluation of whether "service charges and fees are appropriate," reflecting concerns about equity and trust in community management. Finally, the theme included references to accountability and conflict resolution mechanisms. Although mentioned briefly (e.g., a participant simply noted "Accountability and conflicts"), these comments implied the importance of having formal processes to manage disputes and hold decision-makers accountable. Overall, the Governance and Participation theme highlighted that, beyond social interactions and physical attributes, the questionnaire should address how communities were governed, including transparency, inclusivity, fairness, and conflict management.

In summary, the thematic analysis of the open-ended comments yielded a rich set of recommendations to strengthen the questionnaire. Experts identified items that could be streamlined, clarified, or merged, and they also proposed additional indicators that more accurately reflected the lived realities of Saudi Arabian gated communities particularly in relation to cultural norms, inclusivity, safety for vulnerable groups, everyday social interaction, and governance transparency. These qualitative insights complemented the quantitative results and informed targeted refinements to item wording and scope. Importantly, the new indicators emerging from the thematic analysis were consolidated and incorporated as candidate items for

Delphi Round 2, where they were to be re-evaluated by the panel for importance and consensus (see Figure 29 for the mapping of added indicators to the framework).

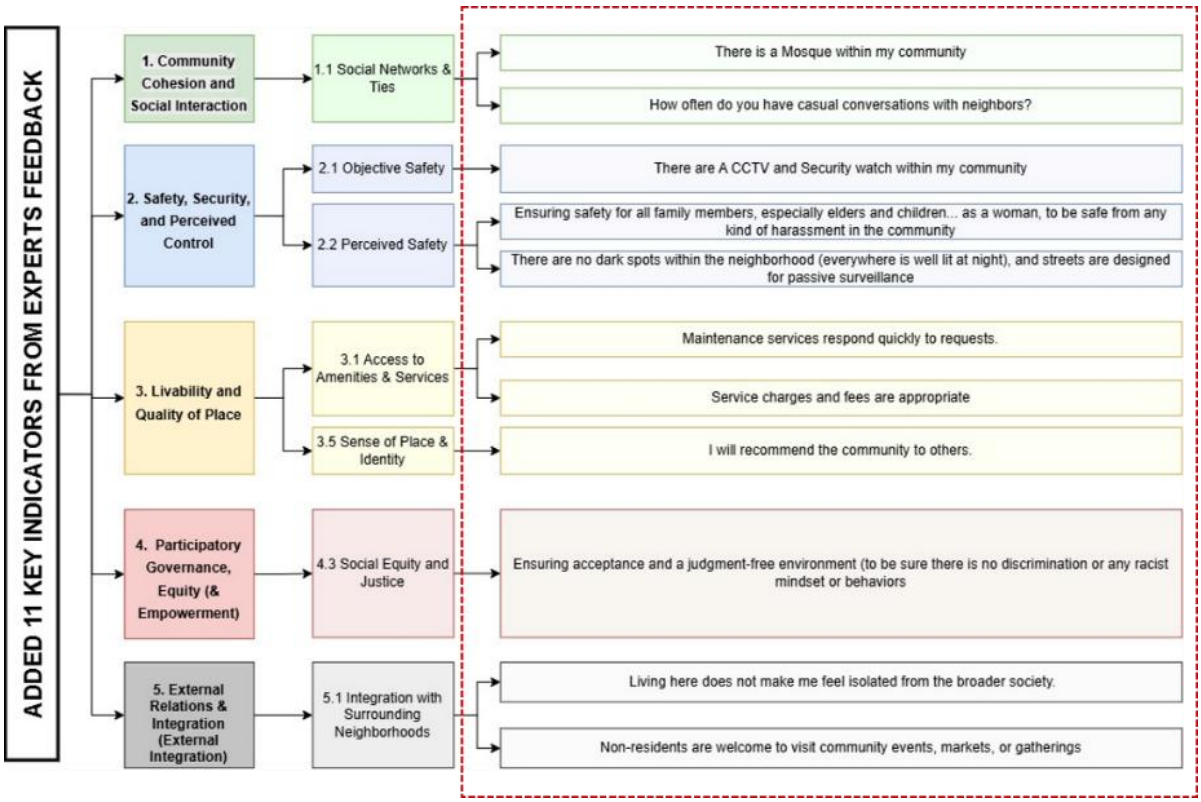


***Figure 29:*** *Added Indicators to the contextualized finalized assessment framework for round 2*

Consensus and selection across rounds. The findings demonstrate rapid convergence in Round 1. Using the study's decision rule (Mdn ≥ 5 and IQD ≤ 1.0), experts reached consensus on 33 out of 42 indicators, while 9 indicators showed insufficient agreement and were flagged for follow-up. During instrument revision, one non-consensus item was consolidated based on qualitative feedback, resulting in eight re-rated indicators carried forward to Round 2. In Round 2 (n = 30), a total of 19 indicators were evaluated (eight re-rated items plus eleven new indicators proposed through Round 1 open-ended feedback; Tables 4 and 5). Applying the same retention criteria (Mdn ≥ 5 and IQD ≤ 1.0), 12 indicators were accepted and 7 were excluded, resulting in the finalized 45-indicator framework (FASSGC-45) while maintaining the same five-category structure.

**Summary of Delphi Round 1**

Delphi Round 1 evaluated a total of 42 original social sustainability indicators for Saudi gated communities across five thematic categories. All indicators received median scores above the neutral value of 4, indicating overall relevance. Applying the predefined consensus criteria (median $\geq 4$ and IQD $\leq 0.5$), 33 indicators were accepted, while 9 indicators were identified as re-rating due to lower median values and/or higher interquartile ranges. A detailed overview of indicator medians, IQD values, and consensus status (accepted, re-rated, or newly added) was presented in Table 30.

Indicators related to community cohesion and social interaction demonstrated consistently high importance ratings, with median values generally ranging between 5 and 6 and IQDs below or equal to 0.5, indicating strong consensus. Experts emphasized trust, mutual support, respect for diversity, and participation in community activities as core elements of social sustainability. All original indicators within this category met the acceptance criteria, contributing to its position as one of the strongest thematic areas in Round 1.

Within the safety, security, and perceived control category, indicators achieved some of the highest median scores overall, ranging from approximately 5 to 7, with several indicators showing very low disagreement (IQD as low as 0.5). Indicators related to feeling safe at home and while walking within the community ranked at the top of the overall list. Only one safety-related indicator required re-rating due to conceptual overlap and a higher IQD.

***Table 30:*** *Summary of Delphi 1 consensus*

| Accepted Indicators | Re-rated Indicators | Added Indicators |
|---|---|---|
| 1.1 I have good relationships with neighbour where we have occasional visits. | 2.2 Index of safety on the streets. | Existence of security infrastructure such as CCTV surveillance, |
| 1.2 If I need help or support, I will ask my neighbour, and I will help my neighbour (there is mutual support). | 3.9 Population Density. | Frequency of casual interactions with neighbours |
| 1.3. I participate with neighbour in social, cultural, and religious events and voluntary work, and I'm an active member of community associations. | 3.17 I'm Satisfied with attractiveness of the design features of the community (such as lighting fixtures, etc.) | There is a mosque within my community |
| 1.4 I volunteer for activities that help in developing my community. | 3.19 I Feeling that it is a good place to live in forever. | Ensuring that all resident groups (especially women and children) feel safe in the community. |

