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Development of a Place-Based Social Sustainability Model in Architecture Faculties Using the Delphi Method and Shannon Technique*

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ABSTRACT

The spatial quality in architecture faculties, shaped by students' perspectives and attitudes toward their surrounding environment, can enhance the place-based social sustainability. This, in turn, increases spatial satisfaction and encourages students' presence and productivity in such spaces. Social sustainability is one of the three pillars of sustainable development, and its theoretical framework can be applied toward improving the spatial quality of architecture schools. Given the significance of the topic and the lack of comprehensive research in this area, the present study aims to identify and define the components and indicators of place-based social sustainability using the Delphi method and expert insights. It further evaluates the relative importance and weighted influence of these factors on the enhancement of spatial quality in architecture faculties, thereby establishing a theoretical framework and developing a conceptual model. This research is categorized as developmental-applied in terms of purpose, and descriptive-analytical in terms of methodology. The research design employs both qualitative and quantitative approaches, emphasizing logical reasoning and analysis. Data collection was conducted through document analysis and a two-stage Delphi method (open interviews and closed questionnaires). Data analysis and evaluation were performed using SPSS software and the Shannon entropy technique. Based on the results obtained from interviews and questionnaire evaluations, the components of social sustainability that influence the qualitative structure of educational spaces in architecture faculties were identified. A model was developed accordingly, consisting of eight components and 54 associated indicators, each weighted according to its level of importance. The Shannon entropy algorithm was used to determine the weight and significance of each element. The findings indicate that the components of "Nature-Centeredness" and "Security" have the highest impact on improving the spatial quality of architecture faculties. Subsequently, "Facilities and Infrastructure," "Physical Structures," "Social Structures," "Human-Centeredness," and "Identity" were identified as influential components in spatial quality enhancement.

Keywords: Place-Based Social Sustainability, Architecture Faculty, Spatial Quality, Shannon Entropy Technique.

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1. INTRODUCTION

Social sustainability, as a relatively emerging concept within the dimensions of sustainable development, includes social capital, social equity and justice, social cohesion, and cultural dimensions. It is a broad and profound concept that encompasses numerous elements and indicators. This dimension of sustainability focuses on human needs and individuals' qualitative reactions to places. The influence of space on an individual's sense of place attachment amplifies the significance of social sustainability. Social sustainability is derived from the needs, cultures, and lifestyles of modern humans, aiming to improve and enhance the quality of life. Its primary focus is on present and future individuals, and its goal is to meet their needs, raise the quality of life, and utilize all capacities and potentials to improve living conditions.

The formation of social sustainability—considered one of the most critical concerns of contemporary societies—requires a socio-physical network (Ghafourian et al. 2016). Therefore, indicators that relate to basic needs and quality of life improvement fall under this domain (Sobhani and Rajabi 2016). The concept of social sustainability is primarily associated with qualitative dimensions and is assessed through concepts such as human well-being and quality of life (Goodland 2003). In this concept, a sustainable society is not solely dependent on quantitative and physical development. However, by emphasizing qualitative development, it moves toward a sustainable life process for current and future generations (Mafi and Abdollahzadeh 2015). Today's concept of sustainability in architecture is rooted in a cultural and social approach to architecture (Habibi 2007). The reflection of social sustainability in architecture leads to the creation of responsive architecture that aligns with essential and higher human needs, behavioral patterns, and enhances spatial quality. This architecture embodies culture, beliefs, and behavioral patterns. Among these, supporting social and cultural life through the creation of identity-based structures aimed at generating a sense of place, building desirable living environments, and flexible spaces is considered a practical strategy for achieving social sustainability.

The primary concern of architects is to create spaces that meet the needs of activities and enhance human quality of life. Yet, the designer/architect themselves require a context where they can evaluate and correctly analyze this issue—a context made available in the educational spaces of faculties and architecture schools (Alal-Hesabi and Norouzian Maleki 2008). Paying attention to social sustainability in the design of spaces within faculties of art and architecture is of special importance due to the particular structure and pedagogical principles of these fields, as well as the role of students in shaping and attributing identity to future urban and architectural spaces. These academic spaces or architecture faculties require special attention to spatial quality characteristics to become desirable, provide student satisfaction, and be socially sustainable. Creating a dynamic space that responds to the social, cultural, and educational needs of students is considered essential in designing such spaces. The dimensions of social sustainability can be regarded as one of the most practical options in the design, planning, and creation of lively and creative spaces in architecture faculties. Accordingly, this study, considering the significance and necessity of the topic, aims to define a conceptual model of social sustainability and seeks to answer the following questions:

- What are the components of place-based social sustainability in educational spaces of architecture faculties?
- Which factors, alongside improving spatial quality in architecture faculties, contribute to enhancing the social sustainability of such spaces?

2. RESEARCH BACKGROUND

The research background is composed of three principal axes as follows:

- Axis One: Studies on the subject of sustainability and social sustainability

Adloo (2013) examined the principles of social sustainability in architectural and urban planning processes, aiming to clarify the foundations and principles of social sustainability as a model for urban design and residential complexes. Nasrin et al. (2013) assumed that social sustainability indicators do not carry equal weight. They employed the Analytic Network Process (ANP) model and the Delphi method to determine the weight of each indicator and identify the components of social sustainability. Taheri (2015) investigated social sustainability criteria in Iranian housing that has established a unique balance between the private domain (housing) and the public realm (community). Azizzadeh (2015) evaluated the design of sustainable urban spaces by defining qualitative environmental criteria based on human perception and aligned with user needs. Chavoshi Sarvi and Jalali Motahari (2016) examined the role of culture and human needs in vernacular architecture from the perspective of social sustainability, assessing how spatial patterns respond to human needs. Nasrin and Basravi (2016) sought, with a view to global experiences regarding social sustainability, to identify the features that can help form a sustainable society and pave the way for achieving it. Hassanzadeh and Farokhzad (2017) introduced some indicators of social sustainability by examining human needs, culture, and environmental conditions. Shiea et al. (2017) extracted spatial components influencing social sustainability in their research, identifying 23 codes through source review and

categorizing them into five groups: activity, safety, identity, people-centeredness, and spatial integration. Noori (2019) investigated the efficient relationship between the multidimensional characteristics of architectural joints and sustainable architecture indicators. Haji Agha Bozorg et al. (2021) assessed the factors influencing place attachment as a key indicator of social sustainability in the semi-private spaces of residential complexes, aiming to create an environment that meets human needs appropriately and responsively. In international research, Van Clerk et al. (2008) proposed comprehensive components for evaluating sustainable communities. Dixon and Colantonio (2009) addressed social sustainability and its explanation in the context of sustainable urban regeneration. In addition to defining social sustainability and emphasizing its role, this study analyzed indicators and identified the best methods for measuring and monitoring social sustainability in existing urban regeneration sites across Europe. Dempsey et al. (2009) distinguished between physical and non-physical indicators of social sustainability. According to them, an attractive public realm, desirable local environmental quality, accessibility, and walkable neighborhoods are the most essential physical indicators of a thriving community.