| | | |
|---|---|---|
| 1.5 There is a level of acceptance and open mindedness within neighbour. | 3.20 There are changes that happened through time in the community. | There are no dark spots within the neighborhood |
| 1.6 I respect my neighbour of different ethnicities and am satisfied with homogeneity. | 3.21 I have a desire to leave the community | Maintenance services responds quickly to requests |
| 1.7 I trust people in my community. | 4.6 Level of Education and Literacy within the community. | Servies fees and charges are appropriate |
| 2.1 Crime Reported Rate | 4.7 Presence of risk assessment, routes, safe meeting points. | I recommend my community to others |
| 2.3 I Feel comfortable, safe and secure walking during the daytime and nighttime. | | Acceptance and judgment free environment |
| 2.4 I Feel that my house and community is safe and secure during whether I'm attending or not attending it. | | Living here does not make me feel isolated |
| 2.5 I'm Satisfied with level of privacy that is available in the community. | | Non residents are welcome to visit the community |
| 3.1 I use different available facilities such as the community center, public library, and sports facilities. | | |
| 3.2 I'm satisfied with the transportation modes in the community and outside the community | | |
| 3.3 My community streets and pavements are friendly for walking and biking. | | |
| 3.4 Number of services distributions within the community. | | |
| 3.5 I'm Satisfied with the available green areas within my community. | | |
| 3.6 The availability of a range of activities (Such as kid's activities, celebrations, etc.) in open public spaces will improve social interaction in the community. | | |
| 3.7 Outdoor areas (plaza, squares) are well distributed in the community to satisfy resident€™s needs. | | |
| 3.8 There is an opportunity for play and leisure activities in the community. | | |
| 3.10 Houses in the community are friendly for people with disabilities. | | |
| 3.11 People are aware to Clean their environment and the community. | | |
| 3.12 Housing Types. | | |
| 3.13 The Community and houses meet the needs of those who live in. | | |
| 3.14 I am satisfied with living in this community and planning to stay here. | | |
| 3.15 I'm Satisfied with less noise and pollution from neighbour. | | |
| 3.16 I'm Satisfied with cleanliness of the community and street lighting. | | |
| 3.18 I feel attached, loyal and proud to be resident in this community | | |
| 4.1 I contribute to making decisions and to associations in my community. | | |
| 4.2 I'm a member of the community association, and I help organize events in my community. | | |
| 4.3 There is access to the community and job opportunities. | | |
| 4.4 Are their activities and programs that accommodate all ages and all social groups. | | |
| 4.5 I Pay fees for the benefit of my community. | | |
| 5.1 The gated community does not hinder me from identifying strangers and building strong connections and relationships with communities outside the gated community. | | |
| 5.2 I can access the urban working areas in the community. | | |

The livability and quality of place category displayed greater variability in expert agreement. While most indicators were accepted with median scores between 5 and 6 and acceptable IQD values, six indicators in this category exceeded the IQD threshold of 0.5 or showed borderline median values. These included indicators related to population density, aesthetic quality, perceived long-term permanence, environmental awareness, and perceived changes over time. As a result, these indicators were flagged for re-evaluation in Round 2.

Results for participatory governance, equity, and empowerment revealed comparatively lower consensus. Although several indicators such as resident involvement in decision-making and inclusive activities were accepted with median scores around 5 to 6, two indicators in this category received lower median values (approximately 4 to 5) and high IQDs (up to 1.875). These indicators were therefore identified as weak measures of social sustainability and were scheduled for revision or potential removal.

Indicators addressing external relations and integration were both accepted, with median values around 6 and low IQDs (≤ 0.5). Experts agreed that accessibility to surrounding urban areas and maintaining connections beyond the gated community were important components of social sustainability.

In addition to rating the original indicators, qualitative feedback from Round 1 resulted in the proposal of 11 new indicators addressing gaps in the framework. These indicators focused on informal neighbor interactions, cultural and religious gathering spaces, inclusivity and absence of discrimination, resident feedback mechanisms, transparency in community management, physical security infrastructure, and external community engagement. All newly proposed indicators were organized under the five thematic categories and were listed in Table 31 for evaluation in Delphi Round 2.

Indicators. Results show that experts generally rated the proposed indicators as important for assessing social sustainability in the gated community context. In Round 1 (n = 50), mean (M) ratings of the 42 indicators ranged between 4.22 and 6.46 (out of 7). Although, the median importance ratings across the 42 indicators ranged from 5 to 7 (out of 7), while IQD values ranged from 0.5 to 1.875, indicating broad perceived relevance alongside varying degrees of agreement. This pattern is expected because the indicator set was not generated ad hoc; it resulted from a structured evidence-based process that consolidated a large international

pool (initially 605 indicators, reduced to 42 key indicators) before entering Delphi validation. Although differences across expert subgroups were examined, no statistically significant differences were detected (ANOVA, $p > 0.05$), so the interpretation focuses on pooled panel results.

Consensus and selection across rounds. The findings demonstrate rapid convergence in Round 1. Using the study's decision rule (Mdn $\geq 5$ and IQD $\leq 1.0$), experts reached consensus on 33 out of 42 indicators, while 9 indicators showed insufficient agreement and were flagged for follow-up (Figure 3; Table 3). During instrument revision, one non-consensus item was consolidated based on qualitative feedback, resulting in eight re-rated indicators carried forward to Round 2. In Round 2 ($n = 30$), a total of 19 indicators were evaluated (eight re-rated items plus eleven new indicators proposed through Round 1 open-ended feedback; Tables 4 and 5). Applying the same retention criteria (Mdn $\geq 5$ and IQD $\leq 1.0$), 12 indicators were accepted and 7 were excluded, resulting in the finalized 45-indicator framework (FASSGC-45) while maintaining the same five-category structure.

Highest-ranked priorities. The Round 1 rankings indicate that the most decisive priorities for social sustainability in Saudi gated communities relate to perceived safety, security, and control. The two highest-ranked indicators were: "I feel that my house and community is safe and secure whether I'm attending or not" ($M = 6.46$; Mdn = 7; IQD = 0.5; Overall rank = 1) and "I feel comfortable, safe, and secure walking during daytime and nighttime" ($M = 6.38$; Mdn = 7; IQD = 0.5; Overall rank = 2). Privacy also ranked among the top priorities, with "I'm satisfied with the level of privacy available in the community" achieving $M = 6.08$; IQD = 0.5; Overall rank = 4.

These results suggest that, in this context, social sustainability is strongly grounded in everyday lived experience of safety and privacy, consistent with the core value proposition of

gated living. Cohesion, trust, and social compatibility were also highly valued. For example, mutual respect across different backgrounds and satisfaction with resident social compatibility (Mdn = 7; IQD = 0.875), and trust in community members (Mdn = 6; IQD = 1.0) were retained, indicating that low-friction coexistence and interpersonal confidence are important dimensions of social sustainability within gated settings.

### 4.4.2 Round 2: Final Delphi Results and Analysis

In the second Delphi round, the expert panel revisited the indicators that had lacked consensus in Round 1 and evaluated the new indicators introduced based on the first-round feedback. A total of 16 indicators were rated by the 30 participating experts in Round 2. This set included all nine original items that had been flagged for re-evaluation, along with the additional indicators suggested by panelists (consolidated from the 11 new proposals). The same consensus criteria were applied in Round 2.

**Characteristics of the selected samples**

Table 31 presented the demographic and professional characteristics of the study sample. A total of 30 respondents participated in Round 2 of Delphi. In terms of educational level, the largest proportion of participants held a master's degree (43.4%), followed by those with a PhD or Doctorate (30%), while 26.6% held a bachelor's degree.

Regarding current employment, most respondents were academicians in higher education institutions (66.6%). Professionals working in private practice, such as architects, engineers, or planners, accounted for 30% of the sample, whereas a small proportion were employed in governmental or semi-governmental organizations (3.4%).

With respect to years of professional experience, the largest group reported less than five years of experience (36.6%), followed by those with more than fifteen years of experience (30%). Participants with ten to fifteen years and five to nine years of experience each

represented 16.6% of the sample. Overall, the Round 2 sample was predominantly composed of academically affiliated professionals with a diverse range of professional experience.

***Table 31**: Characteristics of the Selected Sample (Round 2)*

| Variable Name | Options | Number | Percentage % |
|---|---|---|---|
| **Education Level** | Bachelor | 8.00 | 26.6% |
| | Master | 13.00 | 43.4% |
| | PhD, Doctorate | 9.00 | 30% |
| | **Total** | 30 | 100% |
| **Current Work** | Academician in higher education institution | 20.00 | 66.6% |
| | Employed in governmental or semi-governmental organization | 1.00 | 3.4% |
| | Professional in private practice (Architect, Engineer, Planner) | 9.00 | 30% |
| | **Total** | 30 | 100% |
| **Year of Experience** | More than 15 years | 9.00 | 30% |
| | 10 to 15 years | 5.00 | 16.6 |
| | 5 to 9 years | 5.00 | 16.6 |
| | Less than 5 years | 11.00 | 36.6% |
| | **Total** | 30 | 100% |

## Descriptive Statistics (Means, Median, SD, IQD) – Round 2

Table 32 presented the descriptive statistics for Delphi Round 2, in which 30 experts returned and re-rated a selected group of indicators using a 7-point Likert scale. This round aimed to confirm expert consensus and refine the framework by identifying indicators that demonstrated sufficient importance and agreement. The weighted mean (M) values ranged from 4.20 to 6.40, while interquartile deviation (IQD) values ranged from 0.5 to 2.0, indicating varying levels of priority and consensus among the experts.

***Table 32:** Categories and their indicators ranking based on experts (Round 2)*

| Category | Indicators | Mean (WM) | Median | Std. Deviation (SD) | Interquartile Deviation (IQD) |
|---|---|---|---|---|---|
| **1. Community Cohesion and Social Interaction** | 1.8 Frequency of casual interactions with neighbours | 5.57 | 6 | 1.305 | 1.0 |
| | 1.9 There is a mosque within my community | 5.67 | 6 | 1.295 | 1.0 |
| | 2.2 Index of safety on the streets. | 4.87 | 5 | 1.769 | 1.375 |

| | | | | | |
|---|---|---|---|---|---|
| **2. Safety, Security, and Perceived Control** | 2.6 Ensuring that all resident groups (especially women and children) feel safe in the community. | 5.67 | 6 | 1.295 | 1.0 |
| | 2.7 Existence of security infrastructure such as CCTV surveillance, | 5.67 | 6 | 1.295 | 1.0 |
| | 2.8 There are no dark spots within the neighborhood | 4.80 | 5 | 1.769 | 1.375 |
| **3. Livability and Quality of Place** | 3.9 Population Density. | 4.70 | 5 | 1.841 | 1.875 |
| | 3.17 I'm Satisfied with attractiveness of the design features of the community (such as lighting fixtures, etc.) | 5.67 | 6 | 1.269 | 1.0 |
| | 3.19 I Feeling that it is a good place to live in forever. | 5.63 | 6 | 1.273 | 1.0 |
| | 3.20 There are changes that happened through time in the community. | 4.80 | 5 | 1.769 | 1.375 |
| | 3.21 I have a desire to leave the community | 4.40 | 5 | 1.589 | 1.375 |
| | 3.22 Maintenance services respond quickly to requests | 5.67 | 6 | 1.295 | 1.0 |
| | 3.23 Servies fees and charges are appropriate | 5.67 | 6 | 1.295 | 1.0 |
| | 3.34 I recommend my community to others | 6.40 | 6 | 0.770 | 0.5 |
| **4. Participatory Governance, Equity & Empowerment** | 4.6 Level of Education and Literacy within the community. | 4.57 | 5 | 1.736 | 1.5 |
| | 4.7 Presence of risk assessment, routes, safe meeting points. | 4.20 | 5 | 2.107 | 2.0 |
| | 4.8Acceptance and judgment free environment | 5.33 | 6 | 1.213 | 0.5 |
| **5. External Relations & Integration** | 5.3 Living here does not make me feel isolated | 5.66 | 6 | 1.295 | 1.0 |
| | 5.4 non-residents are welcome to visit the community | 5.66 | 6 | 1.295 | 1.0 |

Indicators were retained when they achieved a weighted mean of 5.00 or higher and an IQD of 1.0 or lower, reflecting both importance above the neutral midpoint and acceptable consensus in line with Delphi methodology. Indicators that failed to meet one or both criteria were excluded from the refined framework. This approach allowed the study to distinguish between core indicators and those considered less central to assessing social sustainability in gated communities.

The retained indicators were primarily related to liveability, perceived safety, inclusivity, and overall community satisfaction. The highest-rated indicator was recommending the community to others (Indicator 3.34), which achieved a weighted mean of 6.40 and a very low IQD of 0.5, indicating strong consensus. Other highly rated indicators included satisfaction with design attractiveness, responsiveness of maintenance services, appropriateness of service fees, and feelings of long-term attachment to the community, all of which reflected experts' emphasis on everyday lived experience and quality of place.

Within the Safety, Security, and Perceived Control category, experts placed greater importance on indicators related to inclusive and perceived safety, such as ensuring that women and children felt safe and the presence of visible security infrastructure. In contrast, more technical or spatial safety indicators, such as street safety indices and the absence of dark spots, received lower ratings and did not meet the retention criteria, suggesting that experts prioritized experiential safety over abstract measures.

The excluded indicators were mainly associated with risk preparedness, population characteristics, and weaker forms of community attachment. The presence of risk assessment measures and emergency infrastructure received the lowest importance rating and the highest level of disagreement. Similarly, indicators related to population density, education level, and residents' desire to leave the community were rated below the importance threshold. Although these indicators were not considered unimportant, experts viewed them as less critical or more context-dependent compared to indicators capturing safety, acceptance, and positive engagement within the community. Table 33 Summarized the Accepted and Dropped indicators that are used in finalized proposed measurement assessment framework for assessing social sustainability in gated community.

***Table 33:*** *Summary of Delphi 2 consensus*

| **Accepted Indicators** | **Dropped Indicators** |
|---|---|
| 1.8 Frequency of casual interactions with neighbours | 2.2 Index of safety on the streets. |
| 1.9 Presence of a mosque within the community | 2.8 Absence of dark spots within the neighbourhood |
| 2.6 Ensuring all resident groups (especially women and children) felt safe | 3.9 Population density |
| 2.7 Existence of security infrastructure such as CCTV surveillance | 3.20 Changes that occurred over time in the community |
| 3.17 Satisfaction with the attractiveness of community design features | 3.21 Desire to leave the community |
| 3.19 Feeling that the community was a good place to live in forever | 4.6 Level of education and literacy within the community |
| 3.22 Maintenance services responded quickly to requests | 4.7 Presence of risk assessment, routes, safe meeting points. |
| 3.23 Service fees and charges were appropriate | |
| 3.24 Recommending the community to others | |
| 4.8 Acceptance of a judgment-free environment | |
| 5.3 Living in the community did not create a feeling of isolation | |
| 5.4 non-residents were welcome to visit the community | |

**Category Prioritisation Rankings**

To assess the perceived importance of each dimension of social sustainability, experts were asked to rank the five categories from 1 (most important) to 5 (least important). The analysis revealed that *Safety, Security, and Perceived Control* received the highest priority, with the lowest average rank (Mean = 2.1) and the highest number of first-place rankings (n = 20). This was followed by *Livability and Quality of Place* (Mean = 2.6) and *Community Cohesion and Social Interaction* (Mean = 3.2). The categories of *Participatory Governance and Empowerment* and *External Integration* were generally rated lower in importance, with average ranks of 3.7 and 4.3, respectively.

These findings, as presented in Table 34, indicated that experts prioritized immediate security and livability factors when assessing social sustainability within gated communities, while placing relatively less emphasis on governance-related dimensions and external connectivity.

***Table 34:*** *Ranking for Categories*

| Category | Average Rank | 1st Rank Count | 2nd | 3rd | 4th | 5th |
|---|---|---|---|---|---|---|
| Safety, Security, and Perceived Control | 2.1 | 20 | 10 | 12 | 5 | 3 |
| Livability and Quality of Place | 2.6 | 10 | 15 | 12 | 8 | 5 |
| Community Cohesion and Social Interaction | 3.2 | 7 | 8 | 15 | 12 | 8 |
| Participatory Governance, Equity (& Empowerment) | 3.7 | 5 | 8 | 8 | 18 | 11 |
| External Relations and Integration | 4.3 | 3 | 4 | 6 | 9 | 28 |

### 4.4.3 Finalized proposed measurement Assessment Framework – FASSGC-45

This section presented the finalized social sustainability assessment framework after two rounds of Delphi FASSGC-45, incorporating expert feedback from Round 1 and Round 2. The final framework included all 33 indicators that achieved consensus in Round 1, plus an

additional 12 indicators accepted based on Round 2 results, for a total of 45 indicators. It retained the five main categories of the preliminary FASSGC-42 model but refined and expanded it in response to expert input. The finalized framework (illustrated in Figure 30) was structured hierarchically into five core categories with corresponding sub-categories and specific indicators under each. These five categories and their validated sub-components are summarized as follows:

Community Cohesion & Social Interaction: Encompassed four sub-categories *Social Networks & Ties*, *Community Participation*, *Social Inclusion*, and *Trust & Reciprocity* reflecting the strength of relationships and social capital among residents. This category's indicators measured how often and how well neighbour interact informally, engage in communal activities, including diverse groups, and trust or help one another. Several new indicators were added to capture nuances of cohesion that experts felt were missing in the initial framework. For example, the *frequency of casual interactions with neighbours* was introduced in Round 2 to gauge everyday informal contacts. The presence of shared community spaces (such as a mosque within the community for cultural and religious gatherings) was also included to reflect the importance of venues that foster social interaction. Together, the indicators in this category assessed the foundational "social fabric" of the gated community, from neighborly communication and mutual aid to residents' sense of acceptance and belonging.

Safety & Security: Covered both objective and perceived aspects of residents' safety, organized into sub-categories for *Objective Safety*, *Perceived Safety*, and *Privacy Level*. This category addressed the critical need for residents to feel safe and in control of their environment. Its indicators ranged from tangible security conditions (e.g. a crime-free environment, presence of security measures) to residents' subjective feelings of safety in

various situations. Based on expert feedback, additional emphasis was placed on concrete security features and inclusive safety. For instance, an indicator on the *existence of security infrastructure (CCTV surveillance)* was added to strengthen Objective Safety measures. Likewise, ensuring that all resident groups (especially women and children) feel safe in the community was explicitly measured after Round 2 revisions. Perceived Safety indicators included feelings of security when walking alone at night or when children play outdoors, which were among the highest-rated items by experts. Privacy was also gauged through indicators of residents' satisfaction with personal and spatial privacy at home, recognizing that a sense of privacy contributes to overall security in gated communities.