- Axis Two: Studies on improving the physical and content quality of architecture faculties

Nadimi (2005) emphasized the necessity of strategic planning and task division based on the strengths of architecture faculties in the face of the recent rapid quantitative expansion of architectural education that has inevitably led to a decline in quality. Naghdibishi and Eslami (2012) investigated and modeled structural strategies for the Faculty of Architecture at the College of Fine Arts, University of Tehran, drawing from past experiences. Ghasemzadeh and Rahimi (2016) identified and evaluated the factors affecting spatial quality in architecture faculties from the students' perspective. Ardestani et al. (2018) assessed daylight and glare in classrooms using dynamic indices. Hamzehnejad and Fakourian (2018) studied the design and planning of architectural educational environments, focusing on a comparative analysis of components that influence student creativity across four campuses: Iran University of Science and Technology, Tabriz Islamic Art University, Shahid Bahonar University of Kerman, and Isfahan University of Art.

- Axis Three: Sources addressing social sustainability in architectural spaces

Zarei Hajiabadi and Alitajer (2016) evaluated the role of the built environment in student interactions within informal spaces of architecture schools. They argued that students' social lives in both formal and informal spaces of the faculty can significantly influence the learning process. Iran Zadeh et al. (2019) conducted a case-based study (Faculty of Art and Architecture, Islamic Azad University of Tabriz) to identify and prioritize the factors influencing place-based social sustainability in educational spaces. Iran Zadeh et al. (2020) sought to develop a place-based social sustainability model to enhance the quality of places in educational environments. Numerous studies have been conducted on the subject across these three axes. The extensive range of past research and the absence of a comprehensive survey on place-based social sustainability in the context of architecture faculties underscore the necessity of the present study. A summary of these studies is presented in Table 1.

Table 1. Literature Review

Authors	Subject and Objectives
Studies on Social Sustainability	
Nastaran et al. (2013)	Evaluation of social sustainability indicators using Analytic Network Process (ANP).
Behnamifar and Ghaemi Shad (2013)	Evaluation of influential indicators on social sustainability using factor analysis.
Azizzadeh (2015)	Development of Social Sustainability Indicators in Public Spaces.
Matinfar and Akhlaghpaseand (2016)	Exploration of residential complex design with a focus on social sustainability.
Ghafelehbashi et al. (2017)	Evaluation of satisfaction and social sustainability in residential spaces.
Ansari et al. (2017)	Examination of social sustainability and its conceptual framework.
Hassanzadeh and Farrokhzad (2017)	Review of social sustainability indicators in architecture and urbanism.
Moghbel Esfahani et al. (2017)	Explanation and clarification of the role of social schools in forming social sustainability.
Ghafourian et al. (2017)	Recognition of social sustainability components influencing participation and social interaction in residential spaces.
Karami and Mohammad Hosseini (2017)	Study of the effect of socially interactive spaces on social sustainability in residential complexes.

Authors	Subject and Objectives
Studies on Social Sustainability	
Ketabchi et al. (2018)	Evaluation and Measurement of Social Sustainability Components in Residential Complexes.
Asgari (2020)	Evaluation of the role of urban regeneration in social sustainability in newly developed neighborhoods.
Bagheri et al. (2022)	Investigation of physical factors that improve the quality of life and their impact on social sustainability in contemporary housing.
Studies on Improving Physical and Spatial Quality of Architecture Faculties	
Naghdibishi and Eslami (2012)	Analysis and modeling of structural strategies for the Faculty of Architecture at the University of Tehran, inspired by past experiences.
Ghasemzadeh and Rahimi (2016)	Identification and evaluation of components affecting the spatial quality of architecture faculties from students' perspectives.
Zarei Hajiabadi and Alitajer (2016)	The role of the built environment in student social interactions within informal architecture school spaces.
Hamzehnejad and Fakourian (2018)	Investigating the impact of the architecture school building on students' creativity.
Eslami et al. (2016)	Development of executive strategies for the Faculty of Architecture at the University of Tehran.
Rahimi and Ghasemzadeh (2016)	Evaluation of spatial quality components in architecture faculties based on student feedback.
Studies on Social Sustainability in Academic Physical Spaces	
Heydari et al. (2013)	Presentation of a model for identifying influential parameters in place meaning within educational settings.
Azamati et al. (2014)	The Impact of Expandable University Spaces on Social Sustainability and Vitality Creation.
Hamzehnejad and Fakourian (2018)	The architecture school building serves as a context for nurturing architectural creativity.
Amoudikhajeh and Vaziri Faravani (2018)	Identification and Assessment of the Influence of Social Sustainability Indicators in Cultural Space Design.
Iran Zadeh et al. (2019)	Evaluation, identification, and prioritization of factors influencing place-based social sustainability in architecture faculty educational spaces.
Badri Benam et al. (2020)	Development of a place-based social sustainability model designed to enhance the quality of places in educational environments.
Badri Benam et al. (2020)	Assessment of user satisfaction regarding the functional quality of educational spaces with emphasis on increasing the efficiency of university educational centers.
Studies on Social Sustainability in University Spaces (English Sources)	
Van Clerk (2008)	Definition of a comprehensive indicator to assess sustainable communities.
Dixon and Colantonio (2009)	Identification of Social Sustainability Components in European Urban Regeneration.
Sivunen (2014)	Evaluation of user experience and social-cultural context in strengthening educational environments.
Rout and Galpern (2017)	Assessment of the role of nature in educational spatial structure and its impact on resolving academic challenges.
Akbarinejad (2023)	Integrated assessment of social sustainability and approaches to its quantification.
Finnegan (2023)	Assessment of London schools' sustainability in terms of social interaction and hands-on activities within semantic and functional spaces.

3. THEORETICAL FOUNDATIONS

The theoretical concepts and foundations of the present research initially introduce definitions, theories, and the general structure of social sustainability, as well as its role in the discourse of sustainable development. Subsequently, the manifestation and significance of this concept in architectural space are discussed. Finally, the importance of architecture faculties—whose spatial qualities and influential components are the focus of this study—is presented.

3.1. Concept of Social Sustainability

Since the 1970s, the concept of sustainable development has emerged as a new development paradigm encompassing environmental, economic, and social dimensions. Within this framework, sustainability does not imply stability but rather continuity. The importance lies in maintaining balance between various aspects of sustainability (UN-HABITAT 2004). Social sustainability is considered one of the most vital dimensions of sustainability, as it fosters social cohesion and solidarity, thereby enhancing social tolerance (Mahmoudi et al. 2023). Today, social sustainability is viewed as a fundamental concept in both individual and collective social spheres (Zangeneh et al. 2020), such that its indicators are regarded as some of the most critical tools in urban and architectural planning and policymaking (Mohammadi Doost et al. 2018).

Social sustainability embodies a human-centric perspective on justice and equality. Often, it emphasizes access to social processes and the benefits of modern society. One of its core elements is a commitment to social cohesion and the enhancement of individuals' active participation in societal affairs (Pourtaheri et al. 2011). Due to its inherent interconnectedness with other dimensions, social sustainability adopts a human-oriented and multidimensional definition. This perspective pays attention not only to environmental issues but also to the quality of human life (Hatamikia 2014). The inclusion of concepts such as justice and temporality in social and cultural sustainability has added new depth to the idea of sustainable development, which had previously been overlooked (Habibpour Getabi 2022). Social sustainability aims to meet a wide range of human needs in a manner that preserves nature and its capacities over the long term, while also fulfilling normative demands such as social justice, human dignity, and participation (Litting and Grisler 2005). In addition to traditional criteria such as equity and health, social sustainability introduces and evaluates newer concepts, including happiness, well-being, and the physical and spatial quality of life (Colantonio 2009). Murphy (2012) identifies four fundamental pillars of social sustainability: equity, participation, sustainability awareness, and social cohesion. Gates and Lee emphasize the role of individual capacities—such as access to opportunities, resources, and cultural recreation programs—as well as social capacities—such as identity, participation, and spaces for artistic and social activities—in the development of social processes and the maintenance of a balanced structure (Nastaran et al. 2013).

To identify the components of social sustainability and develop conceptual and strategic models, it is essential to consider the nature of relationships among individuals and communities (Mohammadi Sarin Dizaj et al. 2023). Models of application should be developed and maintained over the long term to achieve sustainable social development (Zal 2007). Due to the conceptual ambiguity and multidimensional nature of social sustainability, it is extraordinarily complex (Holmberg and Sandbrook 1992). The concept of social sustainability can be examined as a state, a best-practice benchmark, a systemic and complex approach, or a process (McKenzie 2004). In other words, a fuzzy understanding of social sustainability has emerged, leading to multidimensional interpretations (Colantonio 2009) and, consequently, a wide range of definitions (Vaezzadeh et al. 2015; Colantonio and Lane 2007). One of the main challenges lies in the difficulty of quantifying social issues and defining associated concepts (Burton 2003). The advantage of the multidimensional nature of social sustainability is that it provides a framework for understanding how different policies impact various conditions and contexts. Therefore, the concept of social sustainability is entirely dependent on the political, social, economic, and environmental limitations and capacities of each context (Manzi et al. 2010). As such, theorists have proposed a wide array of definitions, yet there remains no consensus on standard criteria or perspectives for its adjustment and contextualization. It seems that reaching a comprehensive definition is a complex task. Given the wide range of ideas proposed by both domestic and international scholars, a collection of key theories is summarized in Table 2.

Table 2. Theorists' Perspectives on the Concept of Social Sustainability

Theorist	Components and Indicators of Social Sustainability
Maslow (1954)	The hierarchy of human needs theory
Jacobs (1961)	Emphasis on social interactions, safety, vitality, social justice, and human scale
Schultz (1963)	Emphasis on social interactions, identity, human scale, accessibility, dynamism, and social justice
Gehl (1971)	Emphasis on social interactions, spatial dynamism, vitality, and human scale
Altman (1975)	Emphasis on security, spatial dynamism, social interaction, privacy, personal space, territoriality, and crowding
Alexander (1979)	Emphasis on social interactions, identity, human scale, accessibility, dynamism, and social justice

Theorist	Components and Indicators of Social Sustainability
Rappaport (1981)	Emphasis on social interactions, social homogeneity, place memory, and spatial meaning
Baumeister and Leary (1995)	Expansion and cohesion of interpersonal relationships
Smith and Dixon (1996)	Economic, social, and environmental factors in urban contexts; peri-urban spatial relations
Mitlin and Satresuit (1996)	Emphasis on justice and social equity as core concepts of social sustainability
Overton and Scheyvens (1999)	Attention to the poor and fulfilling basic needs; emphasis on balance, social justice, and freedom
Paul and Stern (2000)	Peaceful coexistence and social and cultural integration of diverse groups
Koning (2001)	Equal rights, avoidance of social fragmentation, and good quality of life and livelihood
Omann and Spangenberg (2002)	A human concept emphasizing intergenerational and intragenerational justice and social cohesion
Goodland (2003)	A compassionate, tolerant, flexible society with moral capital
Porio and Crisol (2004)	Enhancing users' tenure security through improved urban services
Litting and Griebler (2005)	Fulfillment of a wide range of human needs while preserving nature and its long-term capabilities
Choguill (2008)	Emphasis on social interaction, participation, sense of belonging, interpersonal relations, and collective activity
Rice (2008)	Cohesion and expansion of collective relationships
Colantonio and Dixon (2009)	Social integration, sense of identity and place, health, social capital, happiness, and quality of life
Davidson and Wilson (2009)	Development-oriented, environment-oriented, and people-oriented approaches
Xing et al. (2009)	Social, spatial, and environmental justice
Dempsey (2011)	Emphasis on social interactions, participation, community resilience, sense of place, social equity, and safety
Murphy (2012)	Justice, participation, awareness for sustainability, and social cohesion
Woodcraft (2015)	Provision of infrastructures supporting social and cultural life, facilities, and social amenities
Duxbury and Jeannotte (2015)	Quality of life and access to social and cultural services
Baffoe and Mutisya (2015)	Access to social and cultural services
Kutayand Tektufekci (2016)	A measurable concept of dynamic human and environmental systems
Skotharkar (2017)	Satisfaction with physical space, accessibility, and access to amenities
Dogu and Aras (2019)	Participation and sense of place attachment

3.2. Concept of Place-based Social Sustainability in the Architectural/Spatial Context

Rogers (2005), a prominent architectural theorist, argues that sustainable design should not only address energy consumption and the environmental impacts of buildings and cities but must also give equal importance to social and economic sustainability. Over the past three decades, with the growing emphasis on social perspectives within architectural theory, urban spaces, and architectural environments—parallel to developments in social sciences—the role and significance of social sustainability have been rediscovered in architectural discourse (Hamzavi 2010). Most scholars emphasize that the social dimension of sustainability in built and architectural environments holds substantial weight, addressing user needs and qualitative responses of individuals to places (Shieh et al. 2017). This approach to social sustainability in architecture stems from a socio-cultural perspective that prioritizes the influence of behaviors, beliefs, and culture on architectural design (Habibi 2007). Its main goal is to enhance users' satisfaction and quality of life in both the present and the future, while incorporating cultural values and societal habits (Chavoshi Saravi and Jalali Motahari 2016). John Lang (1938) believes that the social sustainability of built spaces involves several key components, including environmental quality, security, sense of belonging and identity, individuality, aesthetic value, and social comfort—all of which aim to meet various human needs. Since society acts as the soul within the architectural body, the characteristics of this body significantly influence its internal growth and vitality, creating a reciprocal relationship between the two (Hamzavi 2010). Hence, social sustainability

requires a spatial-social network that integrates political and social principles with issues such as participation, happiness, well-being, and quality of life (Ghafourian et al. 2016). This network is built upon a triangular foundation of people, space, and collective life, addressing spatial dimensions, opportunities for social interaction, understanding diverse user groups, empowering marginalized communities, and promoting public participation (Hamzavi 2010). To achieve non-physical aspects of sustainability in built environments, architectural design must consider both fundamental and advanced human needs, prioritize spatial quality, align environmental and physical patterns of buildings, and reflect these needs within the spatial fabric (Shoja and Sajadzadeh 2015). At the architectural scale, social sustainability focuses on space, guiding design through the study of human needs and behaviors to foster long-term interaction between people and their environment (Chavoshi Saravi and Jalali Motahari 2016). Moreover, the social sustainability of physical environments enhances a place's capacity to confront challenges and adapt to external changes by promoting social mobility, cohesion, institutional capacity-building, and a strong sense of place, ultimately improving the quality of the place (Javedan and Rokneddin Eftekhari 2010). As the architectural container of social relationships, design can play a vital role in fostering mutual influence among social groups (Chavoshi Saravi and Jalali Motahari 2016). In the pursuit of identifying social sustainability indicators in architectural and urban spaces, researchers often refer to concepts like spatial justice, social equity, cohesion, social capital, and societal stability, which are foundational for empowering communities through social sustainability (Dempsey et al. 2011).