Liveability & Quality of Place: This was the most comprehensive category, comprising five sub-categories *Access to Amenities & Services*, *Public Open Space & Interaction Opportunities*, *Housing Quality & Affordability*, *Well-being & Satisfaction*, and *Sense of Place & Identity*. It captured how the physical environment and services in the community support residents' daily life and satisfaction. Indicators in this category assessed the availability and accessibility of essential facilities (e.g. walkable access to shops, parks, and schools), the quality and maintenance of common spaces for recreation and social interaction, the design and affordability of housing, residents' overall contentment with living in the community, and their emotional attachment or pride in the place. Given its broad scope, this category contained the largest number of indicators in the framework. Expert input during the Delphi process led to refining several liveability indicators to ensure clarity and relevance. For example, an indicator on *maintenance service responsiveness* ("maintenance requests were addressed promptly") was validated in Round 2 to capture the quality of services contributing to residents' satisfaction. Similarly, the indicator *"satisfaction with the attractiveness of community design features"* was retained as a measure of the aesthetic and design quality of the place, which experts confirmed as important. Overall, the Liveability and Quality of Place category in the

finalized framework holistically evaluates the extent to which the gated community's environment is convenient, pleasant, and nurturing of a high quality of life.

Participatory Governance & Equity (Empowerment): Focused on the governance structures, inclusivity, and empowerment mechanisms within the community. It was divided into four sub-categories *Participatory Governance*, *Social Equity & Justice*, *Rights & Responsibilities*, and *Community Resilience*. This category's indicators assessed whether residents have a voice in community decision-making and feel a sense of influence or control (e.g. participation in a homeowners' association or community meetings), whether management processes are transparent and fair, and whether all groups are treated equitably in terms of access to community resources and opportunities. The framework also examined residents' fulfillment of civic roles and obligations (for instance, awareness of community rules or contributing to community upkeep) under Rights & Responsibilities. Based on Round 1 feedback, the study identified governance transparency and resident feedback mechanisms as under-represented issues, which were then addressed in Round 2. A new indicator was added to measure the *existence of formal channels for resident feedback* to community management, reflecting the importance of responsive governance. Additionally, experts' lower ratings for some original indicators (e.g. those related to residents' education level or detailed emergency plans) led to de-emphasizing or dropping those items in the final framework. Instead, a broader indicator of *community resilience* was maintained to capture preparedness for challenges or crises in a general sense (without focusing on specific emergency procedures, which experts found less immediately important). In sum, the finalized governance and equity indicators ensure that the framework evaluates how empowered and treated residents feel, and how well the community can collectively manage its affairs and future risks.

External Relations & Integration: Examined the relationship between the gated community and the wider urban context, with two sub-categories *Integration with Surrounding Neighbourhoods* and *Civic Engagement Beyond the Gates*. This category ensured that the framework did not view the gated community in isolation, but rather as part of a larger social system. Indicators assessed the degree of connectivity and interaction with the outside environment, such as the ease of access to surrounding areas and the permeability of the community's boundaries for visitors or services. They also measured residents' participation in broader civic and social activities beyond the compound (for example, involvement in city events or engagement with neighboring communities). Expert panel feedback in Round 1 highlighted external engagement as a vital but previously under-addressed aspect, leading to the introduction of new indicators in Round 2. Notably, the finalized framework included an indicator for *feeling of isolation*, ensuring that *"living in the community does not create a sense of isolation from the city"*, and an indicator that *non-residents are welcome to visit the community*, both of which were accepted in Round 2 to reinforce social integration across the gated boundary. Experts reached strong consensus on the importance of such outward-oriented measures, for instance, *accessibility to surrounding urban areas* and maintaining external social connections achieved high median ratings (around 6 on a 7-point scale) with low disagreement. Thus, the External Relations & Integration category in the final framework captures the extent to which a gated community remains socially open and engaged with the broader society

This finalized framework represents the validated and improved version of the initial FASSGC-42 model, updated considering expert consensus. Through the Delphi process, indicators that were found to be less relevant or unclear were removed or revised, while critical new indicators were added to fill gaps in areas like informal social interaction, cultural inclusivity, vulnerable group safety, governance transparency, and external connectivity.

The result is a *contextualized social sustainability assessment framework* for Saudi Arabian gated communities that has been rigorously vetted. All five main categories, 18 sub-categories, and 45 specific indicators in the framework were confirmed to be important and applicable by subject matter experts, reflecting both the literature foundations and the practical realities of the local context.

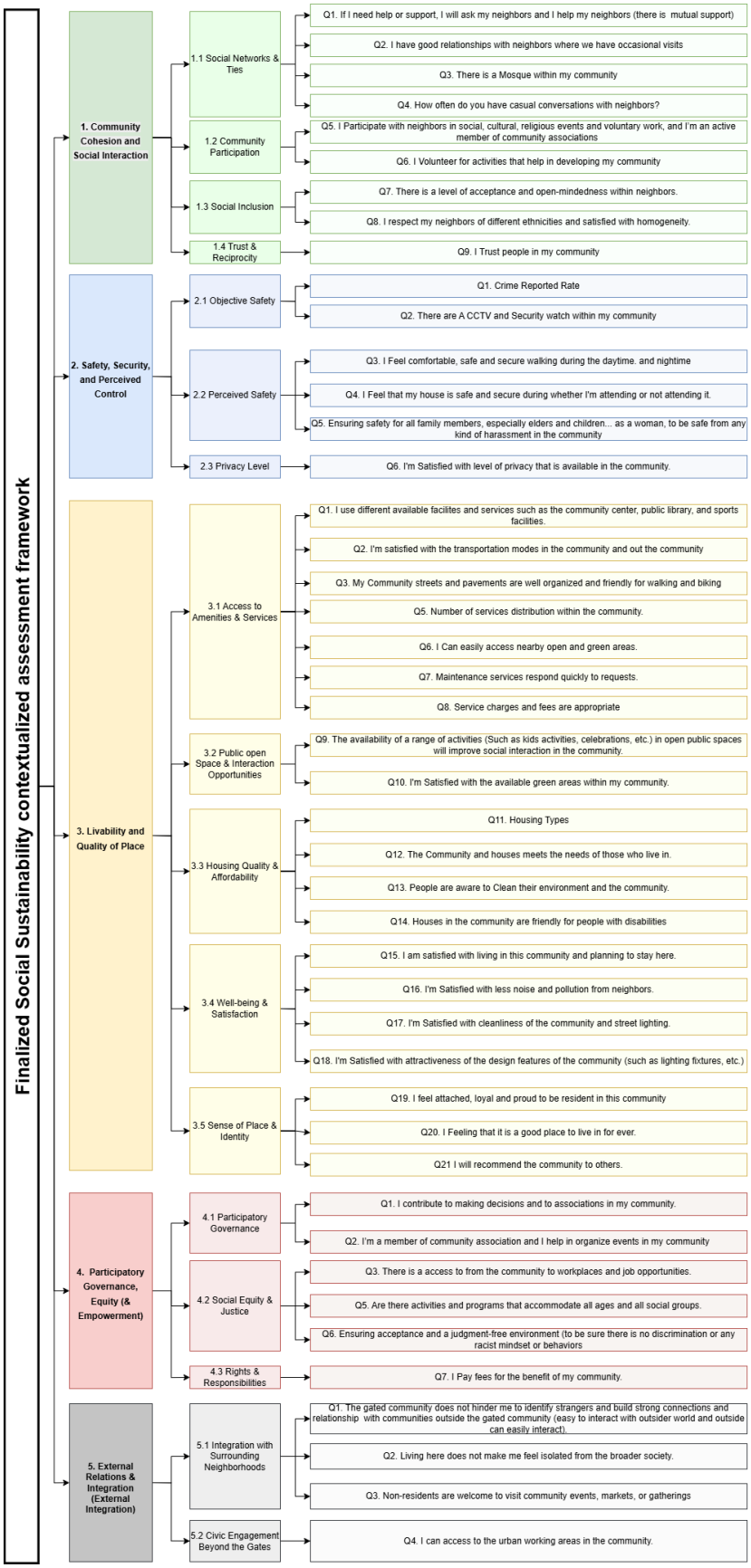


***Figure 30:*** *Finalized Social Sustainability contextualized assessment measurement framework FASSGC-45*

### 4.4.4 Reliability and Validity Testing of FASSGC-45

Internal consistency was assessed using Cronbach's alpha for the full 45-item instrument and for each thematic category (subscale). The overall scale achieved Cronbach's value of 0.86, indicating very good internal consistency and suggesting that the items collectively captured a coherent construct of social sustainability in gated communities. Table 35 summarizes the alpha coefficients for each category.