Place-based social sustainability refers to the process of creating successful, sustainable architectural environments that are informed by people's needs for living and working, thereby fostering greater social coexistence. It merges the design of physical territory with the social realm, offering the infrastructure necessary to support social and cultural life, social facilities, systems for civic engagement, and spaces for human and communal development (Habibpour Getabi 2022).

A space can be considered socially sustainable when it facilitates a balanced living environment (Chan and Lee 2008). Rather than focusing on abstract characteristics, social sustainability prioritizes human-specific needs and individuals' qualitative reactions to places, needs that are culturally conditioned and deeply linked to the reciprocal relationship between humans and their cultural context. The ultimate goal of social sustainability is to meet human needs and improve the quality of life for both present and future generations by respecting the culture and traditions of all societal groups. Achieving this goal requires an understanding of human behavior, responsiveness to those needs, and awareness of local cultural conditions (Chavoshi Saravi and Jalali Motahari 2016).

Social sustainability of place is realized when users feel satisfied with their presence and function in a given space and enjoy interaction and proximity with others. Over time, such conditions lead to stronger social interactions and a greater sense of belonging and attachment to the built environment. This fosters shared responsibility in maintaining and improving the physical context, thus extending the lifespan of sustainable spaces. In other words, social sustainability maximizes the usability and benefit of the environment, space, and place (Zarghami 2010). Since this depends on fulfilling both the physical and psychological needs of individuals, the design of the environment plays a fundamental role in addressing all functional requirements and supporting users' physical and mental well-being (Sadeghi Niyarki and Sanaeian 2015).

3.3. Necessity of Attention to the Physical Quality of Architectural Education Spaces

Each university possesses a defined physical domain that shapes its social centrality and spatial identity (Zarghami and Azemati 2013). This physical environment plays a crucial role in the educational process, especially in architectural education (Groat and Wang 2005). The sensitivity and importance of architectural education compared to other disciplines lie in the fact that, unlike fields such as the natural sciences or engineering, it cannot be straightforwardly transferred (Broadbent 2010). Physical and functional factors in architectural education spaces, particularly faculties, hold special significance. Findings by Kurt (2009) indicate that the type and internal design structure of architectural education spaces—and the entire complex as a key place for architectural students' thinking—are essential. This design not only influences students' architectural vision but also ensures the mental quality necessary for its historical continuity. Since functional quality and interior space play a crucial role in creating a conducive educational environment for architecture students (Musa et al. 2012), the space and physical form of architectural education should actively support the learning process, rooted in practical and interdisciplinary education (Gislason 2007). According to Turner, three central components create the desirability image of an architectural educational space: legibility, adaptability, and the presence of a sense of place. Factors such as zoning of open and closed spaces, maintaining building boundaries, open spaces, spatial hierarchies and order, spatial characteristics of open areas in university landscape planning, quality of landscape elements, and enclosure of open spaces on campus all contribute to creating a sense of place and sustainability in architectural educational spaces (Turner 1996; Zarghami and Azemati 2013). Architecture students consider functional and physical

parameters more influential than other factors in assigning meaning to their educational environment (Heidari et al. 2013). Prioritization and segregation of educational and research facilities based on usage, cultural and qualitative impact, and standards are essential considerations in architectural education spaces (Eslami and Naghdnisdhi 2012). Experts believe that the fluid and multi-layered structure of architectural education environments today requires a design and functional articulation that embraces a broader perspective on interdisciplinary knowledge and skills (Garip and Garip 2012).
This requires efficient methods that can respond to the quantitative and qualitative needs arising from new social and cultural developments (Alal-Hesabi and Norouziyan Maleki 2008).

4. METHOD

This study is developmental-applied in terms of its objectives, descriptively-analytical in nature, and descriptive-survey in terms of data collection. The research design employs both quantitative and qualitative approaches, with an emphasis on logical reasoning. Data collection involved documentary studies and the Delphi method (open interviews and closed questionnaires). Finally, data analysis and evaluation were conducted using SPSS software and the Shannon entropy technique.
The research was carried out in three main stages, as described below (see Fig. 1):

4.1. First Stage: Research Design Elaboration

To define the overall research design, the first step was reviewing theoretical foundations through literature review and prior research. This included the concepts of sustainable development and the role of social sustainability within it, various theories related to place-based social sustainability, and the importance of attention to this in architectural education spaces (architecture faculties).
In shaping the research structure, the following questions, objectives, and variables were considered:

- Research Questions
1. What are the components of place-based social sustainability in the educational spaces of art and architecture faculties?
2. Which factors, while improving the spatial and physical quality of art and architecture faculties, enhance the social sustainability of such spaces?
- Research Objectives:
1. To identify the components of place-based social sustainability in the educational spaces of art and architecture faculties.
2. To develop a conceptual model of factors affecting the spatial-physical quality of architecture faculties with an approach toward place-based social sustainability.
- Research Variables:
1. Dependent variable (PE): Spatial quality and desirability of art and architecture faculties.
2. Independent variable (PD): Components of place-based social sustainability.

4.2. Stage Two: Research Methodology and Data Collection

The collection and evaluation of social sustainability components of the place were conducted in four steps:
- Step One: Collecting codes derived from theoretical foundations (Fig. 2)
In this step, concerning the research objectives, components relevant to the research design were identified and defined based on principles derived from theoretical foundations, a literature review, and the ideas of previous scholars.
- Step Two: Data collection using the Delphi method – First stage (Fig. 3)
The Delphi method is a systematic and interactive technique that relies on the opinions of independent experts (Mofidi 2022). This method is a structured process for gathering and classifying existing knowledge from a group of specialists and experts through interviews and the distribution of questionnaires, with controlled feedback on the received responses and opinions (Shiee 2017). According to Helmer (1997), Delphi is a valuable communication tool among a group of experts that facilitates the systematization of the group's opinions. Baldwin (1975) believes that in situations where scientific knowledge is insufficient for decision-makers, they are compelled to make decisions relying on their own perceptions or experts' opinions (Sarmad et al. 1998). The Delphi technique offers a suitable approach for specialists to reach consensus without requiring face-to-face interaction. When it is necessary to gather the opinions of a group of experts but it is impossible to bring them together physically, the Delphi method can be employed (Stone, Fish, and Busby 2005; Linstone and Turoff 2002).
At this stage, to determine the components influencing the target community, the Delphi method was used in two phases:
First phase: Conducting open interviews with 10 faculty members from the Architecture and Urban Planning Department at the University of Science and Research. In this phase, indices and factors affecting the enhancement of spatial quality and desirability of architecture faculties, with a social sustainability approach, were identified, and influential codes were extracted.
Step Three: Refinement of extracted codes from previous steps and extraction of final components
In this step, based on the previous two stages, the most essential components were extracted and classified into eight main categories: spatial structure, identity and belonging, physical structure, nature orientation,

humanism, social structures, infrastructures and facilities, and security. Each component within each category includes subgroups of social sustainability indices (Fig. 4).

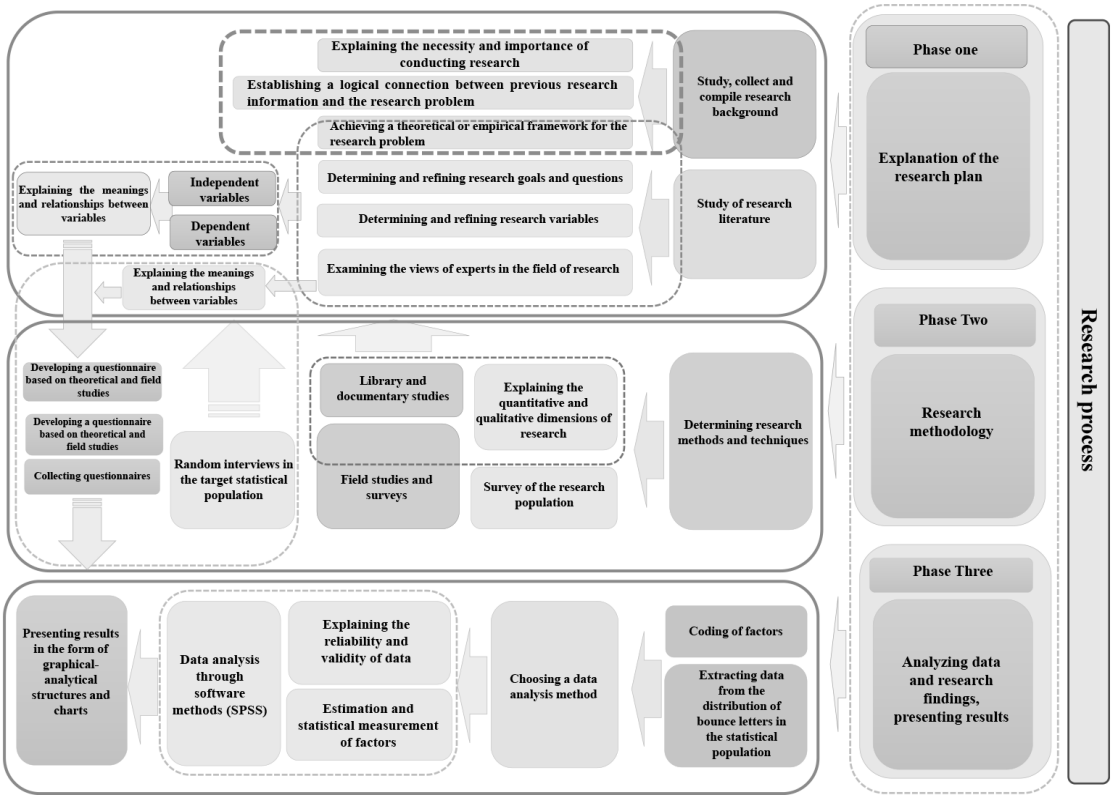

Fig. 1. Process and Flow of the Research

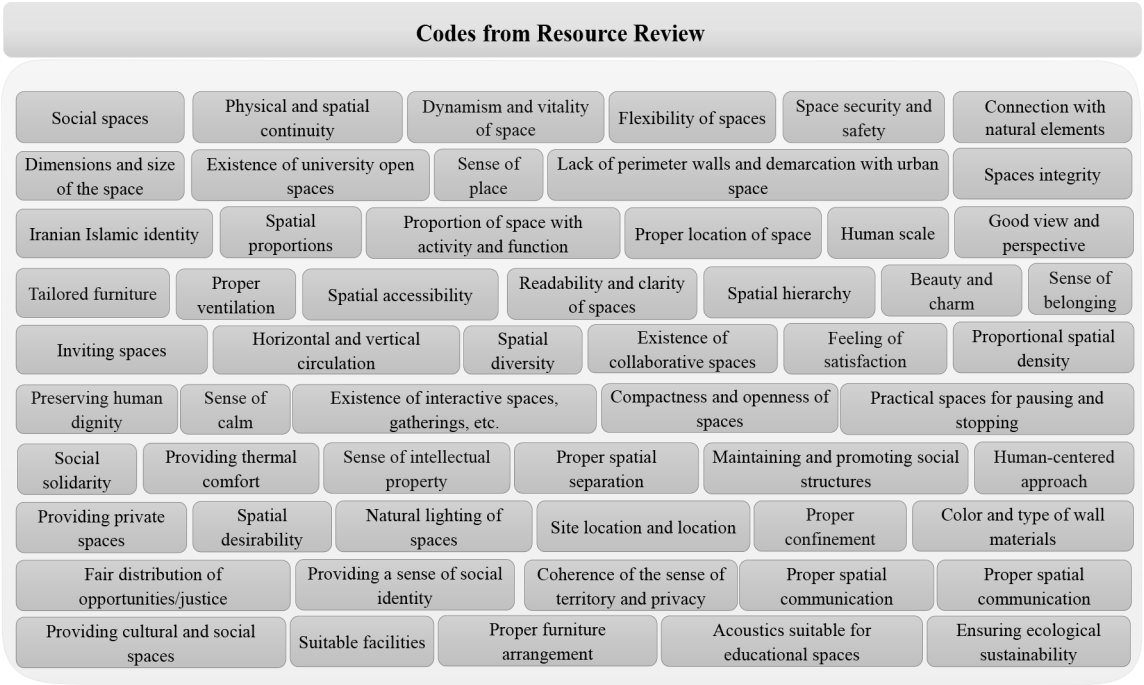

Fig. 2. Step One of Data Collection; Extraction of Components Based on Experts' Ideas Derived from Documentary Studies and Theoretical Foundations