***Table 35:*** *Summary of Cronbach Alpha for each Category*

| Category | # Items | Cronbach's Alpha |
|---|---|---|
| **Overall Scale** | **45** | **0.86** |
| Category 1 Community Cohesion and Social Interaction | 7 | 0.89 |
| Category 2 Safety, Security, and Perceived Control | 7 | 0.78 |
| Category 3 Livability and Quality of Place | 22 | 0.91 |
| Category 4 Participatory Governance, Equity & Empowerment | 7 | 0.84 |
| Category 5 External Relations & Integration | 2 | 0.87 |

Category 1 (Community Cohesion and Social Interaction) achieved Cronbach's alpha of 0.89, indicating good internal consistency. This value exceeded the commonly used 0.70 threshold and suggested that the items coherently captured Neighborhoods cohesion and social interaction.

Category 2 (Safety, Security, and Perceived Control) yielded a Cronbach's alpha of 0.78, indicating acceptable internal consistency. Given the relatively small number of items (n = 5) and the combination of more objective indicators (e.g., reported crime rates) with subjective perceptions (e.g., perceived safety and privacy), a moderate alpha was expected. The result suggested that the items were related yet not redundant and should be interpreted as capturing complementary facets of the safety and security dimension.

Category 3 (Livability and Quality of Place) demonstrated excellent internal consistency, with a Cronbach's alpha of 0.91 for this 22-item subscale. While this indicated a

highly coherent grouping of indicators capturing satisfaction with facilities, mobility, environment, and overall quality of place, very high alpha values may also signal overlap among closely related satisfaction and attachment items. This possibility was therefore considered during subsequent refinement.

Category 4 (Participatory Governance, Equity, and Empowerment) achieved a Cronbach's alpha of 0.84, indicating good reliability across the seven items. This supported the coherence of indicators related to participation, community decision-making, equity, and perceived empowerment.

Category 5 (External Relations and Integration) produced Cronbach's alpha of 0.87 for the two-item subscale. With only two items, Cronbach's alpha largely reflected the inter-item correlation; therefore, although the coefficient was high, the reliability of this domain was interpreted cautiously and was identified as a candidate for expansion in later Delphi rounds.

Overall, all five subscales met or exceeded the conventional 0.70 reliability criterion, and the overall scale alpha of 0.86 indicated that the instrument was suitable for screening indicators in Round 1. At the same time, the high coefficient observed for the larger Livability and Quality of Place subscale suggested potential item redundancy, which was revisited using dispersion statistics and qualitative feedback to guide refinement.

**One-Way ANOVA**

One-way ANOVA tests were conducted to determine whether the mean scores of the five composite indicator categories differed significantly across groups defined by three demographic factors. The five composite category-level scores analyzed were *Community Cohesion and Social Interaction*, *Safety, Security, and Perceived Control*, *Livability and Quality of Place*, *Participatory Governance, Equity, and Empowerment*, and *External*

*Relations and Integration*. Each composite score represented an aggregate (mean) of multiple survey indicators within the corresponding category.

The ANOVA results were reported separately for each grouping variable education level, current work category, and years of experience and included the F-statistic, degrees of freedom (between-groups and within-groups), p-values, and an indication of statistical significance at the 0.05 level.

Differences in composite scores across education levels (Bachelor's, Master's, and PhD/Doctorate) were examined first. Table 36 summarized the one-way ANOVA results for each category. None of the five composite category scores showed statistically significant differences by education level (all $p > 0.05$). The largest group difference was observed for *Community Cohesion and Social Interaction* ($F = 2.442$, $p = 0.098$); however, this result did not reach the 0.05 significance threshold.

***Table 36:*** *the one-way ANOVA results for each category with education background*

| Category Composite Score | F-statistic | df_between | df_within | p-value | Significant (p<0.05)? |
|---|---|---|---|---|---|
| Community Cohesion and Social Interaction | 2.442 | 2 | 47 | 0.098 | No |
| Safety, Security, and Perceived Control | 0.073 | 2 | 47 | 0.93 | No |
| Livability and Quality of Place | 0.142 | 2 | 47 | 0.868 | No |
| Participatory Governance, Equity (& Empowerment) | 1.294 | 2 | 47 | 0.284 | No |
| External Relations & Integration | 0.97 | 2 | 47 | 0.386 | No |

Differences in composite scores across current work categories were examined next. Five groups were considered, including academia, government, private practice, contractor, and real estate developers. Table 237 presented the one-way ANOVA results. No statistically significant differences were observed across any of the five composite category scores by work category (all $p > 0.13$). For example, *Community Cohesion and Social Interaction* yielded $F(4, 45) = 1.838$, $p = 0.138$, indicating no statistically significant variance across occupational groups. It was noted that two categories, *Contractor* and *Real Estate Developer,* each included only one respondent, which may have limited the statistical power of this comparison.

***Table 37:*** *the one-way ANOVA results for each category with working field*

| Category Composite Score | F-statistic | df_between | df_within | p-value | Significant (p<0.05)? |
|---|---|---|---|---|---|
| Community Cohesion and Social Interaction | 1.838 | 4 | 45 | 0.138 | No |
| Safety, Security, and Perceived Control | 0.589 | 4 | 45 | 0.673 | No |
| Livability and Quality of Place | 0.983 | 4 | 45 | 0.426 | No |
| Participatory Governance, Equity (& Empowerment) | 1.584 | 4 | 45 | 0.195 | No |
| External Relations & Integration | 0.416 | 4 | 45 | 0.796 | No |

Finally, differences in composite scores across years of work experience were examined. Work experience was categorized into four groups: less than five years, five to nine years, ten to fifteen years, and more than fifteen years. Table 38 summarized the one-way ANOVA results. None of the composite category scores differed significantly across experience groups (all $p > 0.09$). The External Relations and Integration category exhibited the greatest variation across experience levels ($F(3, 46) = 2.262$, $p = 0.094$); however, this value did not meet the 0.05 threshold for statistical significance.

***Table 38:*** *the one-way ANOVA results for each category with years of experience*

| Category Composite Score | F-statistic | df_between | df_within | p-value | Significant (p<0.05)? |
|---|---|---|---|---|---|
| Community Cohesion and Social Interaction | 1.53 | 3 | 46 | 0.219 | No |
| Safety, Security, and Perceived Control | 1.202 | 3 | 46 | 0.32 | No |
| Livability and Quality of Place | 0.442 | 3 | 46 | 0.724 | No |
| Participatory Governance, Equity (& Empowerment) | 0.908 | 3 | 46 | 0.444 | No |
| External Relations & Integration | 2.262 | 3 | 46 | 0.094 | No |

Across all three grouping variables, the one-way ANOVA results showed no statistically significant differences in the mean composite scores for *Community Cohesion and Social Interaction*, *Safety, Security, and Perceived Control*, *Livability and Quality of Place*, *Participatory Governance, Equity, and Empowerment*, or *External Relations and Integration*. Within this sample of 50 respondents, variations in education level, current work category, and years of experience did not produce statistically significant differences in any of the five composite indicators (all p-values $\geq 0.09$).

Although a small number of comparisons approached statistical significance such as education level in relation to *Community Cohesion and Social Interaction* and years of experience in relation to *External Relations and Integration* ($p \approx 0.09–0.10$) these results did not meet the conventional 0.05 threshold. Overall, no statistically significant effects of education, occupation, or professional experience on the category-level scores were confirmed. The findings indicated that respondents' assessments of community cohesion, safety, livability, governance-related equity, and external integration were broadly consistent across different educational backgrounds, work roles, and experience levels.

**Pearson Correlation**

To explore the interrelationships among the five thematic categories of social sustainability, Pearson correlation coefficients were computed based on experts' aggregated ratings for each category. Table 39 presented the correlation values along with their statistical significance. The results revealed several strong and statistically significant associations, indicating substantial overlap in how experts perceived the relevance of these domains.