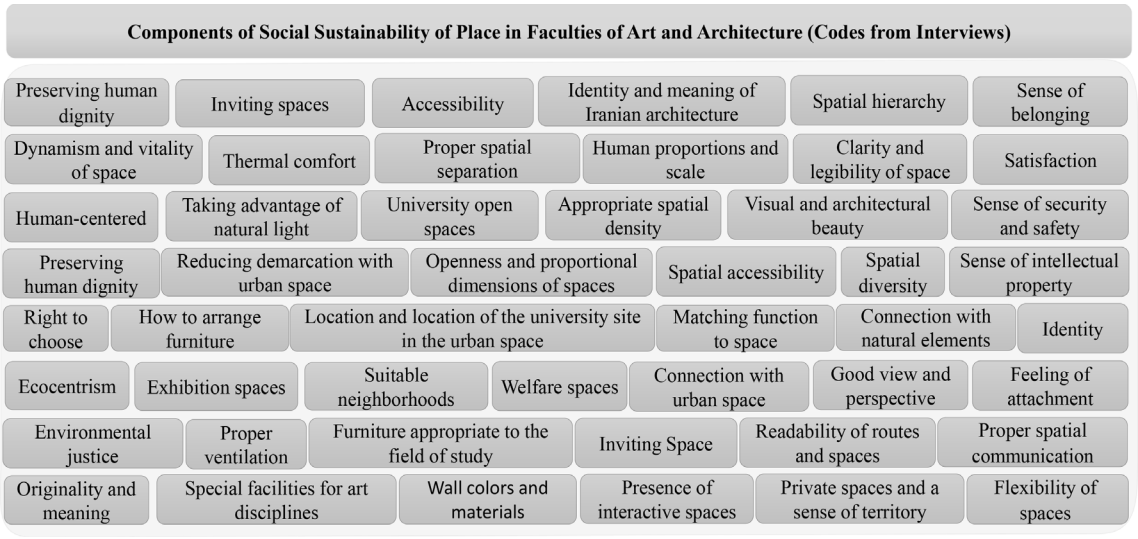

Fig. 3. Step Two of Data Collection; Components Extracted from the First Stage of the Delphi Method (Open Interviews with Experts in the Research Field)

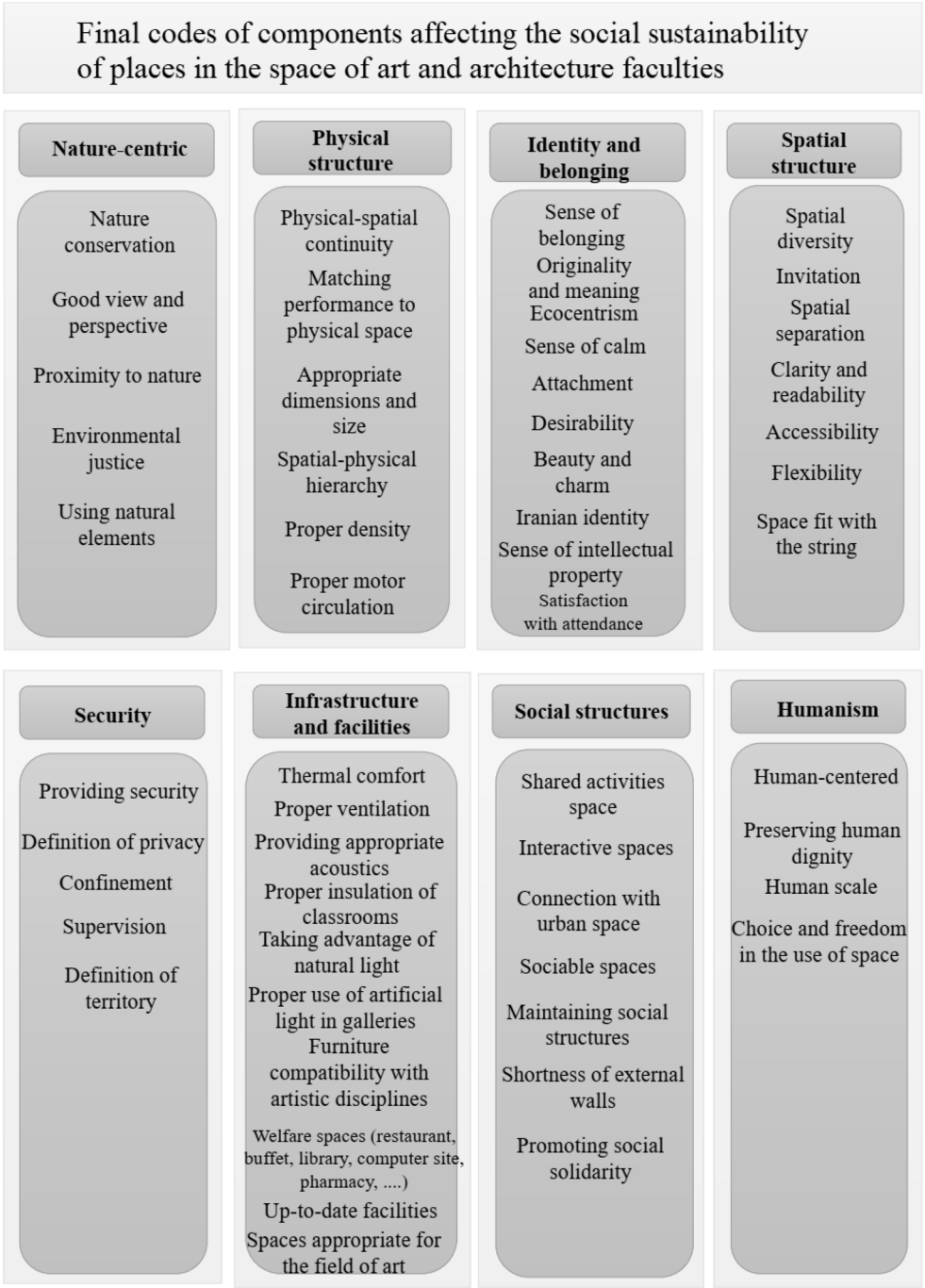

Fig. 4. Refinement of Components Derived from Literature Review and Interviews, and Extraction of Final Codes

Step Four: Scoring and Determining the Structural Weight of Social Sustainability Components Affecting the Spatial Quality of Architecture Faculties Using the Delphi Method (Second Stage)

In this step, to evaluate and assign importance weights to each of the components extracted from the previous steps and to finalize the indicators, a refined questionnaire was prepared and distributed among the expert community. At this stage, the questionnaires served as the basis for evaluating the codes extracted from the previous steps.

Statistical Population: The statistical population for distributing the questionnaires consisted of faculty members and invited professors of the Architecture and Urban Planning Department at the Faculty of Civil Engineering, Architecture, and Art, Islamic Azad University, Science and Research Branch. Currently, 120 instructors (faculty members and invited professors) are teaching in this department, and the questionnaire was distributed among a sample

from this population.

Sample Size: To calculate the sample size, Cochran's formula for qualitative variables (non-parametric estimation) was used. According to this formula, the sample size is 92 individuals.

$$n = \frac{\frac{z^2 pq}{d^2}}{1 + \frac{1}{N}\left(\frac{z^2 pq}{d^2} - 1\right)}$$

N = Population size
z = Percentage error of the criterion acceptable confidence factor
q = A proportion of a population lacking a certain trait (e.g., the population of men)
q(p-1) = A proportion of a population lacking a certain trait (e.g., the population of women)
d = Degree of confidence with desired probability accuracy

The reasoning behind the purposive sampling approach is that the Islamic Azad University, Science and Research Branch, is among the top universities in the country in terms of research and academic performance. According to official national rankings, it ranks third in scientific and research achievements after the University of Tehran and Payame Noor University (https://www.uniref.ir/TopUnivs; https://civilica.com/scientometrics).