***Table 39:*** *Validity test of the questionnaire using Pearson correlation*

| | | Category 1 | Category 2 | Category 3 | Category 4 | Category 5 |
|---|---|---|---|---|---|---|
| **Category 1** | Pearson Correlation | 1 | * | | | |
| | Sig. (2-tailed) | NA | | | | |
| **Category 2** | Pearson Correlation | .325* | 1 | | | |
| | Sig. (2-tailed) | 0.021 | NA | | | |
| **Category 3** | Pearson Correlation | .638*** | .478*** | 1 | | |
| | Sig. (2-tailed) | 0.000 | 0.000 | NA | | |
| **Category 4** | Pearson Correlation | .472*** | .447** | .636*** | 1 | |
| | Sig. (2-tailed) | 0.001 | 0.001 | 0.000 | NA | |
| **Category 5** | Pearson Correlation | .480*** | 0.110 | .512** | .409** | 1 |
| | Sig. (2-tailed) | 0.000 | 0.447 | 0.000 | 0.003 | NA |

The strongest correlation was observed between Category 3 (*Livability and Quality of Place*) and Category 4 (*Participatory Governance, Equity, and Empowerment*), with a coefficient of

r = .636 ($p < .001$), indicating a strong linear association. This suggested that experts who assigned higher importance to livability-related aspects also tended to place greater emphasis on participatory governance features. Category 3 also exhibited very strong correlations with Category 1 (*Community Cohesion and Social Interaction*) ($r = .638$, $p < .001$) and Category 5 (*External Relations and Integration*) ($r = .512$, $p < .001$), reflecting the interconnected nature of place-based satisfaction, social cohesion, and external accessibility.

Moderately strong correlations were identified between Category 1 (*Community Cohesion and Social Interaction*) and Category 4 (*Participatory Governance, Equity, and Empowerment*) ($r = .472$, $p = .001$), as well as between Category 1 and Category 5 (*External Relations and Integration*) ($r = .480$, $p < .001$). These associations suggested that stronger internal social bonds were perceived by experts as contributing to a community's participatory capacity and external connectedness.

In contrast, Category 2 (*Safety, Security, and Perceived Control*) exhibited weaker associations with the other categories. It showed a moderate positive correlation with Category 1 ($r = .325$, $p = .021$) and Category 3 ($r = .478$, $p < .001$), but no statistically significant correlation with Category 5 ($r = .110$, $p = .447$). This indicated that, although safety and perceived control were considered important, they were evaluated somewhat independently from external integration-related factors.

Overall, the correlation analysis highlighted a cohesive structure among most dimensions, particularly those related to livability, community interaction, and governance. The high degree of interrelatedness among these categories supported their conceptual integration within a unified framework of social sustainability. However, the relatively weak association between safety/security and external relations suggested that these dimensions were perceived as more distinct by the expert panel.

The credibility of the finalized framework was further supported by statistical validation evidence. In Delphi Round 1, 33 of the original 42 indicators met the predefined consensus criteria (median importance ≥ 6 and interquartile deviation ≤ 0.5) and were accepted. The remaining items were reconsidered in Round 2, where a total of 16 indicators (including 11 new proposals and 5 revised originals) were evaluated; ultimately, 12 additional indicators achieved consensus and were incorporated, bringing the framework to 45 indicators. Each of the final indicators had a median rating indicating at least moderate to high importance (all above 4 on the 7-point scale), and the inter-expert agreement for these items was strong (IQD ≤ 0.5 in nearly all cases). Moreover, the reliability of the overall instrument was confirmed through Cronbach's alpha analysis. The final set of indicators (treated as a scale) yielded an overall Cronbach's α of 0.86, indicating very good internal consistency. At the category level, the sub-scales also showed solid reliability, with Cronbach's α values ranging from 0.78 for Safety & Security up to 0.91 for Liveability & Quality of Place (three of the five categories exceeded 0.80). This suggests that within each thematic category the indicators cohesively measure their intended construct, and the framework functions as a unified, stable assessment tool. No significant differences were found in importance ratings between different expert groups (for example, across varying professional backgrounds or experience levels, $p > 0.05$), demonstrating a broad consensus on the framework's elements regardless of the experts' profiles. Together, these validation results gave confidence that the finalized framework is both comprehensive in content and robust in its measurement properties, making it a credible instrument for assessing social sustainability in the target context.

In summary, the results of Chapter 4 have culminated in a finalized social sustainability measurement framework that is contextually tailored to gated communities in Saudi Arabia and rigorously validated by expert consensus. The framework comprises five well-defined categories and 45 key indicators that collectively capture the multifaceted concept of social

sustainability from internal community cohesion and quality of life to governance, security, and external social integration. This validated framework addresses the gaps identified in previous studies and provides a practical tool for evaluating and improving social sustainability in residential developments. With the research objectives thus achieved, the next chapter (Chapter 5) will present the conclusions of this study, discuss the broader implications of these findings and offer recommendations for future practice and research.

# CHAPTER 5

# CONCLUSION

This chapter concludes the thesis by synthesizing the main findings, emphasizing the limitations of existing social sustainability assessment instruments, and presenting the contribution of the finalized FASSGC-45 framework. The conclusion is organized around three linked arguments. First, existing instruments are fragmented, uneven, and weakly aligned with the needs of gated communities in Saudi Arabia. Second, the developed framework responds to these weaknesses through a systematic, context-sensitive, and expert-validated structure. Third, the study offers conceptual, measurement, and methodological implications for future assessment of social sustainability in Saudi gated communities.

## 5.1 Conclusions

### 5.1.1 Limitations and Challenges of Existing Assessment Tools/Frameworks

The review and analysis of existing instruments confirmed that current approaches do not provide a sufficiently reliable, comprehensive, or context-sensitive basis for assessing social sustainability within gated communities in Saudi Arabia. The main conclusions are summarized below.

- **Fragmentation and inconsistency:** Fragmentation was one of the clearest findings. The examined instruments did not share a stable core of indicators, categories, or measurement priorities. Instead, each tool emphasized different aspects of social sustainability, which made their results difficult to compare and reduced confidence in their consistency.

- **Incomplete and uneven coverage:** The content analysis showed that existing tools provide partial and uneven coverage of social sustainability. At the sub-category level, no tool exceeded 78% coverage, and several important dimensions were repeatedly omitted. This means that many instruments capture only selected parts of the construct rather than the full social sustainability profile.
- **Unbalanced breadth and depth:** The breadth and depth analysis showed that some instruments covered many categories with limited depth, while others examined a small number of themes in greater detail. This imbalance weakened the ability of existing tools to assess social sustainability holistically and fairly.
- **Weak indicator convergence:** The consolidation process revealed 605 indicator instances across the reviewed literature and tools, which were reduced to 213 unique indicators. This large spread of indicators demonstrated that the field lacks agreement on which indicators should be treated as essential for social sustainability assessment.
- **Structural and conceptual divergence:** The semiotic analysis showed that differences existed not only in the indicators themselves, but also in how tools defined, structured, interpreted, and applied them. Divergence appeared across empiric, syntactic, semantic, pragmatic, and social levels, including differences in indicator definitions, scale types, theoretical orientation, intended users, geographic context, and validation evidence.
- **Weak validation and practical usability:** Many tools lacked clear evidence of reliability testing, validity testing, pilot application, or operational guidance. As a result, their practical usability for planners, developers, and decision-makers remained limited, especially when assessment results were expected to guide real design, management, or policy decisions.
- **Limited relevance to gated communities:** Most instruments were designed for general neighbourhoods, cities, or broader sustainability assessment rather than gated

communities. Consequently, they did not adequately address gated-community-specific issues such as controlled access, privacy norms, internal social interaction, semi-private communal spaces, social permeability, and relationships with surrounding urban areas.

- **Limited suitability for Saudi Arabia:** Existing international tools were not sufficiently aligned with the Saudi social, cultural, spatial, and governance context. Important local dimensions, including culturally appropriate gathering spaces, gender-sensitive use of communal areas, family-oriented patterns of social life, and local expectations of safety and privacy, were not consistently represented.

Overall, the analysis confirmed that existing assessment instruments are not fully suitable for evaluating social sustainability in Saudi gated communities. Their fragmentation, uneven coverage, weak validation, and limited contextual sensitivity justified the need for a new framework developed specifically for this context.

### 5.1.2 The Developed Finalized Contextualized Assessment Framework

In response to the identified gaps, this thesis developed the Framework for Assessing Social Sustainability within Gated Communities, finalized as FASSGC-45. The framework translates social sustainability from a broad conceptual idea into a structured assessment instrument that is specific to gated communities in Saudi Arabia.

- **Systematic indicator reduction:** The development process was systematic and transparent. The study moved from 605 indicator instances to 213 unique indicators, then to 74 contextually relevant indicators, then to 42 key indicators for Delphi review, and finally to 45 validated indicators after expert revision and consensus. This sequence avoided arbitrary selection and linked the final framework to both literature evidence and local expert judgement.

- **Final framework structure:** The finalized framework comprises five main categories, 18 sub-categories, and 45 indicators. This structure provides a balanced assessment model that captures both the internal social conditions of gated communities and their external relationship with the wider urban context.
- **Core categories:** The five main categories are: (1) Community Cohesion and Social Interaction; (2) Safety, Security, and Perceived Control; (3) Livability and Quality of Place; (4) Participatory Governance, Equity, and Empowerment; and (5) External Relations and Integration.
- **Contribution to conceptual clarity:** FASSGC-45 addresses fragmentation in existing instruments by organizing indicators within a clear hierarchical structure. This makes the framework easier to interpret, apply, compare, and refine than disconnected lists of social indicators.
- **Contribution to balanced coverage:** Unlike many existing tools, the framework gives fairer coverage to all five categories and 18 sub-categories. This reduces the risk of overemphasizing familiar dimensions such as amenities or safety while neglecting dimensions such as governance, equity, empowerment, and external integration.
- **External relations and integration:** The inclusion of External Relations and Integration is a major contribution because it prevents gated communities from being assessed as isolated enclaves. The framework recognizes that social sustainability depends not only on internal cohesion, but also on permeability, connection, and interaction with surrounding neighbourhoods and the wider city.
- **Context sensitivity:** The framework reflects the Saudi social and cultural context by incorporating indicators that are sensitive to privacy, family life, gender-appropriate spaces, community events, cultural gathering practices, local safety expectations, and the governance realities of Saudi residential developments.

- **Delphi validation:** The two-round Delphi validation confirmed strong expert convergence around the importance and relevance of the framework. Expert feedback improved indicator clarity supported the contextual fit of the framework, and resulted in the final 45-indicator model.
- **Reliability and validity:** The statistical testing supported the reliability and validity of FASSGC-45. The framework demonstrated strong internal consistency, with an overall Cronbach alpha of 0.86, and the validity testing indicated meaningful relationships among the main categories while preserving the distinct role of each dimension.
- **Original contribution:** The final contribution of this study is the production of the first dedicated and locally validated framework identified for assessing social sustainability within gated communities in Saudi Arabia. FASSGC-45 therefore fills a clear gap in both academic literature and professional practice.

Taken together, these findings confirm that FASSGC-45 is reliable, valid, context-sensitive, and practically relevant. It offers a more coherent basis for assessment than existing instruments and provides a foundation for improving the social performance of current and future gated communities in Saudi Arabia.

## 5.2 Implications

The findings of this thesis have implications at three levels: the conceptual modelling of social sustainability in gated communities, the measurement of social sustainability in practice, and the methodological development of assessment frameworks.

### 5.2.1 Conceptual Modelling of Social Sustainability in GCs

- **Internal and external dimensions:** The study shows that social sustainability in gated communities cannot be understood only through internal resident satisfaction. It must

also be understood through the relationship between the gated community and its surrounding urban context.

- **Multi-dimensional understanding:** The conceptual model frames gated communities as social systems shaped by cohesion, interaction, safety, livability, governance, equity, empowerment, and external integration. This broadens the assessment beyond physical quality or security alone.
- **Balanced interpretation of gating:** The model highlights that privacy and security may support residents' quality of life, but they can also produce separation if not balanced with social permeability and integration. This is especially important in the Saudi context, where gated communities must respond to cultural expectations without weakening wider urban cohesion.
- **Reframing gated communities:** By including external relations as a core category, the study positions gated communities as part of a wider urban system. This conceptual shift helps planners and researchers evaluate whether a gated community contributes to, or disconnects from, the surrounding city.

### 5.2.2 Measuring Social Sustainability in GCs

- **Diagnostic value:** FASSGC-45 provides a practical measurement structure that can be used to diagnose strengths and weaknesses in gated communities. It allows decision-makers to identify whether a community performs well in one dimension, such as safety, while underperforming in another, such as participation or external integration.
- **Comparability:** The framework supports more consistent comparison among gated communities because it uses a fixed set of categories, sub-categories, and indicators. This directly addresses the inconsistency found in existing tools.

- **Decision-making support:** The indicators can support design review, post-occupancy evaluation, community management, development approval, and policy monitoring. This makes the framework useful not only as an academic model, but also as a practical decision-support tool.
- **Guidance for improvement:** The framework can help developers and planners identify targeted interventions, such as improving communal spaces, strengthening resident participation, enhancing pedestrian connectivity, improving safety perceptions, or creating better links with surrounding neighbourhoods.
- **Context-appropriate assessment:** Because the framework was developed for Saudi gated communities, it provides a more locally appropriate assessment basis than generic international instruments. This is important because assessment criteria must reflect local social conditions rather than assuming universal applicability.

### 5.2.3 Methodological Implications

- **Integrated methodology:** The thesis demonstrates the value of combining literature review, content analysis, coverage analysis, semiotic analysis, indicator scoring, contextual relevance screening, Delphi validation, and statistical reliability and validity testing in one framework-development process.
- **Evidence-based selection:** The use of coverage analysis helped reveal what existing tools measured and what they omitted. This made the development of FASSGC-45 evidence-based rather than dependent on researcher preference alone.
- **Semiotic contribution:** The semiotic framework added methodological depth by showing that assessment problems occur at several levels, including definitions, structures, meanings, purposes, users, contexts, and validation practices.

- **Transparent reduction process:** The indicator reduction sequence created a transparent audit trail from the full literature-derived indicator pool to the final validated framework. This strengthens the credibility and repeatability of the research process.
- **Expert-based validation:** The Delphi method ensured that the final framework was not only theoretically grounded but also reviewed by local experts familiar with Saudi planning, architecture, development, and community conditions.
- **Transferability:** The methodological approach used in this thesis can be adapted for other contexts, including other Gulf countries, Arab cities, or specialized residential environments where generic sustainability tools do not adequately capture local social realities.

## 5.3 Future Research

Although the study developed and validated FASSGC-45, further research is needed to test, refine, and expand the framework through empirical application and methodological development.

### 5.3.1 Measuring/Assessing Social Sustainability in GCs

- **Empirical application:** Future studies should apply FASSGC-45 to existing gated communities in different Saudi cities to test its practical performance across diverse urban, social, and economic settings.
- **Resident and stakeholder perspectives:** The framework should be tested with residents, developers, planners, facility managers, and local authorities to compare expert priorities with lived experience. This would strengthen the practical relevance of the framework and ensure that assessment reflects daily community realities.

- **Scoring and rating system:** Future research could develop a formal scoring system or rating scale for FASSGC-45, allowing communities to be classified according to levels of social sustainability performance.
- **Indicator weighting:** Indicator weighting should be explored to determine whether all indicators should carry equal importance or whether some dimensions, such as safety, governance, or external integration, should receive different weights in specific assessment contexts.
- **Longitudinal assessment:** Longitudinal studies should assess gated communities over time to understand how social sustainability changes with demographic shifts, management practices, community events, maintenance quality, and urban growth around the development.
- **Comparative research:** Comparative studies could examine differences between gated and non-gated communities, between Saudi regions, or between Saudi Arabia and other Gulf and Arab contexts. Such studies would clarify which indicators are locally specific and which may have wider regional relevance.
- **External integration research:** Future work should give particular attention to External Relations and Integration, since this category remains underrepresented in existing instruments but is central to understanding whether gated communities support or weaken wider urban social sustainability.

### 5.3.2 Methodological-Related Aspects

- **Expanded validation panels:** Future studies could expand the validation process by involving larger and more diverse expert panels, including municipal officials, developers, community managers, sociologists, and residents.

- **Advanced statistical testing:** Advanced statistical techniques, such as exploratory factor analysis, confirmatory factor analysis, or structural equation modelling, could be used to test the internal structure of FASSGC-45 after it is applied to larger empirical datasets.
- **MCDA-based weighting:** Multi-Criteria Decision Analysis methods, such as the Analytic Hierarchy Process or best-worst method, could be used to refine indicator weights and category priorities.
- **Mixed-method assessment:** Future research should combine survey data with observation, interviews, spatial analysis, and administrative data. This triangulation would strengthen the validity of assessment results and reduce dependence on one data source.
- **Spatial and GIS integration:** GIS and spatial analysis could be used to evaluate walkability, access to amenities, public-space distribution, social permeability, and links between gated communities and surrounding neighbourhoods.
- **Digital tool development:** A digital assessment toolkit could be developed to help planners, researchers, and policymakers apply FASSGC-45 more efficiently, store assessment results, compare communities, and visualize areas requiring intervention.
- **Policy and governance analysis:** Future research should examine how Saudi housing policies, municipal regulations, homeowners' associations, and private management systems influence the social sustainability of gated communities.