Therefore, it appears that the faculty members affiliated with this university can be considered suitable candidates for scoring the data extracted from the theoretical foundations and the codes derived from interviews with a selected group of expert participants.

The evaluation of these variables was conducted using a five-point Likert scale, ranging from 1 (very low) to 5 (very high).

4.3. Research Instrument Reliability (Validity and Reliability)

The content validity of the questionnaire was confirmed through consultation with professors and experts in the field, and its reliability was assessed using Cronbach's alpha coefficient. The primary purpose of using the Cronbach's alpha test is to evaluate the internal consistency of the items within a scale derived through an index-building process. This coefficient indicates the degree of overlap between the various questions in assessing a common trait, known as alpha, which ranges from 0 to 1 (Vaziri 2012).

The obtained Cronbach's alpha value in this study was 0.94, indicating a very high level of reliability for the research instrument.

Table 3. Reliability of the Research Instrument (Research Findings)

No. of Items	Cronbach's Alpha
40	0.94

4.4. Interpretation Model for Evaluation Results

The method used to evaluate the social sustainability components affecting the spatial quality and desirability of architecture faculties was based on a checklist approach. This included the algebraic sum and average calculation of each criterion on a five-point Likert scale, ranging from "Very Low" (score: +1) to "Very High" (score: +5).

Table 4. Model for Data Collection and Result Calculation

Interpretation Model of each Criterion's Evaluation on the Likert Scale	
Score Description	Score Value
Very High	+5
High	+4
Moderate	+3
Low	+2
Very Low	+1

4.5. Third Stage: Data Analysis

At this stage, the collected data—based on interviews and supplementary questionnaires—were analyzed and evaluated.

To assess the value of the components, the Shannon entropy technique was used, as it provides higher accuracy compared to conventional methods.

5. RESEARCH FINDINGS

In the present study, to evaluate the level of agreement among experts for each component and indicator and to rank them, the simplest method—the sum and average of the collected data—was initially used after gathering the questionnaire results. The outcomes are presented as the total and average score of each indicator and component separately in Table 5. In the next step, the data were re-analyzed using the Shannon entropy method. This formula, which offers greater precision than fundamental frequency analysis, enables the calculation of the information entropy of each indicator and subsequently its weight (Azar 2001).

To apply this formula, the frequency table data were first normalized using Equation (1). In this equation, Fij represents the normalized score, and Pij represents the score assigned by each respondent to the relevant category. Next, the information entropy of each category is calculated using Equation (2), where m is the number of respondents and n is the number of categories. Finally, the weight of each component and indicator is obtained using Equation (3).

$$P_{ij} = \frac{F_{ij}}{\sum_{i=1}^{m} F_{ij}} \quad (i = 1,2, \dots m\,; j = 1,2 \dots n) \qquad \text{Equation (1)}$$

$$E_j = -k \sum_{i=1}^{m} [P_{ij} Ln(P_{ij})] \quad j \in 1 \dots n \quad k = \frac{1}{Ln(m)} \qquad \text{Equation (2)}$$

$$W_{ij} = \frac{E_{j-1}}{\sum_{j=1}^{n} (E_{j-1})} \qquad \text{Equation (3)}$$

Table 5. Average Weight of Place-Based Social Sustainability Components in Enhancing the Spatial Quality of Architecture Faculties
(Data Extracted from Questionnaires; Second Round of the Delphi Method)

Component	Subcategories	Total Score	Mean	Component Mean	Indicative Information Load	Index Weight (Shannon Technique)	Component Mean Weight
Spatial Structure	Spatial Diversity	367	3.98	4.00	0.01643659	0.01923778	0.0192367
	Sense of Invitation	341	3.70		0.01555404	0.01925504	
	Spatial Segregation	357	3.88		0.01609969	0.01924437	
	Clarity and Legibility	369	4.01		0.01650360	0.01923647	
	Accessibility	394	4.28		0.01733115	0.01922028	
	Flexibility	356	3.86		0.01606582	0.01924503	
	Functional Suitability	397	4.31		0.01742923	0.01921837	
Identity & Belonging	Sense of Belonging	414	4.51	4.40	0.01798028	0.01920759	0.0192131
	Authenticity & Meaning	398	4.32		0.01746187	0.01921773	
	Eco-Centrism	404	4.39		0.01765711	0.01921391	
	Sense of Calm	409	4.44		0.01781903	0.01921074	
	Attachment	400	4.34		0.01752706	0.01921645	
	Desirability	405	4.40		0.01768955	0.01921327	
	Iranian Identity	401	4.35		0.01755961	0.01921582	
	Intellectual Ownership	409	4.44		0.01781903	0.01921074	
	Satisfaction with Presence	407	4.42		0.01775435	0.01921201	

Component	Subcategories	Total Score	Mean	Component Mean	Indicative Information Load	Index Weight (Shannon Technique)	Component Mean Weight
Physical Structure	Physical-Spatial Continuity	394	4.28	4.03	0.01733115	0.01922028	0.0192351
	Proportionate Dimensions	390	4.23		0.01719997	0.01922285	
	Hierarchy	353	3.83		0.01596405	0.01924702	
	Proportionality	357	3.88		0.01609969	0.01924437	
	Circulation	376	4.08		0.01673718	0.01923190	
	Aesthetic & Attractiveness	357	3.88		0.01609969	0.01924437	
Nature-Orientation	Nature Preservation	356	3.86	3.88	0.01606582	0.01924503	0.0192443
	Views & Landscape	343	3.72		0.01562270	0.01925370	
	Proximity to Nature	390	4.23		0.01719997	0.01922285	
	Environmental Justice	340	3.69		0.01551966	0.01925572	
	Use of Natural Elements	357	3.88		0.01609969	0.01924437	
Human-Centeredness	Human Orientation	397	4.31	4.29	0.01742923	0.01921837	0.0192199
	Preserving Human Dignity	414	4.50		0.01798028	0.01920759	
	Human Scale	361	3.92		0.01623482	0.01924173	
	Freedom & Choice	407	4.42		0.01775435	0.01921201	
Social Structures	Interactive Spaces	390	4.23	4.15	0.017199976	0.01922285	0.0192280
	Urban Connection	357	3.88		0.01609969	0.01924437	
	Shared Workspaces	396	4.30		0.01739657	0.01921900	
	Sociable Spaces	398	4.32		0.01746187	0.01921773	
	Preserving Social Structures	405	4.40		0.01768955	0.01921327	
	Social Cohesion	394	4.28		0.01733115	0.01922028	
	Short External Walls	335	3.64		0.01534727	0.01925909	
Infrastructure & Amenities	Thermal Comfort	377	4.09	4.01	0.01677043	0.01923125	0.0192363
	Ventilation	353	3.80		0.01596405	0.01924702	
	Acoustics	347	3.77		0.01575963	0.01925102	
	Proper Insulation	335	3.64		0.01534727	0.01925909	
	Natural Light	377	4.09		0.01677043	0.01923125	
	Artificial Light	379	4.11		0.01683684	0.01922995	
	Welfare Spaces	394	4.28		0.01733115	0.01922028	
	Updated Facilities	374	4.06		0.01667060	0.01923320	
	Furniture Suitability	388	4.21		0.01713421	0.01922414	
Security	Ensuring Security	414	4.50	3.99	0.01798028	0.01920759	0.0192376
	Privacy	353	3.80		0.01596405	0.01924702	
	Enclosure	335	3.64		0.01534727	0.01925909	
	Surveillance	389	4.23		0.01716711	0.01922349	
	Territory Definition	347	3.77		0.01575963	0.01925102	

Based on the data recorded in the table, the findings obtained from the Shannon entropy technique regarding the ranking and importance of the indicators—which serve as the basis for conclusions in the present study—yield different results compared to ordinary averaging.