In conclusion, this thesis demonstrated that existing social sustainability assessment instruments are fragmented, uneven, weakly validated, and insufficiently suited to Saudi gated communities. In response, it developed FASSGC-45, a locally grounded, expert-validated, and reliable framework composed of five categories, 18 sub-categories, and 45 indicators. The framework provides a clearer and more practical way to assess social sustainability by

addressing internal community life, safety, quality of place, governance, equity, empowerment, and external integration. By doing so, the study contributes to academic knowledge, supports planning and development practice, and provides a foundation for future work aimed at improving the social sustainability of gated communities in Saudi Arabia.

# Appendix

### A. Questionnaire Survey

**Response Format**:

Q1–Q3: Single-choice background questions.

Items 1.1–5.2: Rated on a 7-point importance scale:

1 = unimportant at all

2 = unimportant

3 = somewhat unimportant

4 = neither important nor unimportant

5 = somewhat important

6 = important

7 = important at all

All “Comments or suggestions” questions & Q6: Open-ended.

Q5: Ranking question (1 = most important, 5 = least important).

**Section A – Background information:**

**Q1. What is your education level?**

- Bachelor
- Master’s
- PhD, Doctorate
- Other: _____

**Q2. Which of the following statements best describes your current work?**

- Professional in private practice (Architect, Engineer, Planner)

- Academicians in higher education institutions
- Employed in governmental or semi-governmental organization
- Real estate developer
- Contractor
- Other: _____

**Q3. Years of work experience? ***

- Less than 5 years
- 5 to 9 years
- 10 to 15 years
- More than 15 years
- Other: _____

**Section B – Rating Importance of Indicators:**

**Q4.** These Categories includes a set of indicators that measure community cohesion and social interaction-related aspects. On a scale of 1 to 7, and based on your opinion, rate the importance of each aspect/indicator (1=unimportant at all, 2 or 3 = Somewhat unimportant, 4 = Neither important nor unimportant, 5 or 6= Somewhat important, 7=very important

**Category 1 – Community Cohesion and Social Interaction**

1.1 I have good relationships with neighbour where we have occasional visits.

1.2 If I need help or support, I will ask my neighbour, and I will help my neighbour (there is mutual support).

1.3 I participate with neighbour in social, cultural, and religious events and voluntary work, and I'm an active member of community associations.

1.4 I volunteer for activities that help in developing my community.

1.5 There is a level of acceptance and open mindedness within neighbour.

1.6 I respect my neighbour of different ethnicities and [am] satisfied with homogeneity.

1.7 I trust people in my community.

**Comments or suggestions related to "Community Cohesion and Social Interaction."**

Please add any comments regarding this group of indicators and their contribution.

You may:

1. List any indicator that you think is/are NOT important and should be omitted, or
2. Suggest other indicators that are more appropriate to use to assess "Community Cohesion and Social Interaction" of social sustainability within gated communities in Saudi Arabia.

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**Category 2 – Safety, Security, and Perceived Control**

2.1 Crime Reported Rate.

2.2 Index of safety on the streets.

2.3 I feel comfortable, safe and secure walking during the daytime and nighttime.

2.4 I feel that my house and community is safe and secure whether I'm attending or not attending it.

2.5 I'm satisfied with level of privacy that is available in the community.

**Comments or suggestions related to "Safety, Security, and Perceived Control."**

Please add any comments regarding this group of indicators and their contribution.

You may:

1. List any indicator that you think is/are NOT important and should be omitted, or
2. Suggest other indicators that are more appropriate to use to assess “Safety, Security, and Perceived Control” of social sustainability within gated communities in Saudi Arabia.

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**Category 3 – Livability and Quality of Place**

3.1 I use different available facilities such as the community center, public library, and sports facilities.

3.2 I’m satisfied with the transportation modes in the community and out [of] the community.

3.3 My community streets and pavements are friendly for walking and biking

3.4 Number of services distributions within the community.

3.5 I’m satisfied with the available green areas within my community

3.6 The availability of a range of activities (such as kids’ activities, celebrations, etc.) in open public spaces will improve social interaction in the community.

3.7 Outdoor areas (plaza, squares) are well distributed in the community to satisfy residents’ needs.

3.8 There are opportunities for leisure activities in the community

3.9 Population Density

3.10 Houses in the community are friendly for people with disabilities

3.11 People are aware of cleaning their environment and the community

3.12 Housing Types.

3.13 The community and houses meet the needs of those who live in.*

3.14 I am satisfied with living in this community and planning to stay here

3.15 I'm satisfied with less noise and pollution from neighbour.

3.16 I'm satisfied with cleanliness of the community and street lighting.

3.17 I'm satisfied with attractiveness of the design features of the community (such as lighting fixtures, etc.).

3.18 I feel attached, loyal and proud to be resident in this community.

3.19 I feel that it is a good place to live in forever.

3.20 There are changes that happened through time in the community.

3.21 I have a desire to leave the community.

**Comments or suggestions related to "Livability and Quality of Place."**

Please add any comments regarding this group of indicators and their contribution.

You may:

1. List any indicator that you think is/are NOT important and should be omitted, or

2. Suggest other indicators that are more appropriate to use to assess “Livability and Quality of Place” of social sustainability within gated communities in Saudi Arabia.

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**Category 4 – Participatory Governance, Equity (& Empowerment)**

4.1 I contribute to making decisions and to associations in my community

4.2 I’m a member of the community association, and I help organize events in my community.

4.3 There is a access to from the community to workplaces and job opportunities.

4.4 Are their activities and programs that accommodate all ages and all social groups.

4.5 I pay fees for the benefit of my community.

4.6 Level of Education and Literacy within the community

4.7 Presence of risk assessment, routes, safe meeting points.

**Comments or suggestions related to “Participatory Governance, Equity (& Empowerment).”**

Please add any comments regarding this group of indicators and their contribution.

You may:

1. List any indicator that you think is/are NOT important and should be omitted, or

2. Suggest other indicators that are more appropriate to use to assess “Participatory Governance, Equity (& Empowerment)” of social sustainability within gated communities in Saudi Arabia.

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**Category 5 – External Relations & Integration (External Integration)**

5.1 The gated community does not hinder me from identifying strangers and build strong connections and relationships with communities outside the gated community (easy to interact with outsider world and outside can easily interact).

5.2 I can access the urban working areas in the community

**Comments or suggestions related to “External Relations & Integration (External Integration).”**

Please add any comments regarding this group of indicators and their contribution. You may:

1. List any indicator that you think is/are NOT important and should be omitted, or
2. Suggest other indicators that are more appropriate to use to assess “External Relations & Integration (External Integration)” of social sustainability within gated communities in Saudi Arabia.

**Q5.** The following are the proposed 5 categories of indicators that have been addressed previously. According to your opinion, please rank them from 1 to 5 based on their importance. Notice that a rank (1) indicates that the category is the most important for this study, while rank (5) indicates that it is the least important category.

Please rank:

1. Community Cohesion and Social Interaction
2. Safety, Security, and Perceived Control
3. Livability and Quality of Place
4. Participatory Governance, Equity (& Empowerment)
5. External Relations & Integration (External Integration)

**Q6.** If you think any of the above categories should be separated into more than one category, please mention it/them, and to what they should be divided? (if any).

**B. Formulas**

$$Bc = \frac{Raw\ Breadth\ for\ each\ cateogry}{Total\ number\ of\ breadth\ for\ Categories}$$

Formula1: Normalized breadth at category level.

$$Dc = \frac{Raw\ Depth\ for\ each\ cateogry}{Total\ number\ of\ breadth\ for\ Categories}$$

Formula2: Normalized Depth at category level.

$$Bs = \frac{Raw\ Breadth\ for\ each\ Sub{-}categorgy}{Total\ number\ of\ breadth\ for\ Sub{-}categories}$$

Formula3: Normalized breadth at Sub-category level.

$$Dc = \frac{Raw\ Depth\ for\ each\ Sub-category}{Total\ number\ of\ breadth\ for\ Sub-categories}$$

Formula4: Normalized Depth at Sub-category level.

$$Ss = \sqrt{(Bc \times Dc)}$$

Formula5: Selection Score of category level. Presets: Bc: Normalized Breadth at category leve, Dc: Normalized Depth at Sub-Category Level.

$$Ss = \sqrt{(B_c \times B_s) \times (D_c \times D_s)}$$

Formula6: Selection Score of category level. Presets: Bc: Normalized Breadth at category level, Dc: Normalized Depth at Sub-Category Level. Bs: Normalized Breadth at Sub-Category Level, Ds, Normalized Depth and Subcategory level.

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