According to the averaging results, the component of "Identity" has the highest score and weighted percentage (4.4). Following it, in order of importance for enhancing the spatial quality of architecture faculties, are the other social sustainability components: "Human-centeredness," "Social structures," "Physical structures," "Facilities and infrastructure," "Spatial structures," "Security," and "Nature-centeredness."

According to the results derived from the Shannon algorithm technique, the component "Nature" holds the highest score and weighted percentage (0.192443). After that, the other social sustainability components in descending order of importance for improving the spatial quality of architecture faculties are: "Security," "Spatial structure," "Facilities and infrastructure," "Physical structure," "Social structures," "Human-centeredness," and "Identity."

Based on the information obtained from interviews and the distribution of questionnaires, a model of spatial indicators for social sustainability influencing the enhancement of the physical spatial quality of architecture faculties can be explained by eight components and a total of 54 indicators (Fig. 5). The weighted percentages of the components are derived using the Shannon technique.

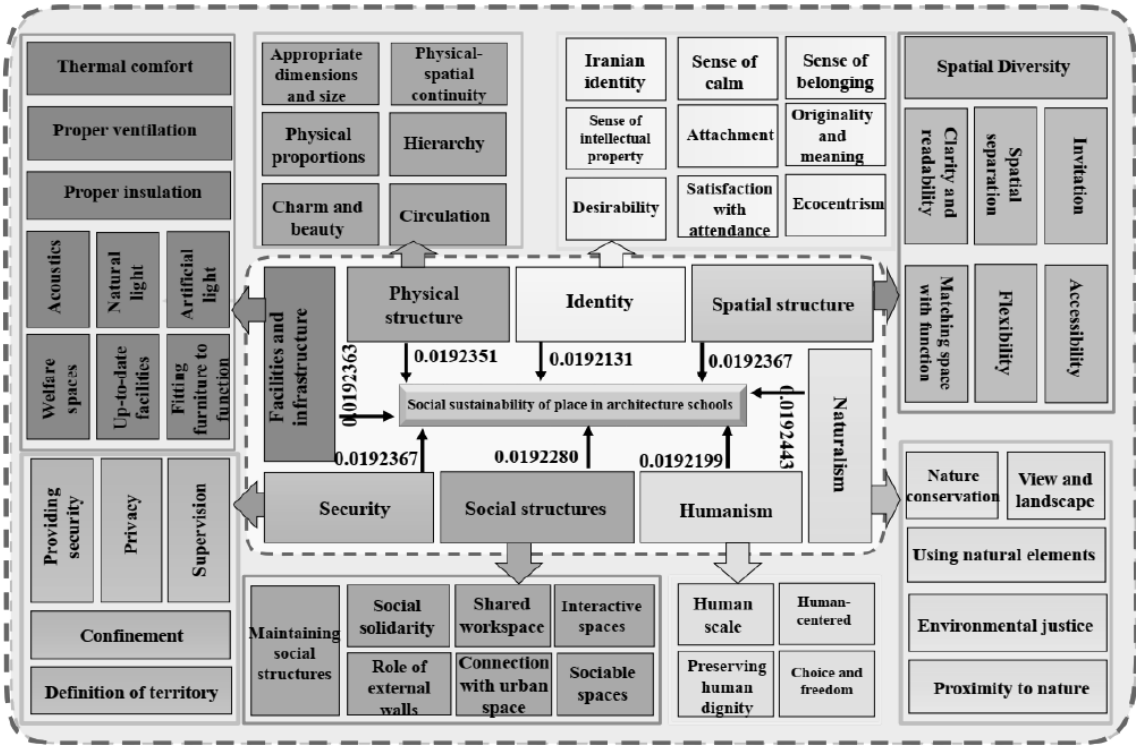

Fig. 5. Final Model of Place-Based Social Sustainability Indicators in Architecture Faculties with Emphasis on Spatial-Physical Quality

6. CONCLUSION

The present study was conducted to elucidate the components of social sustainability that influence the spatial quality of architecture faculties. The concept of social sustainability, which focuses on enhancing human living conditions, has garnered attention since the early 21st century. This approach places humans and their needs at its center. On the other hand, the spatial quality of architecture faculties, as environments that nurture future designers and architects, holds particular significance. This clarifies the social sustainability components of such spaces, which are even more critical. Due to the qualitative nature of this approach, the opinions of experts in the field of architecture were considered to clarify these components.

Based on these expert opinions, the components of social sustainability in architecture faculties can be categorized into eight groups: spatial structure, identity, physical structure, nature-centeredness, human-centeredness, social structures, infrastructure and facilities, and security.

Using the Shannon entropy algorithm technique for weighting these components, nature-centeredness and security were found to have the highest weighted

importance. The nature-centeredness component encompasses the preservation of nature, the inclusion of appropriate views and landscapes, proximity to nature, and environmental justice. The security component includes the subcategories of privacy, enclosure, surveillance, and territoriality.

The findings of this research are proposed as architectural strategies to enhance the quality of educational places in architecture faculties as follows:

- By addressing the hierarchical levels of human needs in architectural educational spaces, the foundation for achieving social sustainability of the place can be established.
- Naturalism: A connection with nature can enhance the vitality of a space. This can be realized indoors by utilizing natural elements and outdoors by providing seating areas, appropriate views and landscapes, or walking paths within natural settings.
- Security: An optimal sense of security and safety in the university's spatial and physical environment encourages students to stay longer and more frequently on campus, thereby increasing opportunities for social interaction.
- Spatial Structures: Clarity and legibility, flexibility, and necessary variety improve the quality of the interior space.
- Facilities: The quantity and quality of facilities in architecture faculties should be proportionate to the field of study.
- Physical Structure: Suitable spatial hierarchy, appropriate dimensions and scale, spatial continuity, and attractiveness are factors that encourage students to be present and engage within the space.
- Social Structures: Shared workspaces for project execution and presentation enhance communication and social cohesion.
- Human-Centeredness: Focusing on human-centered design and preserving human dignity has a positive impact on the sense of belonging to a place.
- Identity: Utilizing indigenous architecture while considering cultural differences increases attachment and spatial desirability, thereby improving students' satisfaction with their presence in the space.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

MORAL APPROVAL

The authors commit to observe all the ethical principles of the publication of the scientific work based on the ethical principles of COPE. In case of any violation of the ethical principles, even after the publication of the article, they give the journal the right to delete the article and follow up on the matter.

PARTICIPATION PERCENTAGE

The authors state that they have directly participated in the stages of conducting research and writing the article.

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